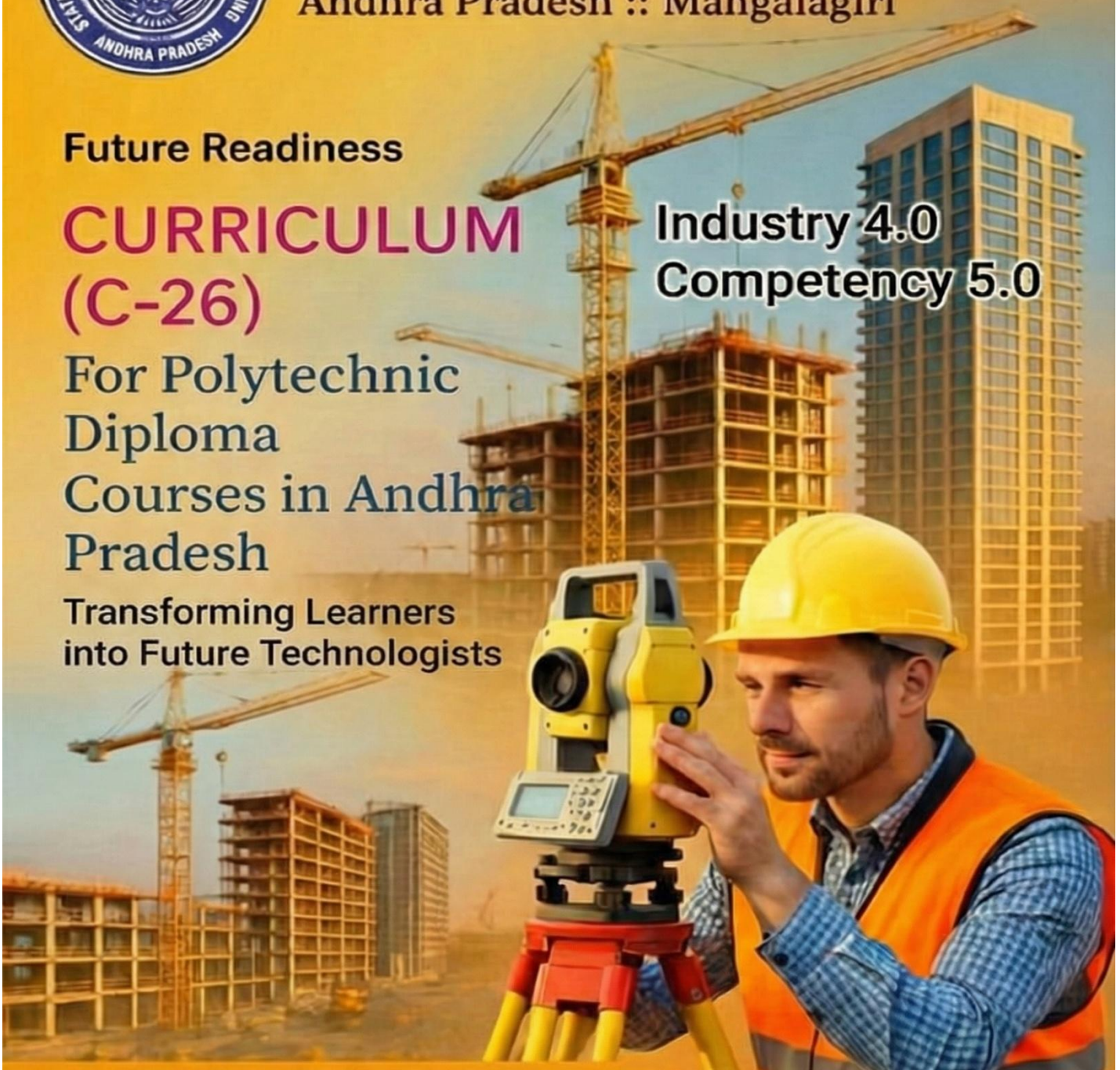
GOVERNMENT OF ANDHRA PRADESH

STATE BOARD OF TECHNICAL EDUCATION AND TRAINING

Andhra Pradesh :: Mangalagiri



Future Readiness

CURRICULUM (C-26)

Industry 4.0
Competency 5.0

For Polytechnic Diploma Courses in Andhra Pradesh

Transforming Learners into Future Technologists

3 YEAR (REGULAR) DIPLOMA IN

CIVIL ENGINEERING

GOVERNMENT OF ANDHRA PRADESH

STATE BOARD OF TECHNICAL EDUCATION AND TRAINING
ANDHRA PRADESH :: AMARAVATI

3 YEAR DIPLOMA IN CIVIL ENGINEERING

CURRICULUM -2026 (C-26)

STATE BOARD OF TECHNICAL EDUCATION AND TRAINING
ANDHRA PRADESH : : AMARAVATI

1. PREAMBLE

The world is evolving rapidly, and education must evolve with it. In today's dynamic environment, our approach to learning must equip students not only with knowledge but also with the practical experience in innovation, critical thinking ability and problem-solving mindset required to excel in both academic and professional spheres.

At the heart of the new curriculum, lies the belief that education should be student-centered, fostering curiosity, creativity and a lifelong passion for learning. The **State Board of Technical Education and Training (SBTET), Andhra Pradesh** aims to create a safe, supportive, and inclusive learning environment where every student is encouraged to reach their fullest potential. This curriculum is designed to provide a strong foundation for lifelong growth and employability, ensuring that learners graduate not only with a diploma but also with the competence and confidence to thrive in a rapidly changing world.

The **SBTET, A.P**, has consistently strived to meet the aspirations of all stakeholders students, parents, industries, academia and society at large by keeping its diploma programmes relevant to emerging technologies and industrial advancements. To this end, SBTET, A.P. has regularly reviewed and updated its curricula through a systematic, evidence-based and consultative process.

Building on the success of earlier curricula and responding to the demands of new-age technologies, SBTET, A.P. resolved to update the Polytechnic C-23 Curriculum and introduce the **new Curriculum (C-26)**, aligning it with global technological trends, skill-development goals and industry expectations. The revision process was initiated in November 2024, with comprehensive feedback collected from all stakeholders i.e, students, parents, industry experts, academia, alumni, faculty, heads of sections and principals across all the state.

A pivotal meeting was convened under the chairmanship of Sri. Gummala Ganesh Kumar, I.A.S., Director of Technical Education & Chairman, SBTET, to discuss the revamping of the curriculum with an emphasis on industry relevance, academic flexibility, skill orientation and employability.

Further, Sri. Gummala Ganesh Kumar, I.A.S., reiterated the importance of industrial exposure, project-based learning, and practical training to bridge the gap between classroom learning and industry requirements. He highlighted the need to make the curriculum more innovative, flexible, and technology-driven to prepare students for emerging fields such as Artificial Intelligence (AI), Machine Learning(ML), Quantum Computing, Internet of Things (IoT), Drone Technology and Industry 4.0.

To ensure a holistic and futuristic approach, two regional workshops were conducted with industry experts, academic experts from higher level institutes and subject experts at Tirupati and Visakhapatnam. The Programme(Branch)-wise expert committees comprising members from industry, higher-education institutions and polytechnic faculty were constituted. In the subsequent 20 workshops conducted, these committees explored strategies to integrate the following key components into the curriculum, with the objective of enhancing employability and industry readiness.

- Internet of Things (IoT) for all programmes
- Balanced ratio of Theory and Practical (50:50)
- Emerging technologies such as Artificial Intelligence (AI), Machine Learning (ML) and Quantum Computing and Drone Technology
- Industry 4.0 and 5G Technologies
- Critical Thinking, Quantitative Aptitude and Reasoning Skills to prepare students for placement processes
- Introduction of Elective Courses (Subjects) to provide flexibility and promote specialization in emerging domains
- Inclusion of Audit Courses to encourage innovative and holistic development, ethics, environmental awareness, Entrepreneurship and lifelong learning beyond the core curriculum

- Adoption of Practicum-based Learning, wherein certain courses are designed to be taught through hands-on, activity-oriented, and experiential methods instead of the conventional lecture mode, enabling students to apply concepts directly through practice and experimentation.

A series of workshops, consultations, and validation meetings with subject experts, industrialists, and academicians were conducted to comprehensively review and refine the draft curriculum. The final version was further vetted by industry professionals and academicians from reputed higher-education institutions to ensure academic rigor, practical relevance, and alignment with current and emerging industry needs.

The Curriculum 2026 (C–26) has been developed through the active participation of polytechnic faculty, industry representatives, and expert committees, following an Outcome-Based Education (OBE) framework in accordance with NBA guidelines.

This new curriculum reflects the collective vision of educators, industry experts and policymakers to develop competent, innovative, ethical and highly employable diploma graduates. It equips learners with the skills, attitudes and mindset needed to embrace future challenges driven by AI, Quantum Computing, IoT, Industry 4.0, 5G and sustainable technologies.

The C–26 Curriculum has been approved by the Board Members, SBTET, Andhra Pradesh, for implementation from the academic year 2026–27.

2. KEY FEATURES OF THE CURRICULUM C-26

- The C–26 curriculum is a fully restructured and modernized framework developed after a comprehensive review of earlier curricula, with strong emphasis on technology integration, practical exposure, and industry relevance.
- Audit components are introduced to create awareness of emerging technologies such as artificial intelligence, internet of things, robotics, 3D printing, along with ethical and safety considerations.
- Digital skills training is strengthened through laboratory exposure to computer fundamentals, operating systems, and introductory tools related to artificial intelligence, machine learning, and quantum computing.
- Engineering drawing is upgraded to include both traditional manual drafting and computer-aided design, enabling students to produce accurate 2D and 3D drawings.
- Surveying education integrates theory with extensive field practice, covering both conventional and modern measurement techniques.
- Construction materials education is closely linked with site practices to enhance understanding of material behavior and real-world applications.
- Sustainable construction practices are emphasized, including green materials, energy-efficient systems, and environmental rating concepts.
- Advanced surveying methods are introduced using modern instruments, digital mapping, and data analysis techniques.
- Elective options are provided to allow students to specialize in areas such as advanced surveying technologies, construction quality control, and safety practices.
- Basic programming skills are introduced to support computational thinking and technology-enabled civil engineering applications.
- Communication and employability skills are strengthened through focused laboratory training to enhance professional effectiveness and workplace readiness.
- Structural engineering content is updated to include modern construction systems such as prefabricated and modular structures.

- Project management, entrepreneurship, and organizational skills are integrated to prepare students for leadership and supervisory roles.
- Advanced civil engineering technologies are covered, including prestressed systems, modern retaining structures, prefabricated construction methods, and digital applications in civil engineering.
- Overall, the C–26 curriculum places strong emphasis on practical learning, sustainability, technological readiness, industry relevance, and holistic student development.

3. ACKNOWLEDGEMENTS

The members of the working group sincerely thank Sri Gummala Ganesh Kumar, I.A.S., Director of Technical Education and Chairman of SBTET, Andhra Pradesh, and Sri Kona Sasidhar, I.A.S., Principal Secretary, Skills Development and Training Department, for their valuable guidance and support during the revision of the C-23 Curriculum and the development of the new C-26 Curriculum.

We are also thankful to SBTET, Andhra Pradesh, Mangalagiri, for organizing a series of workshops at different stages. These workshops brought together teachers from Polytechnics, experts from reputed National Institutes, Universities, Engineering Colleges and professionals from Industries. Their discussions and feedback helped to review the C-23 Curriculum and design the improved C-26 Curriculum.

We express our gratitude to Sri G.V.V. Satyanarayana Murty, Secretary, SBTET, Andhra Pradesh, Sri V. Padma Rao, Joint Director of Technical Education, Sri A. Ravi Kumar, Joint Secretary (Academic), SBTET AP and all officers from the Directorate of Technical Education and State Board of Technical Education and Training, Andhra Pradesh, for their encouragement and continuous support.

Finally, we sincerely thank all faculty members from various Polytechnics across the state who contributed to this endeavour. Their ideas,

teamwork, and commitment played a key role in shaping the C-26 Curriculum successfully.

4. RULES AND REGULATIONS

4.1 Duration and Pattern of Courses

All Diploma programs approved by AICTE are of three years duration.

- The first year follows a yearly system.
- The remaining period (two years) follows a semester system.
- A run-through system is followed for all Diploma courses, as per eligibility rules.

4.2 Procedure for Admission into the Diploma Programmes:

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 into any of the Diploma Programmes will have to appear for the Common Entrance Test for admissions into Polytechnics (POLYCET) conducted by the State Board of Technical Education and Training, Andhra Pradesh, Mangalagiri. Only the candidates satisfying the following requirements will be eligible to appear for the Common Entrance Test for admissions into Polytechnics (POLYCET).

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

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

c. For admission into Diploma in Pharmacy programme for which entry qualification is 10+2 (MPC/BiPC), candidates need not appear for POLYCET. A separate notification will be issued for admission into this Programme.

4.3 Medium of Instruction

The medium of instruction and examination for all Diploma programmes (branches) shall be English

4.4 Permanent Identification Number (PIN)

Every student is given a Permanent Identification Number (PIN) at the time of admission. This number is used to record and maintain the student's academic and examination details throughout the Diploma along with APAAR ID.

4.5 Number of Working Days per Semester / Year:

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

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

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

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

e) The timings of the institutions shall be preferably from 9:30 am to 4:30 p.m

4.6 Eligibility (Attendance to appear for the Summative Assessment)

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

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

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

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

e) Students whose shortage of attendance is not condoned in any semester / year and who have not paid the condonation fee in time are not eligible to take the Summative Assessment of that semester / year and they will be detained. They may seek re-admission for that semester / year (when offered) in the next subsequent academic semester / year.

f) For INDUSTRIAL TRAINING:

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

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

4.7 Readmission Rules

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

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

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

b) Within 30 days after commencement of class work in any year (including D. Pharmacy Programme or first year course work in Engineering and Non-Engineering Diploma streams). Otherwise, such cases shall not be considered for readmission for that year and they are advised to seek readmission in the next eligible academic year.

c) The percentage of attendance of the readmitted candidates shall be calculated from the first day of beginning of the regular class work for that year / Semester, as officially announced by CTE but not

from the day on which he / she has actually reported to the class work.

d) A candidate detained in any year or semester shall be allowed re-admission to the same year/semester only in the subsequent academic year. This provision shall equally apply to the industrial training also.

4.8 Scheme of Evaluation

a) First Year:

Theory Courses: 70 marks for the Summative Assessment (3 hours) + 30 marks for Formative Assessment.

Laboratory/Drawing Courses: 60 or 30 marks for the Summative Assessment (3 hours) + 40 or 20 marks for Formative Assessment as per the allocated marks to that course.

b) III to V Semesters:

Theory Courses: 70 marks for the Summative Assessment (3 hours) + 30 marks for Formative Assessment.

Laboratory / Drawing Courses: 60 or 30 marks for the Summative Assessment + 40 or 20 formative assessment as per the allocated marks to the course.

4.9 Formative Assessment Scheme:

Formative Assessment shall be conducted for awarding marks on the dates specified and it consists of two components namely, Assessment through Unit Tests and Continuous Internal Assessment (CIA).

Total Formative Assessment Marks (30) =Unit Test (20) + CIA (10)

a) **Theory Courses:**

Three-unit tests shall be conducted for I year and two Unit Tests for semesters. Unit test shall be of 90 minutes duration and for a maximum of 40 marks for each test.

S. No.	Type of Assessment	Weightage Assigned	Remarks
1	Formative Assessment: Through Unit Tests (UT): 20 Marks		

	Testing of knowledge through Unit Tests for Year - UT1+UT2+UT3 for SEM - UT1 + UT2	20	Each Unit test shall be conducted for 40 marks and scaled down to 20. Average of all the unit tests will be taken as Unit Test marks
2	Continuous Internal Assessment (CIA) :10 Marks		
	1. Assignments	05*	
	2. Dynamic Learning Activities: Project Work/ Seminar / Tech-fest /Group Discussion, Quizzes etc.	05**	
	T O T A L	30	

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

***At least one dynamic learning activity is to be conducted which carries 10 marks. The total marks should be scaled down to 5.*

b) Practical Courses:

Award of marks for Formative Assessment shall be as follows:

(i) Drawing Courses:

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

- Each Unit Test will be conducted for a duration of 120 minutes with maximum marks of 40 and scaled down to 20Marks.

(ii) Laboratory Courses:

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

Practical Course. The procedure for Evaluation for Laboratory Courses, other than Drawing courses:

i. Formative Assessment for Laboratory shall be done on the basis of task/s performed by the student in the laboratory.
ii. Question paper for Formative assessment shall also be task/s based and shall be prepared in similar lines of theory courses.

b) Formative Assessment in Laboratory courses shall be done during the course of study and marks shall be awarded by the concerned teacher.

c) For laboratory examinations, 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 the list given below in order of preference. Appointment order copy shall be filed and secured.

i) Nearby Industry
ii) Govt / Semi Govt organization like R & B, PWD, PR, Railways, BSNL, APSRTC, APSEB etc.
iii) Govt / University Engineering Colleges.
iv) Senior Faculty from nearby Polytechnics

Internal examiner shall be the person concerned with Formative Assessment as in (c) above. The Summative Assessment shall be held along with all theory papers in respect of drawing.

In case of drawing course earmarked as Practicum (practical course) the Summative Assessment shall be held along with practical papers.

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

e) Records pertaining to Formative Assessment marks of both theory and practical Courses are to be maintained for official inspection. All the evaluation formats/proformas shall be maintained as per the instructions issued by SBTET, A.P from time to time

iii) Practicum Theory Courses:

Assessment for Practicum theory courses can be done for 30 marks

Sl. No.	Type of Assessment	Weightage Assigned	Remarks
1	Formative Assessment: 30 Marks		
	a) Theory & Practical evaluation: Testing of knowledge through Unit Tests for Year - UT1+UT2+UT3 for SEM - UT1 + UT2	20	Each Test shall be conducted for 40 marks (Theory:30marks Practical:10marks) and scaled down to 20. Average of all the Tests will be taken as Unit Test marks
2	Continuous Internal Assessment (CIA) :10 Marks		
	a) Assignments	05*	All activities shall be recorded. Relevant records are to be filed and secured for further scrutiny of higher authorities
	b) Dynamic Learning Activities: Project Work/ Seminar / Tech-fest /Group Discussion, Quizzes etc.	05**	
	T O T A L	30	20+10

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

***At least one dynamic learning activity is to be conducted which carries 10 marks. The total marks should be scaled down to 5.*

iv) Practicum Practical Courses:

Assessment for Practicum Practical courses can be done for 40 marks

Sl. No.	Type of Assessment	Weightage Assigned	Remarks
1	Formative Assessment: 40 Marks		
	a) Practical & Theory evaluation: Testing of knowledge through Unit Tests for Year - UT1+UT2+UT3 for SEM - UT1 + UT2	30	Each Test shall be conducted for 40 marks (Theory:10marks Practical:30marks) and scaled down to 30. Average of all the Tests will be

			taken as Unit Test marks
2	Continuous Internal Assessment(CIA) :10 Marks		
	a) Assignments	05*	All activities shall be recorded. Relevant records are to be filed and secured for further scrutiny of higher authorities
	b) Dynamic Learning Activities: Project Work/ Seminar / Tech-fest /Group Discussion, Quizzes etc.	05**	
	T O T A L	40	30+10

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

***At least one dynamic learning activity is to be conducted which carries 10 marks. The total marks should be scaled down to 5.*

v) Activity Periods:

1.	a) Library	All activities shall be duly recorded & the relevant documents shall be filed and securely maintained for scrutiny by higher authorities. 0.5 Credits shall be awarded to the successful candidates for each semester/year accordingly.
	b) IPSGM/Sports & Games	
	c) Extra-curricular activities (NSS / NCC/ Clean & Green of Campus etc.,)	

vi) Industrial Training:

In case of Industrial Training, SOP will be circulated by SBTET, A.P from time to time. The Formative Assessment and Summative Assessment shall be done as illustrated in the following table:

Assessment No	Upon completion of	Conducted by	Based on	Max Marks
Pre-Assessment	15 Days to 30 Days from the commenc	Mentor faculty member visits the industry one month after commencement of training and will submit a detailed report to the		

	ement of training	principal outlining the each candidate's details and observed work culture		
1 (Formative Assessment)	Mid Semester Assessment (after three months - at industry	1.The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120
2 (Formative Assessment)	Last month of training (at industry)	1. The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120
3 (Summative Assessment)	After completion of the training (at Institution)	1.The faculty member concerned, 2.HoS concerned 3.An external examiner from Industry	1.Demonstration of any one of the skills listed in learning outcomes	30
			2.Training Report	20
			3. Viva Voce	10
			TOTAL	300

Each staff member shall be assigned a batch of students 10 to 15 as a mentor faculty for making assessment during industrial training.

v) Project Work:

The guidelines to be followed for Project work are as follows:

- ✓ The Project Title and Abstract must be approved by a

committee comprising the Principal, Head of Section(HoS) and the concerned faculty members

- ✓ Students should be encouraged to undertake project work with the potential for publication in academic and professional journals

The Formative Assessment consisting of 40% of the total marks shall be distributed as follows:

Assessment	To be conducted at	Marks (Evaluated for)
Review-1	After the completion of 4 weeks from the start of the semester	10
Review-2	After the completion of 10 weeks from the start of the semester	15
Review-3	After the completion of 14 weeks from the start of the semester	15

The Summative Assessment consisting of 60% of the total marks shall be distributed as follows:

Assessment	To be conducted	Conducted by	Based on	Max Marks
Summative	After completion of the Project work	1.Project Guide 2.HoS concerned 3.An external examiner	1.Demonstration of skill relevant to the Project	30
			2. Project Report	20
			3. Viva Voce	10
			TOTAL	60

4.10 Minimum Pass Marks

a) Theory Courses:

To pass a theory course, a candidate must secure a minimum of 35% in the Summative Assessment (i.e., Min 25 Marks in end) and a combined minimum of 35% from both the Formative and Summative Assessment marks put together.

b) Practical Courses:

For passing a practical Course, a candidate has to secure a minimum of 50% in Summative Assessment and a combined minimum of 50% of both Formative and Summative Assessment marks put together. In case of D.C.C.P., the pass mark for Typewriting and Shorthand is 45% in the Summative Assessment. There are no marks for formative assessment in case of Typewriting and Shorthand courses in D.C.C.P programme.

c) Industrial Training:

The Industrial training shall carry 300 marks and pass marks is 50% in each assessment at the industry (Mid semester Assessment and second assessment) i.e 120 marks out of 240 and in final summative assessment 30 marks out of 60 marks at institution level put together i.e. 150 marks out of 300 marks.

d)The courses successfully completed shall be awarded the allotted credits and the corresponding grade shall be assigned based on the percentage of marks secured.

4.11 Provision for Improvement

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

a) Improvement is allowed in any 4 (Four) courses of the Diploma Programme.

b) The student can avail the improvement chance only once and it must be taken within the two examinations immediately following the completion of their Diploma. However, the duration including Improvement examination shall not exceed FIVE years from the year of first admission.

c) No improvement is allowed in Practical / Lab Courses or Project work or Industrial Training assessment. However, improvement in drawing Course(s) is allowed

d) If improvement is not achieved, the marks obtained in the previous Examinations hold good

e) Improvement is not allowed in respect of the candidates who are punished under Mal-Practice in any examination.

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

g) All the candidates who wish to appear for improvement of performance shall deposit the original Marks Memos of all the years / Semesters including consolidated marks memo(CMM) and also original Diploma Certificate to the Board. If there is improvement in performance of the current examination, the revised Memorandum of marks including CMM and Original Diploma Certificate will be issued, else the submitted originals will be returned.

4.12 Rules of Promotion:

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

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

iii. A candidate shall be promoted to 4th semester provided he/she put the required percentage of attendance in the 3rd semester and paid

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

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

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

VI) Industrial Training shall be treated as the 6th semester, irrespective of whether the training is undertaken during the 5th or 6th semester.

For IVC & ITI Lateral Entry students:

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

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

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

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

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

4.13 Student Performance Evaluation

Successful candidates shall be awarded the Diploma under the following CGPA.

CGPA secured	Division
CGPA ≥ 7.5	First Class with Distinction (who completed Diploma within 3 years)
7.5 > CGPA ≥ 6	First Class
CGPA < 6	Second Class

Note:1. If a candidate secures a CGPA of less than 3.5, he/she shall be treated as failed

2. Candidate should acquire 120 credits to award diploma**.**

Awarding Grade and Grade Points

Students will be awarded Grades and Grade Points considering their Percentage of Marks Evaluated in each Theory and Practical Courses and the Conversion of Percentage of Marks obtained in the Examinations to the Grade Points and Awarding Grades for Every Course is tabulated as shown below:

For Theory Courses		
Percentage of Marks	**Grade Points, GP (10)**	**Grade Awarded**
Above 90	10	A+
From 81 to 90	09	A
From 71 to 80	08	B+
From 61 to 70	07	B
From 51 to 60	06	C+
From 41 to 50	05	C
From 35 to 40	04	D
Below 35	0	F (FAIL)

For Practical Courses		
Percentage of Marks	**Grade Points, GP (10)**	**Grade Awarded**
Above 90	10	A+
From 81 to 90	09	A
From 71 to 80	08	B+
From 61 to 70	07	B
From 51 to 60	06	C+
Equal to 50	05	C
Below 50	0	F (FAIL)

The merit level of a student would be indicated by

1. "Semester Grade Point Average (SGPA)" for the Year or for a Semester.
2. "Cumulative Grade Point Average (CGPA)" for awarding Diploma.

Conversion Formula, EP = Equivalent Percentage = [CGPA Obtained] x 10

4.14 Examination Fee Schedule

Examination fees are as per the notifications issued by the State Board of Technical Education and Training (SBTET), Andhra Pradesh, from time to time.

4.15 Structure of Examination Question Paper

I. Formative Assessment Through Unit Test:

a) Theory Courses

For First Year: Three Unit Tests.

For semesters: Two Unit Tests.

Each test shall be of 90 minutes duration, carrying a maximum of 40 marks and will consist of Part A and Part B

Part A (16 Marks):

1. Objective Type Questions:

Multiple Choice Questions / True or False / Fill in the Blanks- 4 × 1 marks = 4 marks

2. Short Answer Questions:

Four questions - 4 × 3 marks = 12 marks

Part B (24 Marks):

Essay-Type Questions: (Attempt any 3 out of 4) - 3 × 8 marks = 24 marks

Total Marks:4 + 12 + 24 = 40 marks

Computation of Marks

First Year: Average of 3 tests

Semester System: Average of 2 tests

The marks obtained out of 40 shall be scaled down to 20 and treated as the Unit Test marks for each course.

b) Drawing Courses (both Conventional/Hybrid) :

First Year:

Three-unit tests shall be conducted for 40 marks. The duration of each test is 120 minutes

The question paper pattern is as follows:

Part A: Answer all 4 question, 4 X 5M =20M.

Part B: Answer any 2 questions out of 4, 2 X 10M =20M.

Semesters:

Two-unit tests shall be conducted for 40 marks. The duration of each test is 120 minutes

The question paper pattern is as follows:

Part A: Answer all 4 question, 4 X 5M =20M.

Part B: Answer one questions out of two 1 X 20M =20M.

The marks obtained for 40 shall be scaled down to 20 marks and the average of 3tests/2tests shall be taken as final Unit test marks for the course. Remaining 20 marks are given by the teacher based on the performance of the student during regular class work of that course.

c) Laboratory/Workshops:

Fifty percent of the total marks shall be allotted to continuous assessment in labs/workshops and the remaining fifty percent shall be derived from two tests .

d) Assessment of Practicum Courses:

i)Practicum Theory course (out of 30 Marks)

Theory and Practical Assessment: 20 Marks

Continuous Internal Assessment: 10 Marks

Total Marks for the course = 20+10= **30** Marks

ii) Practicum practical course(out of 40 Marks)

Practical & Theory Assessment: 30 Marks

Continuous Internal Assessment: 10 Marks

Total Marks for the course = 30+10 = **40** Marks

** For Practicum (theory and practical) courses, CIA shall be distributed as Assignments-5 Marks, Dynamic Learning Activity -5 Marks*

II. Summative Assessment:

The question paper for theory examination is patterned in such a manner that the weightage of periods /marks allotted for each of the topics for a particular course be considered. Summative Assessment paper is of 3 hours duration.

a) Each theory paper has Section A (short answers) and Section B (essay questions).

Section A: Answer 10 out of 12 questions, Total = 10 × 3M = 30M

Section B: Answer 5 out of 8 questions, Total = 5 × 8M = 40M

Total theory marks for Summative Assessment = 70 Marks.

b) Drawing Course:

I year

Section A: 4 questions 4 X 5M = 20 marks (all to be answered).

Section B: answer 4 questions out of 6 questions. 4 × 10M = 40 marks.

Drawing Courses - III Sem to V Sem

As per the weightage of marks given in blue print of the respective course

c) Practical Examinations:

For practical with total 60 marks: Experiment/exercise = 50 marks; Viva-voce = 10 marks; Total = 60.

For practical with total 30 marks: Experiment/exercise = 25 marks; Viva-voce = 5 marks; Total = 30.

Question papers for practical are drawn by lottery and cover required skills. Changes to the pattern will be notified in advance.

d) Note on Laboratory Evaluation:

Laboratory teaching shall be task/competency based and the Semester-end question papers should follow SBTET norms.

4.16 Issue of Memorandum of Marks

All candidates who appear for the Summative Assessment 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. After successful completion of all courses, Consolidate Memorandum of Marks will be issued.

4.17 Maximum Period for Completion of Diploma

The maximum period to complete a Diploma is twice the duration of the course from the date of first admission (this includes any periods of detention or discontinuation). After this period, students will forfeit the right to complete the Diploma and will not be allowed to appear for exams. This applies to all the Diploma Programmes.

4.18 Eligibility for Award of Diploma

A candidate is eligible for the Diploma if:

i) They have pursued the course for not less than 3 years and not more than 6 years.

ii) Students must complete all the required courses. Those who fail to fulfil the requirements within the maximum permissible period shall forfeit their seat and will not be eligible for re-admission

For IVC & ITI Lateral Entry students:

i) They must pursue the course for not less than 2 years and not more than 4 years.

ii)They must complete all required courses. Failure to meet the requirements within the maximum permissible period shall result in forfeiture of the seat, and the student will not be eligible for re-admission.

Note: As and when a new curriculum is introduced in future, existing curriculum students under C-26 scheme shall write their backlog courses if any in the new curriculum equivalent courses decided by the SBTET, AP.

4.19 Malpractice Cases:

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

4.20. Discrepancies/ Pleas:

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

4.21. General

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

ii. All legal matters pertaining to the State Board of Technical Education and Training, AP are within the jurisdiction of Mangalagiri, Guntur District Andhra Pradesh only.

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

VISION
Develop Civil Engineering professionals competent to face the global challenges in a progressive environment conducive to learn technical knowledge, skills blended with ethics and values, to serve the society and to better it for a happy and comfortable living.

MISSION

M1	To provide a competitive learning environment, through a need-based curriculum designed in collaboration with industry, conducive for high quality education emphasising on transfer of knowledge and skill development essential for the profession and the society as well.
M2	To nurture higher order leadership qualities and ethics and values in students to enable them to be leaders in their chosen professions while maintaining the highest level of ethics.
M3	To encourage the spirit of inquisition to promote innovation and entrepreneurship strengthened with life skills to sustain the stress.
M4	To foster effective interactions and networking with all the stake holders so as to work towards the growth and sustainability of the society and environment.

Programme Educational Objectives (PEOs)

Diploma in Civil Engineering programme is steadfast to transform students in to competent professionals with qualities of good human values and responsible citizens. On completion of the Diploma programme, the students should have acquired the following characteristics

PEO1	To develop abilities and talents leading to creativity and productivity in various fields, and to produce the best Diploma in Civil engineering technicians by correlating in growing needs of the industry
PEO2	To promote among Diploma students the ability to gain multi disciplinary knowledge through industrial training, leading to a sustainable competitive edge in meeting societal needs.
PEO3	To inculcate group work and team management skills, communication skills, leadership skills among the students
PEO4	To sensitize students towards issue of social relevance, openness to other extracurricular activities and to introduce them to professional ethics and practice

PROGRAMME OUTCOMES(POs)

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

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. An ability to apply disciplines - specific knowledge to solve core and/or applied Civil Engineering problems.
2. An ability to plan and perform experiments and practices and to use the results to solve Civil Engineering problems.

3. Apply appropriate technologies and tools with an understanding of the limitations.

DIPLOMA IN CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND MODEL BLUEPRINT FOR EVALUATION

I YEAR

Course Code	Course Title	No. of Periods/week		Practicum (Y/N)	Total No. of Periods/Year	Credits	Scheme Of Examination			
		Theory	Practical				Duration (Hours)	FA (Marks)	SA (Marks)	Total Marks
THEORY COURSES										
26CE101T	English Essentials	3	---	N	90	4	3	30	70	100
26CE102T	Engineering Mathematics – I	6	---	N	180	6	3	30	70	100
26CE103T	Engineering Physics	3	---	N	90	4	3	30	70	100
26CE104T	Engineering Chemistry and Environmental studies	3	---	N	90	4	3	30	70	100
26CE105T	Engineering Mechanics	5	---	N	150	6	3	30	70	100
AUDIT COURSE										
26CE106A	Innovative Technologies in Civil Engineering	2	---	N	60		-	-	-	-
PRACTICAL COURSES										
26CE107D	Engineering Graphics and CAD	---	6	N	180	5	3	40	60	100
26CE108L	Surveying Theory & Practice-I	---	5	Y	150	4	3	40	60	100
26CE109L	Physics Lab	---	3	N	90	1.5	1.5	20	30	50
26CE110L	Chemistry Lab	---		N		1.5	1.5	20	30	50
26CE111L	Computer & Digital Skills Lab	---	3	N	90	3	3	40	60	100
26CE112C	Student Centric Activities	---	3	N	90	1	3			
	TOTAL	**22**	**20**		**1260**	**40**	**-**	**310**	**590**	**900**

Note 1: One credit will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NCC/Clean and Green or Sports/Games

* **Note 2**: For the Physics laboratory half of the first-year students of each programme will attend, while the remaining half will attend the chemistry laboratory. Thus, both laboratories will be engaged simultaneously during the three-hour lab session.

Note 3: 26CE101T, 26CE102T, 26CE103T, 26CE104T, 26CE109L, 26CE110L, and 26CE111L are common to all programmes.

DIPLOMA IN CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND MODEL BLUEPRINT FOR EVALUATION

III SEMESTER

Course Code	Course Title	No. of Periods/week		Practicum (Y/N)	Total No. of Periods/Year	Credits	Scheme Of Examination			
		Theory	Practical				Duration (Hours)	FA (Marks)	SA (Marks)	Total Marks
THEORY COURSES										
26CE301T	Mechanics of Solids & Theory of Structures	5	---	N	75	4	3	30	70	100
26CE302T	Hydraulics	5	---	N	75	3	3	30	70	100
26CE303T	Construction Materials & Practice	6	---	N	90	4	3	30	70	100
ELECTIVE COURSES										
26CE304E	Engineering Mathematics-II	3	---	N	45	2	3	30	70	100
26CE305E	Concrete Technology	3	---	N	45	2	3	30	70	100
26CE306E	Building Services and Maintenance	3	---	N	45	2	3	30	70	100
AUDIT COURSE										
26CE307A	Green Building Technologies	2	---	N	30	--	-	-	-	-
PRACTICAL COURSES										
26CE308D	Civil Engineering Drawing-I Integrated with CAD	---	6	N	90	2.5	3	40	60	100
26CE309L	Surveying Theory & Practice - II	---	6	Y	90	2	3	40	60	100
26CE310L	Material Testing & Hydraulics Practice	---	6	N	90	2	3	40	60	100
26CE311C	Student Centric Activities	---	3	N	45	0.5	-	-	-	-
	TOTAL	**21**	**21**		**630**	**20**	**-**	**240**	**460**	**700**

Note 1: 0.5 credits will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NCC/Clean and Green or Sports/Games

Note 2: 26CE304E is common elective to all programmes.

DIPLOMA IN CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND MODEL BLUEPRINT FOR EVALUATION

IV SEMESTER

Course Code	Course Title	No. of Periods/week		Practicum (Y/N)	Total No. of Periods/Year	Credits	Scheme Of Examination			
		Theory	Practical				Duration (Hours)	FA (Marks)	SA (Marks)	Total Marks
THEORY COURSES										
26CE401T	Design and Detailing of R.C. Structures	6	---	N	90	4	3	30	70	100
26CE402T	Estimation, Costing and Valuation	7	---	N	105	4	3	30	70	100
26CE403T	Irrigation Engineering	5	---	N	75	3	3	30	70	100
ELECTIVE COURSES										
26CE404E	Advanced Surveying Methods	3	---	N	45	2	3	30	70	100
26CE405E	Quality Control and Safety in Constructions	3	---	N	45	2	3	30	70	100
AUDIT COURSE										
26CE406A	Python Programming	2	---	N	30	--	-	-	-	-
PRACTICAL COURSES										
26CE407L	Civil Engineering Drawing-II Integrated with CAD	---	6	N	90	2.5	3	40	60	100
26CE408L	Communications And Employability skills	---	4	N	60	2	3	40	60	100
26CE409L	Surveying Theory & Practice - III	---	6	Y	90	2	3	40	60	100
26CE410C	Student Centric Activities	---	3	N	45	0.5	-	-	-	-
	TOTAL	**23**	**19**		**630**	**20**	**-**	**240**	**460**	**700**

Note1: 0.5 credits will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NCC/Clean and Green or Sports/Games

Note 2: 26CE408L is common laboratory to all programmes.

DIPLOMA IN CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND MODEL BLUEPRINT FOR EVALUATION

V SEMESTER

Course Code	Course Title	No. of Periods/week		Practicum (Y/N)	Total No. of Periods/Year	Credits	Scheme Of Examination			
		Theory	Practical				Duration (Hours)	FA (Marks)	SA (Marks)	Total Mar
THEORY COURSES										
26CE501T	Steel Structures	6	---	N	90	5	3	30	70	100
26CE502T	Water Supply and Sanitary Engineering	6	---	N	90	4	3	30	70	100
26CE503T	Transportation Engineering	5	---	N	75	3	3	30	70	100
ELECTIVE COURSES										
26CE504E	Construction Management & Entrepreneurship	3	---	N	45	2	3	30	70	100
26CE505E	Geotechnical Engineering	3	---	N	45	2	3	30	70	100
AUDIT COURSE										
26CE506A	Advanced Civil Engineering Technologies	2	---	N	30	--	-	-	-	-
PRACTICAL COURSES										
26CE507L	Field Practice	---	7	N	105	2	3	40	60	100
26CE508L	Computer Applications for Civil Engineering	---	6	N	90	2	3	40	60	100
26CE509P	Project work	---	4	N	60	1.5	3	40	60	100
26CE510C	Student Centric Activities	---	3	N	45	0.5	-	-	-	-
	TOTAL	**22**	**20**		**630**	**20**	**-**	**240**	**460**	**700**

Note: 0.5 credits will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NCC/Clean and Green or Sports/Games

DIPLOMA IN CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND MODEL BLUEPRINT FOR EVALUATION

VI SEMESTER

In case of Industrial Training, SOP will be circulated by SBTET, A.P from time to time. The Formative Assessment and Summative Assessment shall be done as illustrated in the following table:

S No	Course	Sub	Duration	Assessment No	Upon completion of	Conducted by	Based on	Max Marks
	Industrial Training	26CE601I	One Semester	Pre-Assessment	15 Days to 30 Days from the commencement of training	Mentor faculty member visits the industry one month after commencement of training and will submit a detailed report to the principal outlining each candidate's details and observed work culture		
				1.(Formative Assessment)	Mid Semester Assessment (after three months - at industry	1.The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120
				2.(Formative Assessment)	Last month of training (at industry)	1. The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120
				3.(Summative Assessment)	After completion of the training (at Institution)	1.The faculty member concerned, 2.HoD concerned 3.An external examiner from Industry	1.Demonstration of any one of the skills listed in learning outcomes	30
							2.Training Report	20
							3. Viva Voce	10
				TOTAL				300

- Each staff member shall be assigned a batch of students 10 to 15 as a mentor faculty for making assessment during industrial training.
- The Industrial Training shall carry 300 marks and pass mark is 50% in assessment at industry (first and second assessment put together) and in final summative assessment at institution put together
- If the student fails to secure 50% marks in final summative assessment at institution level, the student shall reappear for final summative assessment, in the subsequent board examination.
- During Industrial Training the candidate shall put in a minimum of 90% attendance. If the student fails to secure 90% attendance during industrial training, the student should reappear for 6 months industrial training.

I Year

DIPLOMA IN CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND MODEL BLUEPRINT FOR EVALUATION

I YEAR

Course Code	Course Title	No. of Periods/week		Practicum (Y/N)	Total No. of Periods/Year	Credits	Scheme Of Examination			
		Theory	Practical				Duration (Hours)	FA (Marks)	SA (Marks)	Total Marks
THEORY COURSES										
26CE101T	English Essentials	3	---	N	90	4	3	30	70	100
26CE102T	Engineering Mathematics – I	6	---	N	180	6	3	30	70	100
26CE103T	Engineering Physics	3	---	N	90	4	3	30	70	100
26CE104T	Engineering Chemistry and Environmental studies	3	---	N	90	4	3	30	70	100
26CE105T	Engineering Mechanics	5	---	N	150	6	3	30	70	100
AUDIT COURSE										
26CE106A	Innovative Technologies in Civil Engineering	2	---	N	60		-	-	-	-
PRACTICAL COURSES										
26CE107D	Engineering Graphics and CAD	---	6	N	180	5	3	40	60	100
26CE108L	Surveying Theory & Practice-I	---	5	Y	150	4	3	40	60	100
26CE109L	Physics Lab	---	3	N	90	1.5	1.5	20	30	50
26CE110L	Chemistry Lab	---		N		1.5	1.5	20	30	50
26CE111L	Computer & Digital Skills Lab	---	3	N	90	3	3	40	60	100
26CE112C	Student Centric Activities	---	3	N	90	1	3			
	TOTAL	**22**	**20**		**1260**	**40**	**-**	**310**	**590**	**900**

Note 1: One credit will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NCC/Clean and Green or Sports/Games

* **Note 2**: For the Physics laboratory half of the first-year students of each programme will attend, while the remaining half will attend the chemistry laboratory. Thus, both laboratories will be engaged simultaneously during the three-hour lab session.

Note 3: 26CE101T, 26CE102T, 26CE103T, 26CE104T, 26CE109L, 26CE110L, and 26CE111L are common to all programmes.

ENGLISH ESSENTIALS

Course code	Course title	No. Of period / week	Total no. Of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE101T	ENGLISH ESSENTIALS	3	90	30	70	4

TIME SCHEDULE

S. No.	Chapter/ Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions
1.	Exploring English	10	14	2	1
2.	The Better You!	10	11	3	1
3.	Drive to Destiny	10	14		1
4.	Renew, Rewire & Resolve	10	17	2	1
5.	Brains & Bots	10		1	
6	The Blue Planet: Mend or End	10	11	1	1
7	One World One Dream	10	11	1	1
8	The Net Norms	10	11	1	1
9	Managing Moods & Moments	10	11	1	1
	Total	**90**	**100**	**12**	**8**

COURSE OBJECTIVES

(i)	To inculcate knowledge of functional English and enrich vocabulary
(ii)	To impart effective listening, speaking, reading, and writing skills
(iii)	To sensitise the students on themes related to personality, technological advancements, sustainability, and human values

COURSE OUTCOMES

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

CO1	CE101.1	Learn and apply various English grammatical concepts to communicate in academic, professional, personal, and social contexts.
CO2	CE101.2	Use appropriate vocabulary in academic, professional and business correspondence, and on social media platforms.
CO3	CE101.3	Listen/read and comprehend diverse academic, professional, and general listening and reading materials.
CO4	CE101.4	Communicate effectively and fluently in oral and written forms in various life situations.
CO5	CE101.5	Display scientific temper and universal human values; adopt technology for holistic development and harmonious living through one's demeanour and communication.

LEARNING OUTCOMES

1.0 Exploring English

1.1 To read and comprehend simple sentences in a short passage.
1.2 To apply rules of spelling, correct the misspelt words and use dictionary to enrich vocabulary
1.3 To identify various parts of speech suitable to the context and use articles & prepositions accurately.
1.4 To describe a given situation/picture using simple sentences.
1.5 To value the importance of English for employability.

2.0 The Better You!

2.1 To read and comprehend formal and informal conversations.
2.2 To use words suitable to the context in spoken and written communication.
2.3 To use the appropriate forms of verbs.
2.4 To engage in conversations in both formal and informal contexts.
2.5 To demonstrate a positive attitude in personal and academic spheres.

3.0 Drive To Destiny

3.1 To read and comprehend paragraphs for specific and general information, and distinguish different types of paragraphs
3.2 To distinguish word pairs and use them contextually.
3. 3 To frame sentences with proper subject-verb agreement.
3.4 To describe actions using appropriate tenses.
3.5 To set and achieve academic and personal goals.

4.0 Renew, Rewire & Resolve

4.1 To read and comprehend the content and structure of e-mails for different purposes.
4.2 To recognise the root words and use appropriate affixes contextually.
4.3 To use various kinds of sentences for different communicative situations.
4.4 To draft E-mails for academic and professional purposes.
4.5 To apply critical thinking and creativity for solving problems.

5.0 Brains & Bots

5.1 To read and comprehend the description of a process and the use of sequence markers.
5.2 To communicate effectively using phrasal verbs.

5.3 To use active and passive voice appropriately.
5.4 To describe processes and procedures using appropriate sentence forms.
55. To appraise the importance and use of robotics and artificial intelligence in human life.

6.0 The Blue Planet: Mend Or End!

6.1 To read and comprehend the content, structure and purpose of formal and informal letters.
6.2 To describe using appropriate forms of adjectives
6.3 To substitute phrases or clauses with a single word.
6.4 To draft personal and professional letters.
6.5 To realise the importance of environmental protection and ensure sustainability.

7.0 One World - One Dream

7.1 To read and comprehend an essay and analyse its features
7.2 To identify and create shortened forms of words or phrases.
7.3 To report the expressions of the speaker with necessary grammatical changes.
7.4 To draft well-organised essays for academic and professional purposes.
7.5 To appraise the importance of inclusivity in society.

8.0 The Net Norms

8.1 To comprehend and analyse the given text for making notes and summarising.
8.2 To use contemporary language in informal communication.
8.3 To split or combine ideas using conjunctions for effective communication.
8.4 To make notes of textual information and summarise the information.
8.5 To demonstrate ideal behaviour on the internet.

9.0 Managing Moods & Moments

9.1 To read and comprehend different types of reports.
9.2 To analyse and evaluate grammatical errors.
9.3 To use words and phrases in sentences of your own.
9.4 To draft organised and comprehensive reports on experiments, events, visits and incidents.
9.5 To assess the reasons and manage stress and time effectively.

CO-PO/PSO MAPPING

<table>
<tr><th>CO/PO</th><th>PO1</th><th>PO2</th><th>PO3</th><th>PO4</th><th>PO5</th><th>PO6</th><th>PO7</th><th>PS01</th><th>PS02</th><th>PS03</th></tr>
<tr><td>CO1</td><td colspan="4" rowspan="5">POs 1 to 4 are not directly applicable to the English course. However, activities that use content from science and technology relevant to the Programme taken up by the student shall be exploited for communication in the Course.</td><td></td><td>3</td><td>2</td><td colspan="3" rowspan="5">Programme Specific Outcomes are programme specific with technical aspects that are not directly applicable to the English Language course.</td></tr>
<tr><td>CO2</td><td></td><td>3</td><td>2</td></tr>
<tr><td>CO3</td><td></td><td>3</td><td>2</td></tr>
<tr><td>CO4</td><td></td><td>3</td><td>2</td></tr>
<tr><td>CO5</td><td>2</td><td></td><td>2</td></tr>
<tr><td>Average</td><td></td><td></td><td></td><td></td><td>2</td><td>3</td><td>2</td><td></td><td></td><td></td></tr>
</table>

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

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (iv) Library Visits etc.,

COURSE CONTENT

1.0 Exploring English

Reading – Roleplay – Picture Interpretation – Sounds and Spellings – Parts of Speech – Articles and Prepositions

2.0 The Better You!

Reading – Dialogue Writing – Synonyms and Antonyms – Word order – Verbs

3.0 Drive To Destiny

Reading – Paragraph Writing – Homophones, Homonyms, Homographs – Concord – Tenses

4.0 Renew, Rewire & Resolve

Reading – E-mail Writing – Roots, Affixes – Kinds of Sentences

5.0 Brains & Bots

Reading – Describing Process – Phrasal Verbs – Voice

6.0 The Blue Planet: Mend Or End!

Reading – Letter Writing – One-word Substitutes – Degrees of Comparison

7.0 One World - One Dream

Reading – Essay Writing – Abbreviations & Acronyms – Reported Speech

8.0 The Net Norms

Reading – Note making & Summarising – Gen-Z Vocabulary – Synthesis of Sentences

9.0 Managing Moods & Moments

Reading – Report Writing – Usage – Error Analysis

Note: The textbook "English Essentials" (A Textbook of English for I Year Engineering Diploma Courses - by SBTET, AP) is the prescribed text for this course. It comprises various language inputs and activities addressing the Learning outcomes specified in each unit. Every unit will have six major components: Listening, Speaking, Reading, Writing, Vocabulary, and Grammar. The activities will be designed as Individual, Pair and Group activities to facilitate self and peer learning.

REFERENCE BOOKS:

1. Martin Hewings, "*Advanced Grammar in Use",* Cambridge University Press (2007)
2. Murphy, Raymond, "*English Grammar in Use",* Cambridge University Press (2019)
3. Sidney Greenbaum, "*Oxford English Grammar"*, Oxford University Press (1996)
4. Wren and Martin (Revised by N.D.V. Prasad Rao) "*English Grammar and Composition*, Blackie ELT Books", S. Chand and Co. (2023)
5. Sarah Freeman, "*Strengthen Your Writing"*, Macmillan

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS I, II & III

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From 1.1 to 3.5
Unit Test – 2	From 4.1 to 6.5
Unit Test – 3	From 7.1 to 9.5

ENGINEERING MATHEMATICS-I

Course Code	Course Title	No. of Periods/ week	Total No. of periods	Marks for FA	Marks for SA	Credits
26CE102T	Engineering Mathematics-I	6	180	30	70	6

TIME SCHEDULE

S.No.	Unit Title	No. of periods	COs mapped
1	Algebra	31	CO1
2	Trigonometry	63	CO2
3	Co-ordinate Geometry	26	CO3
4	Differential Calculus	34	CO4
5	Integral Calculus	26	CO5
Total Periods		**180**	

S.No.	Chapter	No. of Periods	Marks Allotted	No. of Short Questions	No. of Essay Questions	COs mapped
Unit - I: Algebra						
1	Partial Fractions	6	4	0	1/2	CO1
2	Matrices and Determinants	25	18	2	1&1/2	CO1
Unit - II: Trigonometry						
3	Trigonometric Ratios	4	0	0	0	CO2
4	Compound Angles	8	3	1	0	CO2
5	Multiple and Sub-multiple angles	8	3	1	0	CO2
6	Transformations	9	4	0	1/2	CO2
7	Inverse Trigonometric Functions	8	4	0	1/2	CO2
8	Trigonometric Equations	8	4	0	1/2	CO2
9	Properties of triangles	8	4	0	1/2	CO2
10	Complex Numbers	8	3	1	0	CO2
11	Hyperbolic functions	2	0	0	0	CO2
Unit III: Co-ordinate Geometry						
12	Straight Lines	8	3	1	0	CO3
13	Circles	8	4	0	1/2	CO3
14	Conic Sections	10	4	0	1/2	CO3
Unit – IV: Differential Calculus						
15	Limits and Continuity	6	3	1	0	CO4
16	Differentiation	28	17	3	1	CO4

Unit – V: Integral Calculus						
17	Indefinite integration	18	11	1	1	CO5
18	Definite integration	8	11	1	1	CO5
	Total	180	100	12	8	
			Marks	36	64	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able to	
(i)	To apply the principles of Algebra, Trigonometry and Co-ordinate Geometry to real-time problems in engineering.
(ii)	To build the concepts of indefinite integrals and definite integrals.

COURSE OUTCOMES

CO1	CE102.1	Resolve partial fractions and solve problems on matrices and determinants.
CO2	CE102.2	Use the concept of trigonometric functions, their inverses and complex numbers.
CO3	CE102.3	Find the equations and properties of straight lines, circles and conic sections in coordinate system.
CO4	CE102.4	Evaluate the limits and derivatives of various functions and apply to engineering problems.
CO5	CE102.5	Integrate various functions using different methods and evaluate definite integrals.

LEARNING OUTCOMES

C.O. 1 Resolve partial fractions and solve problems on matrices and determinants.

L.O. 1.1 Define rational, proper and improper fractions of polynomials.

1.2 Explain the procedure of resolving proper fractions of the type $\frac{f(x)}{(ax+b)(cx+d)}$

1.3 Define a matrix and order of a matrix.

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

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

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

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

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

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

1.10 Solve a system of three linear equations in three unknowns using Cramer's rule.

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

L.O. 2.1 Recall the trigonometric ratios and their values at specified angles.

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

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

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

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

2.6 Solve simple problems using the identities on compound angles.

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

2.8 Derive useful allied formulae like $\sin^2 A = \frac{1-\cos 2A}{2}$ etc.

2.9 Solve simple problems using the multiple and sub-multiple formulae.

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

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

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

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

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

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

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

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

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

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

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

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

2.22 Define arithmetic operations on complex numbers with examples.

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

2.24 Explain the concept of hyperbolic trigonometric functions and list appropriate formulae.

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

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

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

3.3 Define locus of a point and circle.

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

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

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

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

3.8 Describe the properties of Parabola $y^2 = 4ax$.

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

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

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

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

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

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

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

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

4.8 Find the derivatives of hyperbolic and inverse hyperbolic functions.

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

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

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

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

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

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

4.15 Define maximum and minimum values of a function and find the maximum and minimum values for quadratic polynomials.

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

C.O. 5 Integrate various functions using different methods and evaluate definite integrals.

L.O. 5.1 Explain the concept of Indefinite integral as an anti-derivative.

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

5.3. Solve problems involving standard functions using these properties.

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

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

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

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

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

5.6. Evaluate the Standard integrals of the functions of the type :

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

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

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

5.7. Evaluate integrals using decomposition method for integrand of the type $\frac{px+q}{(ax+b)(cx+d)}$.

5.8. Solve problems using integration by parts.

5.9 Use Bernoulli's rule to evaluate the integrals of the form $\int u.v dx$.

5.10. State the fundamental theorem of integral calculus.

5.11. Explain the concept of definite integral.

5.12. Solve simple problems on definite integrals.

5.13. State various properties of definite integrals.

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

CO-PO MAPPING

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

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

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

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

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

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

COURSE CONTENT

Unit-I: Algebra

1. **Partial Fractions:** Definitions of rational, proper and improper fractions of polynomials. Resolve rational fractions (proper fractions) of type $\frac{f(x)}{(ax+b)(cx+d)}$ into partial fractions.
2. **Matrices:** Definition of a matrix, types of matrices - Algebra of matrices, equality of two matrices, sum, difference, scalar multiplication and product of matrices. Transpose of a matrix, Symmetric, skew-symmetric matrices - Determinant of a square matrix, minor and cofactor of an element, Laplace's expansion, properties of determinants - Singular and non-singular matrices, Adjoint and multiplicative inverse of a square matrix - System of linear equations in 3 variables-Solutions by Cramer's rule.

Unit-II: Trigonometry

3. **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.
4. **Compound angles:** Formulas of $\sin(A \pm B)$, $\cos(A \pm B)$, $\tan(A \pm B)$, $\cot(A \pm B)$ and related identities.
5. **Multiple and sub-multiple angles:** Formulae for trigonometric ratios of multiple angles 2A, 3A and sub multiple angle A/2.
6. **Transformations:** Transformations of products into sums or differences and vice versa.
7. **Inverse trigonometric functions:** Definition, domains and ranges-basic properties.
8. **Trigonometric equations:** Concept of a solution, principal value and general solution of trigonometric equations: $\sin x = k$, $\cos x = k$ and $\tan x = k$, where k is a constant. Solutions of simple quadratic equations and equations of type $a\sin^2 x + b\sin x + c = 0$ and $a\sin x + b\cos x + c = 0$.
9. **Properties of triangles:** Relations between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule-area of a triangle.
10. **Complex Numbers:** Definition of a complex number, modulus, conjugate and amplitude of a complex number- Arithmetic operations on complex numbers - Modulus-Amplitude(polar) form, Exponential form (Euler form) of a complex number.
11. **Hyperbolic functions:** Definition of hyperbolic and inverse hyperbolic trigonometric functions- and list formulae.

UNIT-III: Coordinate geometry

12 **Straight lines:** Various forms of a straight line - Angle between two lines, perpendicular distance from a point to the straight line, point of intersection of non-parallel lines and distance between parallel lines.

13. **Circle:** Locus of a point, Circle definition-Circle equation given (i) centre and radius, (ii) two ends of a diameter (iii) three non-collinear points of type $(0,0),(a,0),(0,b)$ - General equation of a circle –its centre and radius.

14. **Conic sections**: Definition of a conic - Equation of a conic when focus, directrix and eccentricity are given - Properties of parabola in the standard form $y^2 = 4ax.$

UNIT-IV: Differential Calculus

15. **Concept of Limit:** Definition and Properties of Limits and Standard Limits - Continuity of a function at a point.

16. **Concept of derivative:** Definition (first principle)- different notations- Derivatives of standard algebraic, logarithmic, exponential, trigonometric, inverse trigonometric, hyperbolic and inverse hyperbolic functions - Derivatives of sum, difference, scalar multiplication, product, quotient of functions - Chain rule, derivatives of parametric functions, derivatives of implicit functions, logarithmic differentiation - Second order derivatives – Define maximum and minimum values of a function and find the maximum or minimum values for quadratic polynomial. Functions of several variables, first order partial derivatives.

UNIT-V: Integral Calculus

17. **Indefinite Integration:** Integration regarded as an anti-derivative – Indefinite integrals of standard functions. Properties of indefinite integrals. Integration by substitution or change of variable. Integrals of tan x, cot x, sec x and cosec x.

Evaluation of integrals which are of the following forms:

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

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

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

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

18.**Definite Integration:** Definite integral, fundamental theorem of integral calculus, Properties of definite integrals, evaluation of simple definite integrals.

TEXT BOOK

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

REFERENCE BOOKS

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

SUGGESTED E-LEARNING REFERENCES:

1. https://www.khanacademy.org/

2. https://www.wolframalpha.com/
3. https://onlinecourses.nptel.ac.in/
4. http://tutorial.math.lamar.edu/

UNIT TEST SYLLABUS

Unit Test	Learning Outcomes to be Covered
Unit Test–1	From1.1to 2.11
Unit Test–2	From 2.12 to 3.8
Unit Test–3	From 4.1 to 5.14

ENGINEERING PHYSICS

Course Code	Course Title	No. of Periods/ week	Total No. of periods	Marks for FA	Marks for SA	Credits
26CE103T	Engineering Physics	3	90	30	70	4

TIME SCHEDULE

S. No	Chapter/ Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	CO's Mapped
1.	Units and Measurements	09	06	02	-	CO1
2.	Elements of Vectors	11	14	02	01	
3.	Mechanics	10	11	01	01	CO2
4.	Fundamentals of Astrodynamics	13	19	01	02	
5.	Energy and Thermal Physics	12	11	01	01	CO3
6.	Concepts of Acoustics	12	14	02	01	
7.	Electricity and Magnetism	13	14	02	01	CO4
8.	Modern Physics	10	11	01	01	
	Total	**90**	**100**	**12**	**08**	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to

(i)	To understand the basic concepts of physics for various Engineering applications as required for industries.
(ii)	To equip the students with the scientific advances in technology and make the student suitable for any industrial organization.

COURSE OUTCOMES

CO1	CE103.1	Familiarize with various physical quantities, their SI units and errors in measurements. Understand the concepts of vectors for solving engineering problems.
CO2	CE103.2	Solve problems in engineering using appropriate equations and formulae related to Mechanics. Understand the concepts of gravitation, planetary motion with reference to applications in satellites

CO3	CE103.3	Familiarize with the knowledge of various forms of energy, thermal physics and concepts of acoustics in relevance to the societal requirements.
CO4	CE103.4	Familiarize with the basic knowledge of electricity, magnetism and advances in Modern Physics such as photoelectric cell, optical fibers, superconductors and nanotechnology.

LEARNING OUTCOMES

Upon completion of the course the student shall be able to

1 UNITS AND MEASUREMENTS

1.1 Introduction to Units and Measurements
1.2 Define the terms: a) Physical quantity b) Fundamental physical quantities and c) Derived physical quantities.
1.3 Explain the concept of units in measurement.
1.4 Define the term 'unit'.
1.5 Define fundamental units and derived units.
1.6 State the SI units of fundamental quantities along with their symbols.
1.7 State the common multiples and submultiples used in the SI system.
1.8 State the rules for writing SI units.
1.9 State the advantages of using SI units.
1.10 Differentiate between direct and indirect measurements.
1.11 Define accuracy and least count in the context of measurement.
1.12 Define error in measurement.
1.13 Define absolute, relative and percentage errors and state their respective formulae.
1.14 Solve numerical problems on errors in measurements.

2 ELEMENTS OF VECTORS

2.1 Explain the concept of vectors.
2.2 Define scalar and vector quantities with relevant examples for each.
2.3 Represent a vector geometrically.
2.4 Define equal vectors, negative vector, unit vector, position vector, co-initial vectors, co-planar vectors.
2.5 Resolve a given vector into its rectangular components.
2.6 State and explain the triangle law of addition of vectors.
2.7 State the parallelogram law of addition of vectors.
2.8 Derive the expressions for the magnitude and direction of the resultant vector using the parallelogram law.
2.9 Illustrate applications of the parallelogram law of vectors using examples (i) Bow and arrow (ii) working of a sling (iii) Flying of a bird.
2.10 Define dot product (scalar product) of two vectors.
2.11 Explain (i) work done (ii) power as examples of dot product.
2.12 Define cross product (vector product) of two vectors.
2.13 Explain (i) linear velocity (ii) torque as examples of cross product.
2.14 Solve numerical problems on (i) resolution of vectors (ii) the parallelogram law of vectors iii) dot product.

3 MECHANICS

3.1 Define linear momentum; Mention its SI unit.
3.2 Define force. Mention its SI unit.
3.3 Define torque. Mention its SI unit.
3.4 Define concurrent forces, co-planar forces.
3.5 State and explain Lami's theorem.
3.6 State equations of motion of a body moving in a straight line with uniform

acceleration.
3.7 Define projectile. Give examples.
3.8 Derive the equation for the path of an oblique projectile.
3.9 Define periodic motion.
3.10 Define Ideal Simple pendulum.
3.11 Write formula for the time period of a simple pendulum.
3.12 Solve numerical problems on equations of motion and simple pendulum.

4 FUNDAMENTALS OF ASTRODYNAMICS

4.1 Define acceleration due to gravity (g); Mention its SI unit.
4.2 State and explain Newton's universal law of gravitation.
4.3 Define universal gravitational constant (G) and mention its value in SI unit.
4.4 Derive the relationship between acceleration due to gravity (g) and the universal gravitational constant (G).
4.5 State and explain Kepler's laws of planetary motion.
4.6 Define orbital velocity and state its formula.
4.7 Define escape velocity and state its formula.
4.8 Derive the relationship between escape velocity and orbital velocity.
4.9 Define the term 'satellite'.
4.10 Define natural and artificial satellites. Give examples for each.
4.11 Mention the applications of artificial satellites.
4.12 Solve numerical problems on (i) Newton's law of gravitation (ii) orbital velocity (iii) escape velocity.

5 ENERGY AND THERMAL PHYSICS

5.1 Define work done; Mention its SI unit.
5.2 Define power; Mention its SI unit.
5.3 Define energy; Mention its SI unit.
5.4 List various forms of energy.
5.5 Define potential energy; Give examples and derive its equation.
5.6 Define kinetic energy; Give examples and derive its equation.
5.7 Derive the relationship between kinetic energy and linear momentum.
5.8 State the law of conservation of energy; Give any two examples.
5.9 State Boyle's law; Write its equation.
5.10 State Charles's volume law; Write its equation.
5.11 State Charles's pressure law; Write its equation.
5.12 Define an Ideal gas.
5.13 Derive the ideal gas equation (PV = nRT).
5.14 Solve numerical problems on (i) Work done (ii) Potential energy (iii) Kinetic energy (iv) Relation between K.E. and momentum (v) Gas laws

6 **CONCEPTS OF ACOUSTICS**

6.1 Define longitudinal waves. Give examples.
6.2 Define transverse waves. Give examples.
6.3 Define sound. Mention SI unit for intensity of sound.
6.4 Define musical sound.
6.5 Define noise.
6.6 Distinguish between musical sound and noise.
6.7 Define noise pollution.
6.8 Explain the sources of noise pollution.
6.9 Explain the effects of noise pollution.
6.10 Explain methods of minimizing noise pollution.
6.11 Define Beats. Write formula for beat frequency.
6.12 State Doppler's Effect. Mention its applications.
6.13 Explain the concept of echo.
6.14 Mention the applications of echo.
6.15 Define reverberation and reverberation time.

6.16 Write Sabine's formula and name the parameters in it.
6.17 Solve numerical problems on echo.

7 ELECTRICITY AND MAGNETISM

7.1 State and explain Ohm's law.
7.2 Define electrical resistance; Mention its SI unit.
7.3 Define specific resistance (resistivity);Mention its SI unit.
7.4 State and explain Kirchhoff's Current Law.
7.5 State and explain Kirchhoff's Voltage Law.
7.6 Derive an expression for the balancing condition of Wheatstone's bridge with neat diagram.
7.7 Describe Meter bridge with necessary circuit diagram.
7.8 Write formula to find unknown resistance using meter bridge.
7.9 Explain the concept of magnetic field.
7.10 Define uniform and non-uniform magnetic fields.
7.11 Define magnetic pole strength; Mention its SI unit.
7.12 Define magnetic moment; Mention its SI unit.
7.13 Define magnetic lines of force.
7.14 Write the properties of magnetic lines of force.
7.15 State Coulomb's inverse square law of magnetism. Write its equation.
7.16 Derive the expression for the moment of couple acting on a bar magnet placed in a uniform magnetic field.
7.17 Solve numerical problems on (i) Ohm's law (ii) Kirchhoff's first law (iii) Wheatstone bridge and Meter bridge (iv) Coulomb's inverse square law of magnetism.

8 MODERN PHYSICS

8.1 State and explain photoelectric effect.
8.2 Write Einstein's photoelectric equation and name the terms in it.
8.3 Explain the working of a photoelectric cell.
8.4 List the applications of the photoelectric cell.
8.5 Define critical angle.
8.6 Explain the phenomenon of total internal reflection.
8.7 Define optical fiber; Explain the principle and working of an optical fiber.
8.8 List the applications of optical fiber.
8.9 Define Superconductor and superconductivity.
8.10 List the applications of superconductors.
8.11 Define Nanotechnology and Nano materials.
8.12 Write applications of Nano materials.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	1		1
CO2	3	2	1	1	1		2
CO3	3	2	1	1	1		2
CO4	3	2	1	1	3		2
Average	3	2	1	1	1.5		1.75

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

Note: The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following. (i) Seminar (ii) Viva-voce (iii) Assignments (iv) Quiz competitions (v) Industrial visits (vi) Techfest (vii) Mini project (viii) Group discussions (ix) Virtual labs (x) Library visit for e-books

COURSE CONTENT

1. **Units and measurements:**

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

2. **Elements of Vectors:**

Introduction of Scalars and Vectors – Representation of a vector –Types of vectors - Resolution of vector into rectangular components – Triangle law of vectors - Parallelogram law of vectors- examples- derivation of magnitude and direction of resultant vector- Dot product- Cross product - Problems.

3. **Mechanics**:

Introduction to Mechanics – Momentum –force-torque. Concurrent and coplanar forces - Lami's theorem – equations of motion of a body moving in a straight line – projectile - path of projectile in oblique projection – periodic motion -Ideal simple pendulum- Time period of simple pendulum- Problems.

4. **Fundamentals of Astrodynamics:**

Concept of acceleration due to gravity (g) -Newton's law of gravitation- Universal Gravitational constant G – Relation between g and G- Kepler's laws of planetary motion – Orbital velocity and escape velocity – Satellites: Natural and artificial - Applications of artificial satellites – Problems.

5. **Energy and thermal Physics**

Work done, Power and Energy - forms of energy - Potential energy - Kinetic energy- Momentum- K.E and Momentum relation – Law of Conservation of energy- Boyle's law - Charle's volume law -Charle's pressure law- Ideal Gas equation- Problems.

6. **Concepts of Acoustics**

Longitudinal wave- transverse wave- musical sound - noise - Noise pollution – Causes, effects, Methods of minimizing noise pollution- Beats - Doppler's Effect - applications - Echo- Reverberation - Reverberation time- Sabine 's formula - Problems.

7. **Electricity and Magnetism**

Ohm's law- Resistance - Specific resistance - Kirchoff's laws - Wheatstone's bridge- Meter Bridge. Concept of magnetic field- magnetic pole strength – Magnetic Moment- magnetic lines of force - Coulomb's inverse square law of magnetism– Torque acting on a bar magnet- Problems.

8. **Modern Physics**

Photoelectric effect – Einstein photo electric equation – photoelectric cell – Applications of photoelectric cell – critical angle, Total internal reflection- Optical Fiber - Principle – working-Applications of optical fibers - Superconductivity–applications – Nanotechnology – applications.

REFERENCES:

1. Intermediate physics - Volume - I & 2
2. Telugu Academy (English version)
3. Unified physics Volume 1, 2, 3 and 4 -Dr. S.L Guptha and Sanjeev Guptha
4. Concepts of Physics, Vol 1 & 2 -H.C. Verma
5. Text book of physics Volume I & II -Resnick & Holiday
6. Fundamentals of physics -Brijlal & Subramanyam
7. Text book of applied physics -Dhanpath Roy
8. NCERT Text Books of physics -Class XI & XII Standard
9. e-books/e-tools/websites/Learning Physics software/PhET Interactive Simulations

TABLE SHOWING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS:

Unit test	Learning outcomes to be covered
Unit test - 1	From 1.1 to 3.12
Unit test - 2	From 4.1 to 6.17
Unit test - 3	From 7.1 to 8.12

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for FA	Marks for SA	Credits
26CE104T	Engineering Chemistry and Environmental Studies	3	90	30	70	4

TIME SCHEDULE

Chapter No.	Unit Title/Chapter	No. of Periods	Weightage	No. of Short Questions (3 marks)	No. of Essay Questions (8 marks)	COs Mapped
1	Basic Concepts of Chemistry	14	18	2	1.5	CO1
2	Solutions, Acids and Bases	14	18	2	1.5	CO1
3	Electrochemistry	12	11	1	1	CO2
4	Corrosion	8	11	1	1	CO2
5	Water Treatment	8	11	1	1	CO3
6	Polymers and Engineering Materials	10	11	1	1	CO4
7	Fuels and Alternative Energy Sources	6	3	1	0	CO4
8	Environmental Studies	18	17	3	1	CO5
TOTAL		**90**	**100**	**12**	**8**	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to

(i)	To develop a fundamental understanding of core chemical principles and their relevance to a wide range of engineering applications.
(ii)	To explore and analyse natural and anthropogenic environmental challenges through an interdisciplinary lens, incorporating physical, chemical and socio - cultural perspectives.
(iii)	To reinforce theoretical concepts by conducting relevant experiments/exercises

COURSE OUTCOMES

CO1	CE104.1	Explain the basics of atomic structure, chemical bonding, oxidation-reduction, mole concept, concentration expressing methods of solutions, acids-bases, pH and buffer solutions.
CO2	CE104.2	Explain electrolysis, Galvanic cell, batteries and corrosion.
CO3	CE104.3	Explain the chemistry involved in the treatment of hardness in water.
CO4	CE104.4	Explain the preparation and applications of polymers, and understand the composition and uses of alloys, nanomaterials and green fuels.
CO5	CE104.5	Explain environmental concepts, pollution types, global issues, green chemistry principles and sustainable development goals.

LEARNING OUTCOMES

At the end of the course student will be able to….

1.0 **Basic Concepts of Chemistry**

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

1.2 Understand the concept of Atomic number and Mass number.

1.3 Calculate the number of electrons, number of protons and number of neutrons in atoms, if Atomic number and Mass number are given.

1.4 Explain the Postulates of Bohr's atomic theory and its limitations.

1.5 Explain the values and significance of four Quantum numbers.

1.6 Define Orbital of an atom and draw the shapes of s, p orbitals.

1.7 Distinguish between orbit and orbital.

1.8 Explain (i). Aufbau principle (ii). Hund's rule and (iii). Pauli's exclusion principle.

1.9 Write the Electronic configuration of elements up to Atomic number 20.

1.10 Explain the significance of chemical bonding.

1.11 Understand the concept of Octet rule.

1.12 Define Ionic bond and explain it in the formation of NaCl.

1.13 Define Covalent bond and explain it in the formation of H_2, O_2 & N_2 molecules (Lewis Dot Method).

1.14 List out the Properties of Ionic compounds and Covalent compounds and distinguish between their properties.

1.15. Understand the electronic concept of oxidation, reduction and redox reactions.

2. **Solutions, Acids and Bases**

2.1 Define the terms: (i). Solution (ii). Solute and (iii). Solvent with examples.

2.2 Classify solutions based on physical state of solvent with examples.

2.3 Define the terms: (i). Atomic weight, (ii). Molecular weight, and (iii). Equivalent weight.

2.4 Calculate Molecular weight and Equivalent weight of the given Acids (HCl, H_2SO_4, H_3PO_4),Bases (NaOH, $Ca(OH)_2$, $Al(OH)_3$ and Salts (NaCl, Na_2CO_3, $AlCl_3$).

2.5 Define Mole and solve numerical problems on Mole concept.

2.6 Define Molarity, Normality and solve numerical problems on Molarity and Normality.

(a). Calculate the Molarity & 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.

2.7 Explain Arrhenius theory of Acids and Bases and give its limitations.

2.8 Define pH and mention its Significance.

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

3.0 **Electrochemistry**

3.1 Define the terms (i). Conductor (ii). Semiconductor (iii). Insulator. (iv). Electrolyte (Strong and Weak) and (v). Non-electrolyte. Give two examples for each.

3.2 Define Electrolysis and Explain electrolysis by taking an example of molten NaCl.

3.3 State the applications of electrolysis.

3.4 Understand Electrode potential and Standard reduction potential (SRP).

3.5 Define electrochemical series and state its significance.

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

3.7 Distinguish between electrolytic cell and galvanic cell.

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

3.9 Explain the construction, working and applications of (i). Dry cell (Leclanché cell) and (ii). Lithium-ion battery.

4.0 **Corrosion**

4.1 Define the term corrosion.

4.2 State the factors which influencing the rate of corrosion.

4.3 Describe the formation of (a). Composition cell (b). Stress cell and (c). Concentration cell during corrosion.

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

4.5 Explain the methods of prevention of corrosion by:

(a). Protective Coatings (through flow chart with examples) and

(b). Cathodic Protection Methods. ((i). Sacrificial Anode Process and (ii). Impressed Voltage Process)

5.0 Water Treatment

5.1 Define soft water and hard water.

5.2 Define hardness of water and classify its types.

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

5.4 State the disadvantages of using hard water in industries.

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

5.6 Explain the method of softening of hard water by Ion exchange method (By indicative reactions).

5.7 Explain the concept of Reverse Osmosis in removing hardness of water.

5.8 List out the applications and advantages of reverse osmosis technique.

5.9 List out the essential qualities of drinking water/potable water.

5.10 Explain Municipal treatment of water for drinking purpose (only flow chart).

6.0 **Polymers and Engineering Materials.**

6.1 Explain monomers, polymers and the concept of polymerization.
6.2 Describe the methods of polymerization (a). Addition Polymerization of Polythene and (b). Condensation Polymerization of Bakelite (Only flow chart).
6.3 Define plastic. Write the monomers and uses of plastics: (i). PVC and (ii) Nylon (6,6).
6.4 Define Biodegradable polymers. State applications of (i). PHBV and (ii). PBAT.
6.5 Define an alloy. Write the composition and applications of the following alloys: (i). Stainless Steel and (ii). Nitinol.
6.6 Define Nano Materials and State applications of (i). Graphene and (ii). Nanotubes.

7.0 Fuels and Alternative Energy Sources

7.1 Define the term fuel.
7.2 Classification of fuels as Natural fuels and Synthetic fuels.
7.3 Write the composition and uses of the following:
(i) LPG (ii) CNG and (iii). Power alcohol.
7.4 State the Renewable and Non- renewable energy sources with examples.
7.5 Define Green fuel. State the advantages and disadvantages of hydrogen as a green fuel.

8.0 **Environmental Studies**

8.1 Importance of environmental studies.
8.2 Define the following terms:
(i). Pollution, (ii). Pollutant, (iii). Sink, (iv). Receptor, (v). Particulate Matter, (vi). Dissolved Oxygen (DO) and (vii). Threshold Limit Value (TLV).
8.3 State the uses of forest resources.
8.4 Define deforestation. Explain the causes, effects and controlling methods of deforestation.
8.5 Define Air pollution. Explain the causes, effects and controlling methods of Air pollution.
8.6 Explain the global impacts of Air pollution: (i). Global Warming, (ii). Ozone Layer Depletion and (iii). Acid Rain.
8.7 Define Water pollution. Explain the causes, effects and controlling methods of Water pollution.
8.8 Define e – pollution. State the sources of e – pollution. Explain its health effects and its management.
8.9 Define Green Chemistry. List the Green Chemistry Principles.
8.10 Define Sustainable Development and List the Sustainable Development Goals.

CO-PO MAPPING

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

3 = Strongly mapped 2 = Moderately mapped 1 = Slightly mapped

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

(i).Seminars (ii).Tutorials (iii).Guest Lectures (iv).Assignments (v).Quiz Competitions, (vi). Industrial Visit (vii). Tech Fest (viii). Mini Project (ix). Group Discussions (x) Virtual Classes and (xi). Library Visit for e-books

COURSE CONTENT

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

1. Basic Concepts of Chemistry

Atomic Structure:

Introduction - Fundamental particles – their mass and charge – Atomic number and Mass number - definition with examples – calculation of electrons, protons and neutrons in atoms – Bohr's atomic theory and limitations - Quantum numbers – Orbital concept, shapes of s, p Orbitals – Distinguish between Orbit and Orbital - Aufbau principle - Hund's rule - Pauli's exclusion Principle - Electronic configuration of elements (Atomic number(Z) from 1 to 20).

Chemical Bonding:

Introduction – Octet rule - Types of chemical bonds – Ionic bond (NaCl) and Covalent bond (H_2, O_2 & N_2 molecules) as examples – Properties of Ionic and Covalent compounds. Electronic concept of oxidation, reduction and redox reactions.

2. Solutions, Acids and Bases

Solutions:

Introduction – Idea of solute, solvent and solution - Types of solutions based on physical state of solvent – Atomic weight – Molecular weight, Equivalent Weight (Acids, Bases and Salts) - Mole concept – Numerical problems on Mole concept - Methods of expressing concentration of a

solution – Molarity - Normality – Numerical problems on Molarity and Normality.

Acids and Bases:

Introduction - Arrhenius theory of acids and bases – pH Scale – its significance – Buffer solution – Definition – Types of buffer solutions with examples – its applications.

3. Electrochemistry

Introduction - Conductors, Semiconductors, Insulators with examples - Electrolytes (Strong and Weak) and Non-electrolytes – Definition – Examples – Electrolysis – Definition – Electrolysis of molten NaCl – Applications of electrolysis – Electrode potential - Standard reduction potential – Definition – Electrochemical series – Significance – Construction and working of Galvanic cell – Differences between Electrolytic cell and Galvanic cell - Batteries - Types of batteries – Definition and examples – construction, working and applications of: (i). Dry Cell (Leclanché Cell) and (ii). Lithium-ion battery.

4. Corrosion

Introduction – Definition - Factors influencing the rate of corrosion – Composition cell, Stress cell and Concentration cell during corrosion – Rusting of iron and its mechanism – Prevention of corrosion - Protective Coating methods (flow chart with examples) - Cathodic Protection methods.

5. Water Treatment

Introduction – Soft and Hard water – Hardness of water – Types of hardness – salts responsible for hardness - Degree of hardness – Methods of expressing hardness (mg/L and ppm) – Disadvantages of using hard water in industries - Softening of hard water by Ion exchange method – Concept of Reverse Osmosis process – Applications and Advantages of Reverse Osmosis - Essential qualities of drinking water/potable water – Municipal treatment of water for drinking purpose (only flow chart).

6. Polymers and Engineering Materials

Polymers:

Introduction- Monomers - Polymers - Polymerization – Types of Polymerization – Addition polymerization (Polythene) and Condensation polymerization (only flow chart of Bakelite) - Plastics – monomers and uses of PVC and Nylon (6,6) - Biodegradable Polymers: (i). PHBV and (ii). PBAT (Composition and Uses).

Engineering Materials:

Alloys - Definition - Composition and applications of (i). Stainless Steel and (ii). Nitinol, Nano Materials – Definition - Applications of (i) Graphene and (ii). Nanotubes.

7. Fuels and Alternative Energy Sources

Introduction – Definition - Classification of fuels – Composition and uses of (i). LPG (ii). CNG and (iii). Power alcohol - Renewable and Non-renewable energy sources – Advantages and disadvantages of Hydrogen as a green fuel.

8. Environmental Studies

Introduction - Importance of environmental studies – Important terms related to environment – Pollution, Pollutant, Sink, Receptor, Particulate Matter, Dissolved Oxygen (DO), Threshold Limit Value (TLV) - Uses of

forest resources – Deforestation - Definition – causes, effects, controlling methods –Air pollution – Definition, causes, effects, controlling methods - Global impacts of Air pollution – Global warming, Ozone layer depletion, Acid rain – Water pollution – Definition, causes, effects, controlling methods – e - pollution, Definition, sources, effects, management - Green Chemistry – Definition – Principles of Green Chemistry – Sustainable Development – Definition – Goals.

REFERENCE BOOKS:

1. Jain & Jain : Engineering Chemistry
2. O.P. Agarwal, Hi-Tech. : Engineering Chemistry
3. B. K. Sharma : Engineering Chemistry
4. A. K. De : Engineering Chemistry
5. Mahua Basu & S. Xavier : Fundamentals of Environmental Studies
6. Anubha Kaushik & C.P Kaushik : Environmental Studies

SYLLABUS FOR UNIT TESTS

Unit Test	Learning outcomes to be covered
Unit Test –1	From 1.1 to 2.9
Unit Test –2	From 3.1 to 5.10
Unit Test –3	From 6.1 to 8.10

ENGINEERING MECHANICS

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE105T	ENGINEERING MECHANICS	05	150	30	70	6

TIME SCHEDULE

S. No.	Chapter/Unit Title	No. of Periods	Weightage of Marks	No. of Short Answer Questions	No. of Essay Questions	CO's Mapped
1	Introduction	4	3	1	--	CO1
2	Forces & Moments	23	25	3	2	CO1
3	Centroid	18	11	1	1	CO2
4	Moment of Inertia	25	14	2	1	CO2
5	Simple Stresses and Strains	40	25	3	2	CO3
6	Shear force and Bending Moment	40	22	2	2	CO4
	Total	150	100	12	8	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able to	
(i)	Explain the concepts of forces and their types, understand the applications of forces and moments, and compute geometric properties such as centroid and moment of inertia for various sections.
(ii)	Describe the fundamentals of simple stresses and strains, their practical applications, and their relevance to the mechanical properties of materials.
(iii)	Analyse the effect of loading on beams and construct shear force and bending moment diagrams for simple beams.

COURSE OUTCOMES

CO1	CE105.1	Explain the basic concepts of Engineering Mechanics, including different types of forces and moments, and apply these principles to solve simple Civil Engineering problems.
CO2	CE105.2	Compute the Centroid, Centre of Gravity, Moment of Inertia, and Radius of Gyration for various structural sections.
CO3	CE105.3	Calculate simple stresses and strains in structural materials subjected to axial loads.

CO4	CE105.4	Explain the concepts of shear force and bending moment, Compute values, and Draw SFD and BMD for beams under different loadings.

LEARNING OUTCOMES

1. INTRODUCTION

1.0 Define Mechanics and Engineering Mechanics
1.1 State the applications of Engineering Mechanics
1.2 State the branches of Engineering Mechanics
1.3 Define the terms 1. Statics, 2. Dynamics, 3. Kinetics and 4. Kinematics
1.4 List the systems of measurements and Units
1.5 List S.I and M.K.S units of physical quantities used in Civil Engineering

2. FORCES AND MOMENTS

2.1 Define the following terms: Force, Moment & Resultant
2.2 Distinguish between
  2.2.1 Scalar and Vector quantities
  2.2.2 Coplanar and non-coplanar forces
  2.2.3 Parallel and non-parallel forces
  2.2.4 Like and unlike parallel forces
2.3 Define "Parallelogram law of forces" and derive the resultant of two coplanar forces acting at a point by Parallelogram law of forces.
  2.3.1 Compute the resultant of two coplanar forces acting at a point by Parallelogram law of forces
2.4 Define i) Triangle law of forces, ii) Polygon Law of forces
2.5 Explain 'Lami's Theorem'
  2.5.1 Solve simple problems using Lami's Theorem
2.6 Define 'Resolution of forces'
  2.6.1 Calculate resultant of co-planar concurrent forces by analytical methods.
2.7 Solve problems on computation of the resultant of a system of coplanar parallel forces.
2.8 Define Couple, Moment of a couple.
  2.8.1 State the properties of a couple.
2.9 Define Equilibrium of forces and Equilibrant.
2.10 List the conditions of equilibrium of a rigid body subjected to a number of coplanar forces.

3. CENTROID

3.0 Define Centroid and Centre of gravity
3.1 Distinguish between Centroid and Centre of gravity
3.2 State the need for finding the Centroid and Centre of gravity for various engineering applications.
3.3 Calculate the positions of Centroid for simple plane figures from first principles
3.4 Explain the method of determining the Centroid by 'Method of Moments'.
3.5 Calculate the position of Centroid for standard sections - L, T, I, Channel section, and Unsymmetrical I - Section
3.6 Calculate the position of Centroid of built-up sections consisting of RSJs and flange plates and Plane figures having hollow portions

4. MOMENT OF INERTIA

4.1 Define Moment of Inertia, Polar Moment of Inertia and Radius of gyration
4.2 State the necessity of finding Moment of Inertia for various engineering applications
4.3 Compute Moment of Inertia and Radius of Gyration for regular geometrical sections like T, L, I, Channel section, and Unsymmetrical I - Section

4.4 State 1. Parallel axis theorem and 2. Perpendicular axis theorem to determine Moment of Inertia
4.5 Compute MI of standard sections by applying the parallel axis theorem.
4.6 Compute MI of built-up sections by applying the parallel axis theorem.
4.7 Calculate the radius of gyration of standard sections.
4.8 Compute Polar Moment of Inertia for solid and hollow circular sections by applying perpendicular axis theorem.

5. SIMPLE STRESSES AND STRAINS

5.1 Define the following terms:
a) Stress b) Strain c) Modulus of Elasticity d) Longitudinal Strain e) Lateral Strain f) Poisson's ratio g) Modulus of rigidity h) Bulk Modulus i) Working stress j) Factor of safety k) Resilience l) Strain Energy m) Proof resilience n) Modulus of Resilience
5.2 Distinguish between different kinds of stresses and strains
5.3 Draw the stress-strain curve for ductile materials (Mild steel) and explain the salient points on the curve.
5.4 States Hooke's law, limit of proportionality, factor of safety and the factors affecting the Factor of Safety
5.5 Solves problems on relationship between simple stress and simple strain under axial loading on uniform bars and stepped bars.
5.6 State the relationship among the elastic constants. Solves problems on relationship between elastic constants.
5.7 Define composite member and calculate stresses in simple and composite members under axial loading
5.8 Define temperature stress, strain and Hoop stress.
5.9 List and explain mechanical properties of materials

6. SHEAR FORCE AND BENDING MOMENT

6.1 6.1.1 Define Types of Supports
– a) Roller Support b) Hinged Support c) Fixed Support
6.1.2 Define Types of beams
– a) Cantilever beam b) Simply supported beam c) Fixed beam d) Continuous beam e) Overhanging beam f) Propped Cantilever beam
6.1.3 Define types of loads
– a) Point Load b) Uniformly Distributed Load c) Uniformly Varying load
6.2 Calculate reactions at roller, hinged and fixed supports for
a) Simply Supported beams,
b) Cantilever beams and
c) Overhanging beams.
6.3 Explain a) Shear Force and b) Bending Moment
6.4 Explain sign conventions used for 1. Shear Force diagram and 2. Bending Moment diagrams.
6.5 Deduce the relationship among the rate of loading, shear force and bending moment
6.6 Determine Shear Force and Bending Moments on Cantilever and Simply Supported beams for simple cases of loading (Point Load, Uniformly Distributed Load) analytically
6.7 Describe the procedures for sketching the Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD)
6.8 Sketch Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD) for Cantilever and Simply Supported Beams
6.9 Define point of contra flexure
6.10 Determine the Shear Force, Bending Moment and point of contra-flexure for overhanging beams and sketch Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD) for overhanging beams.

CO-PO MAPPING

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	1					3	2	1
CO2	2	2	2					3	2	1
CO3	3	3	3					3	2	1
CO4	3	3	3					3	2	1
Average	2.5	2.5	2.25					3	2	1

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits, etc.

COURSE CONTENT

1. INTRODUCTION

Mechanics-Engineering Mechanics-Applications and branches of Engineering Mechanics - Statics, Dynamics, Kinetics and Kinematics - Systems of measurements and Units - S.I and M.K.S units of physical quantities used in Civil Engineering.

2. FORCES & MOMENTS

Definition of a Force - Vectors and Scalars - Vector representation of a Force - Systems of Forces - Coplanar Forces - Resultant of forces at a Point – Parallelogram Law and Triangle Law of Forces – Lami's theorem – Polygon Law of Forces – Resolution of Forces - Parallel Forces – Like and unlike Forces – Moment of a Force - Units and sense – Couple - Moment of a Couple – Properties of a Couple - Conditions of Equilibrium of a Rigid body subjected to a number of coplanar forces.

3. CENTROID

Definitions – Centroid - Centre of gravity – Need - Position of Centroid of standard figures like rectangle, triangle, parallelogram, circle, semi-circle and trapezium – Method of Moments - Determination of location of Centroid of standard sections - T, L, I, Channel section, Unsymmetrical I - Section and built-up sections consisting of RSJs with flange (cover) plates and plane figures having hollow portion.

4. MOMENT OF INERTIA

Definition and necessity of Moment of Inertia - Perpendicular and parallel axes theorems – Moment of Inertia of standard sections like rectangle, triangle, circle and hollow circular sections - Moment of Inertia of built up sections- T, L, I, Channel section using parallel axis theorem - Moment of Inertia and radius of gyration of built-up sections consisting of the combinations of RSJs plates, channels & flange plates etc - Polar Moment of Inertia of solid and hollow circular sections using Perpendicular axis theorem.

5. SIMPLE STRESSES AND STRAINS

Stress and strain – type of stresses and strains - Stress strain curves for ductile materials- mild steel, elastic limit, limit of proportionality, yield point, ultimate

stress; breaking stress; working stress, factor of safety – Factors affecting factor of safety - Hooke's law – Young's modulus – deformation under axial load - Shear stress and Shear Strain – Modulus of rigidity - Longitudinal and lateral strain - Poisson's ratio - Bulk Modulus – Relationship between elastic constants (Proof not required, only problems) - Composite sections – Effect of axial loads - Temperature stresses – Strains (No problems) – Hoop stress - Resilience – Strain energy-Proof resilience and Modulus of resilience – Mechanical properties of materials - Elasticity, Plasticity, Ductility, Brittleness, Malleability, Stiffness, Hardness, Toughness, Creep, Fatigue, examples of materials which exhibit the above properties.

6. SHEAR FORCE AND BENDING MOMENT

Types of supports – Roller, Hinged and Fixed - Beams – Types of beams – Cantilever – Simply supported – Overhanging – Fixed – Continuous and Propped cantilever- Types of loads – Point Load, Uniformly Distributed Load (UDL) and Uniformly Varying Load (UVL) – Calculation of reactions (Point load, UDL only) - Explanation of S.F and B.M. at a section- Relation between rate of loading SF and BM – Sign conventions for SF and B.M diagrams - Calculation of S.F. and B.M values at different sections for Cantilever and Simply supported beams - Overhanging beams under point loads and uniformly distributed loads, position and significance of points of contra flexure - Drawing S.F. and B.M diagrams by analytical methods – Location of points of contra flexure.

REFERENCE BOOKS

1. Engineering Mechanics, N. H. Dubey, Tata McGraw Hill
2. Engineering Mechanics, R.S. Kurmi, S.Chand and Company Limited
3. Engineering Mechanics, R. K. Singal, M. Singal, R.SingalI. K.International
4. Engineering Mechanics-Statics, P.Dayaratnam, Tata McGraw Hill

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I, UNIT TEST-II & UNIT TEST-III

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.7
Unit Test – II	From 4.1 to 5.5
Unit Test – III	From 5.6 to 6.10

INNOVATIVE TECHNOLOGIES IN CIVIL ENGINEERING

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Credits	Marks for Formative Assessment	Marks for Summative Assessment
26CE106A	Innovative Technologies in Civil Engineering	02	60	-	-	-

TIME SCHEDULE

S. No.	Chapter/Unit Title	No. of Periods	COs Mapped
1	Introduction	6	CO1
2	AI in Civil Engineering	14	CO2
3	3D Printing in Construction	14	CO3
4	Robotics & Automation in Construction	16	CO4
5	Innovation Showcase & Intellectual Property	10	CO4
	Total	60	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Outline the scope and impact of emerging technologies (AI, IoT, 3D printing, robotics) in civil engineering, with a basic awareness of associated ethical and safety considerations.

COURSE OUTCOMES

CO1	CE106.1	Outline the scope and significance of key emerging technologies in civil engineering.
CO2	CE106.2	Apply basic AI techniques for simple monitoring and visualization tasks.
CO3	CE106.3	Explain the fundamental process of 3D printing and its relevance to construction practices.
CO4	CE106.4	Explain how robots work in construction using simple control systems and Outline how to create a basic prototype and list simple steps for ensuring safety, ethics, and design protection.

LEARNING OUTCOMES:

1. INTRODUCTION

1.1 Define civil engineering and state its importance in shaping the built environment.

1.2 List the five core domains of civil engineering: Structures, Transportation, Water Resources, Geotechnical, and Geomatics.

1.3 Identify basic engineering tasks in a project lifecycle such as site investigation, planning, design, estimation, construction, monitoring, and maintenance.
1.4 List key emerging technologies relevant to civil engineering, including Artificial Intelligence (AI), Internet of Things (IoT), 3D Printing, and Robotics.
1.5 Explain the significance of innovation in solving real-world civil engineering problems using suitable examples.

2. AI IN CIVIL ENGINEERING

2.1 Define artificial intelligence in simple terms.
2.2 Identify the basic types of AI systems (rule-based systems, machine learning, and deep learning) with simple examples relevant to civil engineering.
2.3 List commonly used general-purpose AI tools and describe their typical uses: (Google Gemini, Amazon Alexa, Microsoft Copilot, Apple Siri)
2.4 List AI tools commonly used in civil engineering and explain their basic purpose: (ChatGPT, SketchPro AI, PlanFinder.ai, AutoDraw)
2.5 List two everyday examples of AI applications (e.g., voice assistants, recommendation systems).
2.6 Explain the three-step AI workflow: data → pattern → advice.
2.7 Describe how AI tools can help find weak spots in buildings.
2.8 Describe how AI can detect cracks in bridge photos.
2.9 Describe how AI can predict peak traffic times on a road.
2.10 Describe how AI can forecast rising water levels in a river.
2.11 Demonstrate an AI-driven colour transformation of a 2D elevation drawing.
2.12 Demonstrate how AI can generate a simple 3D view from a 2D plan.

3. 3D PRINTING IN CONSTRUCTION

3.1 Define 3D printing and compare it with traditional construction methods in simple terms.
3.2 List commonly used 3D printing materials in construction, such as plastic filaments and printable concrete.
3.3 Explain how 3D printing works using the concept of building an object layer by layer.
3.4 Describe the basic idea of “slicing” a 3D model before printing.
3.5 Identify simple design rules needed for 3D printing, like avoiding big overhangs or using supports.
3.6 Outline the full process of 3D printing a small construction part (from design → slicing → printing → curing).
3.7 Create a paper-based model to simulate how layers build up a 3D-printed structure.
3.8 List at least two beginner-friendly 3D printing software tools or platforms

4. ROBOTICS & AUTOMATION IN CONSTRUCTION

4.1 Define a robot and name its basic parts (frame, sensors, actuators, controller).
4.2 Explain how a robot works using a simple control loop: *Sense* → *Think* → *Act*, with the help of a basic diagram.
4.3 Identify common robots used in construction, such as bricklaying robots, rebar-tying robots, and drones.
4.4 Describe what a proximity sensor and a limit switch do in a robot system.
4.5 Explain how a motor (servo or DC) helps the robot move or perform actions.
4.6 Discuss one main advantage (like higher speed or better accuracy) and one challenge (like high cost or rough site conditions) of using robots at construction sites.
4.7 Draw a basic block diagram of a motorized wheelbarrow with labels for sensors, motors, and other key parts.
4.8 Suggest a simple tool or machine that uses automation (like a power-assisted trolley) to make work easier on a construction site.

5. INNOVATION SHOWCASE & INTELLECTUAL PROPERTY

5.1 Define what "*innovation"* means in simple terms and its importance in solving real-life problems
5.2 Use the SCAMPER method (Substitute, Combine, Adapt, Modify, Put to other use, Eliminate, Rearrange) to come up with new or improved ideas for simple civil-engineering elements.
5.3 Draw a neat and clear sketch of an idea that can be used for making a model.
5.4 Build a small model or prototype using simple materials like cardboard or foam boards.
5.5 List the materials needed and steps to be followed for making the prototype.
5.6 Create a poster or display board showing the problem, their idea, and how it helps.
5.7 Present the idea and model to classmates in a short and clear explanation (project pitch).
5.8 Explain the basics of intellectual property: what a patent is and how it differs from design registration.
5.9 Take part in a small "Innovation Showcase" event by displaying the project and participating in peer review/voting.

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2				2		2	2		1
CO2	3	2	1	1	2	1	3	3	1	2
CO3	2		2	1	2	1	2	2	1	2
CO4	2		2	1	2		2	2	1	2
Average	2.25	2	1.67	1	2	1	2.25	2.25	1	1.75

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc

COURSE CONTENT

1. INTRODUCTION

Civil Engineering and its core domains – Overview of emerging technologies - (AI, IoT, 3D-printing, Robotics) – Role of innovation and prototyping

2. AI IN CIVIL ENGINEERING

Definition and types of AI – AI workflow (data → pattern → advice) – Free/trial AI tools demo – Civil-engineering use-cases (crack detection, traffic forecasting, flood prediction, landslide mapping, BIM clash checks) – AI-powered visualization (colour swaps, 2D→3D previews)

3. 3D PRINTING IN CONSTRUCTION

Additive vs. subtractive methods – Common printing materials (plastic filament, concrete paste) – Extrusion process and model slicing – Design rules for overhangs and supports – End-to-end workflow (design → slice → print → cure) – Paper-layer mock up activity

4. **ROBOTICS & AUTOMATION IN CONSTRUCTION**

   Robot definition and core components – Sense→think→act control loop – On-site robot examples (bricklayers, rebar-tiers, drones) – Key sensors and actuators – Benefits and limitations of automation – Sketching low-tech robotic aid concepts

5. **INNOVATION SHOWCASE & INTELLECTUAL PROPERTY**

   SCAMPER ideation method – Converting ideas to sketches and prototypes – Model making with cardboard or foam-core – Prototype build planning – Designing display boards and pitches – Basics of patent vs. design registration – Organizing a mini-innovation showcase.

REFERENCE BOOKS

1. Fundamentals of Civil Engineering by M.C. Punmia, B.C. Punmia & A.K. Jain (Laxmi Publications)
2. Artificial Intelligence & Machine Learning by V. Rajaraman & C. Sandhya (PHI Learning)
3. Rapid Prototyping: Principles and Applications by R. T. Kumar (Vikas Publishing)
4. Robotics and Automation by K.S. Fu, R.C. Gonzalez & C.S.G. Lee (Tata McGraw-Hill) — Indian edition
5. Intellectual Property Rights by P. Narayanan (Eastern Economy Edition)

REFERENCE WEBLINKS

1. NPTEL “Introduction to Civil Engineering”
2. Introduction to Civil Engineering Profession - Course
3. NPTEL “Applications of Artificial Intelligence”
4. Fundamentals Of Artificial Intelligence - Course
5. Indian Patent Office – Beginner’s Guide https://ipindia.gov.in/writereaddata/Portal/Images/pdf/Beginner_s_Guide_to_IP.pdf

ENGINEERING GRAPHICS AND CAD

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE107D	Engineering Graphics and CAD	06	180	40	60	4

TIME SCHEDULE

S. No.	Chapter/Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	COs Mapped
1	Introduction to Engineering Drawing	06	-	-	-	CO1
2	Freehand lettering, Numbering and Dimensioning practice	15	5	1	-	CO1
3	Geometrical Constructions	15	15	1	1	CO2
4	Basics of CAD in Civil Engineering	27	5	1		CO3
5	Projections of points, Lines, Planes & Solids	24	15	1	1	CO4
6	Sections of Solids	21	10	-	1	CO4
7	Orthographic Projections	42	20	-	2	CO5
8	Isometric Views	30	15	-	1	CO5
	Total	180	80	4	6	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Understand the basic graphical skills and use them in the preparation of engineering drawings manually and using AUTOCAD.

COURSE OUTCOMES

CO1	CE107.1	Practice the use of engineering drawing instruments and familiarize with the conventions to be followed in engineering drawing as per BIS
CO2	CE107.2	Construct basic geometrical constructions

CO3	CE107.3	Understand AutoCAD and draw the basic engineering objects using AutoCAD.
CO4	CE107.4	Visualize and draw the orthographic projections of i) Points ii) Lines iii) Regular Planes iv) Regular Solids V) Sections of regular solids manually and using AutoCAD
CO5	CE107.5	Visualize and draw the Orthographic projections and isometric views of objects manually and using AutoCAD

LEARNING OUTCOMES

1. BASIC CONCEPTS OF ENGINEERING DRAWING

1.0 State the importance of drawing as an engineering communication medium.
1.1 State the necessity of B. I. S. Code of practice for Engineering Drawing.
1.2 Explain the linkage between Engineering drawing and other courses of Civil Engineering.
1.3 Select the correct instruments to draw the different lines / curves.
1.4 Use correct grade of pencil to draw different types of lines and for different purposes.
1.5 Select and use appropriate scales for a given application.
1.6 Identify different drawing sheet sizes as per I.S. and Standard Lay- outs.
1.7 Prepare title block as per B.I.S. Specifications.

2. FREE HAND LETTERING, NUMBERING AND DIMENSIONING PRACTICE

2.1 Write titles using vertical lettering and numerals of 7mm and 10mm height.
2.2 Write titles using sloping lettering and numerals of 7mm and 10mm height.
2.3 Select suitable sizes of lettering for different layouts and applications.
2.4 Acquaint with the conventions, notations, rules and methods of dimensioning in engineering drawing as per the B.I.S.
2.5 Dimension a given drawing using standard notations and desired system of dimensioning.

Drawing Plate 1: Lettering Practice – Includes two exercises
Drawing plate 2: Dimensioning Practice- Comprises5 to 6 exercises

3. GEOMETRIC CONSTRUCTIONS

3.1 Practice the basic geometric constructions like
i) Division of a line into number of equal parts
ii) Construction of Exterior and interior tangents to two given circles
iii) Drawing tangent arcs to two given lines and arcs
3.2 Draw any regular polygon using general method, when i) Given Side length ii) Inscribed in a circle (radius given), and iii) Circumscribed about a Circle (radius given).
3.3 Draw the conics using general and special methods.
3.4 Identify the applications of the above constructions in engineering practice.

Drawing Plate - 3: Problems on Geometrical Constructions up to Polygon Construction
Drawing Plate - 4: Problems on Construction of Conic Sections

4. BASICS OF CAD IN CIVIL ENGINEERING

4.1 Understand the general features of CAD, Hardware and Software requirements.
4.2 Knows Advantages of using CAD, Starting CAD, Understanding CAD.
4.3 Identify and understand the components of the CAD editor screen, including the Title Bar, Pull-down Menus, Dashboard, Standard Toolbar, Drawing Area, User Coordinate System (UCS), Command Prompt Area, and Status Bar.
4.4 Practice draw and modify commands in CAD using short cut keys.

Commands- Command Entry Options using -Command Line, Menus (File, Edit, View, Insert, Format, Tools, Draw, Dimension, Modify, Window, Help) and Dialog Boxes. Using a wizard, using a template, starting from scratch.

4.5 Practice Setting up limits, Object snap, Units, Paper space, Print, Plot Style Manager.

4.6 Draw CAD Basic Entities- Drawing Line, Arc, Circle, Rectangle and Polygons, and Ellipse using different Coordinate Systems such as, Absolute Cartesian Coordinates, Relative Cartesian Coordinates, Absolute Polar coordinates, and Relative Polar Coordinates.

4.7 Learn Direct distance entry and line command, picking coordinates on the screen and line command.

4.8 Practice Hatching, Dimensioning, Dimension Style, Point and Point Style and Text style –Single Line Text and Multi Line Text Commands.

Drawing Plate 5: Lettering and Dimensioning Exercises – Printed using AutoCAD

Drawing Plate 6: Geometric Constructions up to Polygon Construction – Printed using AutoCAD

Drawing Plate 7: Conic Constructions – Printed using AutoCAD

5. PROJECTIONS OF POINTS, LINES, PLANES & SOLIDS

5.1 Explain the basic principles of the orthographic projections

5.2 Visualize and draw the projection of a point with respect to the two reference planes (Horizontal Plane and Vertical Plane).

5.3 Visualize and draw the projections of straight lines with respect to the two reference Planes (up to lines parallel to one plane and inclined to another plane)

5.4 Visualize and draw the projections of planes (up to planes perpendicular to one plane and inclined to the other plane)

5.5 Visualize and draw the projections of solids (up to axis of solids parallel to one plane and inclined to the other plane)

Drawing Plate 8: Exercises on Projections of Points, Lines, and Planes

Drawing Plate 9: Exercises on Projections of Solids

Drawing Plate 10: Projections of Planes and Solids – Printed using AutoCAD

6. SECTIONS OF SOLIDS

6.1 Identify the need to draw sectional views.

6.2 Differentiate between true shape and apparent shape of a section

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

Drawing Plate 11: Exercises on Sections of Solids

Drawing Plate 12: Sections of Solids – Printed using AutoCAD

7. ORTHOGRAPHIC PROJECTIONS

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

7.2 Draw the minimum number of views needed to represent a given object fully.

Drawing Plate 13: Exercises on Orthographic Projections of Simple Engineering Objects

Drawing Plate 14: Exercises on Orthographic Projections of Complex Engineering Objects (Curved, Chamfered, Truncated, etc.)

Drawing Plate 15: Orthographic Projections – Printed using AutoCAD

8. PICTORIAL DRAWINGS

8.1 Identify the need for pictorial drawings.

8.2 Differentiate between isometric scale and true scale.

8.3 Prepare Isometric views for the given orthographic drawings.

Drawing Plate 16: Exercises on Isometric Views

CO-PO MAPPING

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3		3				1	2	1
CO2	3	3		3				1	2	1
CO3	3	3	2	3			3	2	2	2
CO4	3	3	2	3	1		2	2	2	2
CO5	3	3	2	3	1		2	2	2	2
Average	3	3	2	3	1		2.3	1.6	2	1.6

COURSE CONTENT

NOTES:
B.I.S Specifications should be strictly followed in all the topics.
A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.

1. INTRODUCTION TO ENGINEERING DRAWING

Explanation of the scope and objectives of the course of Engineering Drawing. Its importance as a graphic communication -Need for preparing drawing as per standards – SP-46 – 2003 – Mention B.I.S - Role of drawing in Engineering Education– Link between Engineering drawing and other courses of study.
Engineering drawing instruments- Classifications: Basic Tools, tools for drawing straight lines, tools for curved lines, tools for measuring distances and special tools like Mini drafter & Drafting machine –Mentioning of names under each classification and their brief description -Scales: Recommended scales, reduced and enlarged - Lines: Types of lines, selection of line thickness - Selection of Pencils -Sheet Sizes: A0, A1, A2, A3, A4, A5- Layout of drawing sheets in respect of A0, A1, A3 sizes - Sizes of the Title block and its contents - Care and maintenance of Drawing Sheet, Drawing plate: Lay out of sheet – as per SP-46-1988 to a suitable scale -Simple Exercises on the use of DrawingInstruments. Importance of Title Block.

2. FREE HAND LETTERING, NUMBERING AND DIMENSIONING PRACTICE

Importance of Lettering – Types of Lettering - Guide Lines for Lettering - Practicing of letters and numbers of given sizes (7mm, 10mm and 14mm) - Advantages of Single Stroke or Simple Style of Lettering - Use of Lettering Stencils.
Purpose of Engineering Drawing, Need of B.I.S code in Dimensioning -Shape description of an Engineering object -Definition of Dimensioning size description - Location of features, Surface finish, Fully dimensioned drawing -Notations or Tools of dimensioning, Dimension line, Extension line, Leader line, Arrows, Symbols, Number and Notes, Rules to be observed in the use of above tools -Placing dimensions: Aligned system and unidirectional system (SP-46-2003)-Arrangement of Dimensions - Chain, Parallel, Combined, Progressive, and Dimensioning by Co-ordinate methods.

3. GEOMETRIC CONSTRUCTION

Division of a Line: To divide a straight line into given number of equal parts - Construction of tangent lines: To draw interior and exterior tangents to two circles of given radii and center to center distance - Construction of Tangent Arcs: i) To draw a tangent arc of a given radius to touch two lines inclined at a given angle (acute, right, or obtuse), ii) To draw a tangent arc of a given radius touching a circle or an arc and a given line, and
iii) To draw tangent arcs of a given radius (R) touching two given circles, both

internally and externally - Construction of a polygon: Construction of any regular polygon by general method for given side length, inscribing a circle of given radius and superscribing about a circle of given radius - Conics – Explanation of Ellipse, Parabola, and Hyperbola as sections of a double cone and as the locus of a moving point – Eccentricity of the above curves – Their engineering applications such as projectiles, reflectors, and P–V diagram of a hyperbolic process – Construction of any conic section with a given eccentricity by general method – Construction of ellipse by concentric circles method, oblong method, and arcs of circles method – Construction of parabola by rectangle method and tangent method – Construction of rectangular hyperbola.

4. BASICS OF CAD IN CIVIL ENGINEERING

Introduction to CAD – General features of CAD, hardware and software requirements – Advantages of using CAD, starting CAD, understanding the CAD environment – Editor screen components: title bar, pull-down menu bars, dashboard, standard toolbar, drawing area, UCS, command prompt area, and status bar – Demonstration of draw and modify commands using shortcut keys – Command entry options using the command line, menus (File, Edit, View, Insert, Format, Tools, Draw, Dimension, Modify, Window, Help), and dialog boxes – Starting a drawing using a wizard, a template, or from scratch – Setting up drawing limits, object snap, units, paper space, print settings, and plot style manager – CAD basic entities: drawing line, arc, circle, rectangle, polygons, and ellipse using different coordinate systems such as absolute Cartesian coordinates, relative Cartesian coordinates, absolute polar coordinates, and relative polar coordinates – Using direct distance entry and screen coordinate picking with line command – Applying hatching, dimensioning, dimension style, point and point style, and text styles including single-line and multi-line text commands.

5. PROJECTION OF POINTS, LINES, PLANES AND SOLIDS

Classification of projections – Concepts of observer, object, projectors, projection, reference planes, and reference line – Various angles of projection – Differences between first angle and third angle projections – Projections of points in different quadrants – Projections of straight lines: (a) Parallel to both the planes, (b) Perpendicular to one of the planes, (c) Inclined to one plane and parallel to the other – Projections of regular planes: (a) Plane parallel to one of the reference planes, (b) Plane perpendicular to HP and inclined to VP and vice versa – Projections of regular solids: (a) Axis perpendicular to one of the planes, (b) Axis parallel to VP and inclined to HP and vice versa.
Practice the drawing exercises manually and reproduce the same using AutoCAD.

6. SECTIONAL VIEWS

Need for drawing sectional views – what is a sectional view - Hatching – Section of regular solids inclined to one plane and parallel to the other plane.
Practice the drawing exercises drawn manually and using AutoCAD

7. ORTHOGRAPHIC PROJECTIONS

Meaning of orthographic projection – Use of viewing box and model – Number of views obtained on the six faces of the box – Legible sketches limited to 3 views for representing objects – Concept of front view, top view, and side view – Sketching these views for various engineering objects – Explanation of first angle projection – Positioning of three views in first angle projection – Projection of points to locate corners of object surfaces – Use of miter line to draw the third view when two views

are given – Method of representing hidden lines – Selection of the minimum number of views required to describe an object fully.
Practice the drawing exercises drawn manually and using AutoCAD

8. PICTORIAL DRAWINGS

Briefly introduces various types of pictorial drawings such as isometric, oblique, and perspective, highlighting their applications. Covers isometric drawings in detail: explanation of isometric axes and the 120° angle between them, concept of visual distortion in measurements, and the need for an isometric scale. Differentiates between isometric scale and ordinary scale, as well as isometric view and isometric projection. Explains isometric and non-isometric lines, and the construction of isometric drawings for standard features like rectangles, circular shapes, and non-isometric lines using box and offset methods.
Includes drawing exercises, both manually and using AutoCAD.

ASSESSMENT METHODOLOGIES

Sl. No	Assessment	Duration (minutes)	Max marks	
1.	FA - Written Test manual	120	40	Average of all CIE=40 Marks
2.	FA -2 Practice Test AUTOCAD	120	40	
3	FA -3 Written Test manual	120	40	
4.	FA -4 Practice Test AUTOCAD	120	40	
5.	FA -5 Written Test manual	120	40	
6.	FA -6 Practice Test AUTOCAD	120	40	
Summative Assessment - Manual drawing ONLY		60 Marks		
Total Marks (FA + SA)		40+60=100 marks		

REFERENCE BOOKS:

1. Engineering Drawing,N.D.Bhatt, Charotar Publications
2. Engineering Graphics ,P I Varghese, McGraw-hil
3. Engineering Drawing,Basant Agarwal & C.M Agarwal,McGraw-hill
4. SP-46-2003, Bureau of Indian Standards
5. Bureau of Indian Standards. Engineering Drawing Practice for Schools and Colleges IS: Sp-46. BIS. Government of India, Third Reprint, October 1998; ISBN: 81-7061-091-2
6. Dhananjay A. Jolhe, “Engineering Drawing with an Introduction to Auto CAD”, Tata McGrawHill Publishing Company Limited, 2008.
7. Autodesk. AutoCAD User Guide. Autodesk Press, USA, 2015.
8. Sham, Tickoo. AutoCAD 2016 for Engineers and Designers. Dreamtech Press; Galgotia Publication, New Delhi, 2015; ISBN 978-93511991

SURVEYING THEORY & PRACTICE – I

(Practicum-Practical)

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE108L	Surveying Theory & Practice-I	05	150	40	60	4

TIME SCHEDULE

S. No.	Major Topics	No. of Periods	COs MAPPED
1.	Chain surveying	45	CO1
2.	Compass Surveying	45	CO2
3.	Levelling	60	CO3
	Total	150	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	To impart the concepts of surveying, methods adopted, and instruments used to carry out surveying field work with a professional approach.
(ii)	Develop skills in using Chain, Tape, Compass and Dumpy level

COURSE OUTCOMES

CO1	CE108.1	Explain principles of chain surveying, apply standard practices to perform in the field and to plot from field data
CO2	CE108.2	Explain principles of compass surveying, apply standard practices to perform and plot from field data
CO3	CE108.3	Explain principles of levelling, conduct experiments on methods of levelling, longitudinal and cross sectioning for the given alignment and analyse the data by block levelling (contours) and prepare the drawings.

LEARNING OUTCOMES

1. CHAIN SURVEYING

THEORY:

1.1 State the concept and purpose of surveying.
1.2 Classify different types of surveys.
1.3 State the fundamental principles of surveying.
1.4 State the purpose and principle of chain surveying and explain the principles used in chain triangulation.

1.5 List different instruments used in chain surveying and explain their functions.
1.6 Define ranging and explain methods of ranging a line.
1.7 Describe in detail the method of setting out right angles with cross staff and optical square.
1.8 Explain field work procedure in chain survey and method of recording field observations.
1.9 Calculate the areas of irregular boundaries using the average ordinate rule, the trapezoidal rule and Simpson's rule.

PRACTICE:

1.10 Practice unfolding and folding a chain.
1.11 Perform direct ranging on level ground and measure the distance between two given stations and record the measurements in the field book.
1.12 Set out a right angle to a given chain line by using chain only.
1.13 Perform triangulation survey of a given area with chain and cross staff and record all necessary details.
1.14 Calculate the area bounded by the given points by chain triangulation and compare the result with the area calculated from plotting.
1.15 Calculate the area bounded by the given points by chain and Cross staff and compare the result with the area calculated from plotting.
1.16 Calculate the areas of irregular boundaries using the average ordinate rule, trapezoidal rule and Simpson's rule.

PLOTTING:

1.17 Conventional signs in surveying.
1.18 Plotting of land surveys – chain and cross-staff surveying – calculation of areas.
1.19 Plotting of chain triangulation, surveying of small areas around buildings.
1.20 Chain traversing of an area bounded by more than three stations.

2. COMPASS SURVEY

THEORY:

2.1 State the purpose and principles of compass surveying.
2.2 Define -Whole Circle Bearing, Quadrantal Bearing, True Meridian, Magnetic Meridian, True Bearing, Magnetic Bearing, Dip, Declination and Local Attraction.
2.3 Convert Whole Circle Bearing in to Quadrantal Bearing and vice versa.
2.4 Explain Local Attraction and its effects.
2.5 Compute the included angles and true bearings of lines in a compass traverse.
2.6 Explain errors in compass surveying.

PRACTICE

2.7 Identify the parts of a Prismatic Compass
2.8 Set up the compass at a station and carry out temporary adjustments.
2.9 Take bearings of two points from the instrument station and calculate the included angle.
2.10 Perform an open traverse using a compass and chain.
2.11 Perform a closed traverse using a compass and chain.

PLOTTING:

2.12 Plotting of open traverse by compass surveying and locating details.
2.13 Compass survey by method of radiation- calculation of area.

3.LEVELLING

THEORY:

3.1 Define levelling and list the types of levelling instruments, Define the terms - Datum or Datum plane, Reduced level, Level surface, Horizontal surface, Vertical line and Station, Mean Sea level, and Benchmark.

3.2 List the component parts of a Dumpy level and their functions, explain the steps involved in temporary adjustments of a dumpy level, Define Back sight, Fore sight, Intermediate sight, and Change Point.

3.3 List different types of levelling staves, tabulate the levelling field data, state methods of calculating reducing levels. Compare height of instrument and Rise and fall methods. Compute reduced levels by Height of instrument and Rise and fall methods and apply check.

3.4 List the different types of Levelling and describe in detail the Profile levelling

3.5 State the Errors in levelling and the precautions to be taken to prevent errors in levelling. Explain the effect of Errors due to Curvature, Refraction and Combined error (No Problems)

3.6 List the fundamental lines of a dumpy level and state the relationships between them.

3.7 Define Contour, Contour interval and Horizontal equivalent. List the characteristics and uses of contours, explain different methods of contouring and interpolation of contours

PRACTICE:

3.8 Identify the component parts of a Dumpy level or Auto level and study different types of levelling staves.

3.9 Perform the temporary adjustments of a dumpy level or Auto level for taking observations and practice taking staff readings and recording them in the level field book.

3.10 Take staff readings for differential levelling and compute the difference in elevation between two stations (take invert levels also).

3.11 Conduct the profile levelling along a route and compute the RLs at various stations.

3.12 Conduct the profile levelling by taking cross sections across a route and compute the RLs at various stations.

3.13 Conduct profile levelling along a route by taking readings along both longitudinal sections and cross sections and compute the reduced levels.

3.14 Conduct block levelling for the given area.

3.15 Locate the contour points by Radial method in the field.

PLOTTING:

3.16 Plotting of longitudinal sections and cross sections.

3.17 Plotting of contours by Block levelling

CO-PO MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2		1	1	2		1	1	1
CO2	3	2		1	1	2		1	1	1
CO3	3	3		1	1	2		2	2	2
Average	3	2.3		1	1	2		1.3	1.3	1.3

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v)

Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits, etc

COURSE CONTENT

CHAIN SURVEYING

THEORY:

Concept and purpose of surveying - Different types of surveys - Fundamental principles of surveying - purpose and principle of Chain surveying and the principles used in Chain triangulation - different instruments used in Chain Surveying and their functions - ranging and methods of ranging a line - method of setting out right angles with cross staff and optical square - Field work procedure in Chain survey and Method of recording field observations -Calculation of the areas of irregular boundaries using Average Ordinate rule, Trapezoidal rule and Simpson's rule.

PRACTICE:

1. Practice unfolding and folding a chain.
2. Perform direct ranging on level ground and measure the distance between two given stations and record the measurements in the field book.
3. Set out a right angle to a given chain line by using chain only.
4. Perform triangulation survey of a given area with chain and cross staff, and record all necessary details.
5. Calculate the area bounded by the given points by chain triangulation, and compare the result with the area calculated from plotting.
6. Calculate the area bounded by the given points by chain and cross staff, compare the result with the area calculated from plotting.
7. Calculate the areas of irregular boundaries using average ordinate rule, trapezoidal rule and Simpson's rule.

COMPASS SURVEY

THEORY:

Purpose and principles of Compass surveying -Whole Circle Bearing, Quadrantal Bearing, True Meridian, Magnetic Meridian, True Bearing, Magnetic Bearing, Dip, Declination and Local attraction - Conversion of Whole Circle Bearing into Quadrantal Bearing and vice versa - Local attraction and its effects – Computation of the included angles of lines in a Compass traverse and the true bearings of lines in a Compass traverse - Errors in Compass surveying.

PRACTICE:

1. Identify the parts of a prismatic compass
2. Set up the compass at a station and carry out temporary adjustments.
3. Take bearings of two points from instrument station and calculate the included angle.
4. Perform an open traverse with compass and chain.
5. Perform a closed traverse with compass and chain.

LEVELLING

THEORY:

Levelling and List the types of levelling instruments, Define the terms Datum or Datum plane, Reduced Level, Level Surface, Horizontal Surface, Vertical Line and Station, Mean Sea level, Bench Mark - component parts of a dumpy level and their functions, steps involved in temporary adjustments of a dumpy level Define the terms Back sight, Fore sight, Intermediate Sight, Change Point - Different types of levelling staves, tabulation of the levelling field data, methods of calculating reducing levels, Compare height of instrument and Rise and fall methods, Computation of reduced levels by height of instrument and Rise and fall methods, and apply check - Different types of Levelling and describe in detail Profile levelling - Errors in levelling

and the Precautions to be taken to prevent errors in levelling, Explain the effect of Errors due to Curvature and Refraction and Combined error (No Problems) - fundamental lines of dumpy level and state the relationship among fundamental lines of dumpy level -Define Contour, Contour interval and Horizontal equivalent, List the Characteristics and uses of contours, explain different methods of contouring and interpolation of contours

PRACTICE:

1. Identify the component parts of a dumpy level or Auto-level, and study different types of levelling staves.
2. Perform temporary adjustments of a dumpy level or Auto level for taking observations and practice taking staff readings and recording them in level field book.
3. Take staff readings for differential levelling and compute the difference in elevation between two stations (take invert levels also)
4. Conduct profile levelling along a route and compute the reduced levels at various stations.
5. Conduct profile levelling by taking cross sections across a route, and compute the reduced levels at various stations
6. Conduct profile levelling along a route by taking readings along both longitudinal sections and cross sections, and compute the reduced levels.
7. Conduct block levelling for the given area.
8. Locate the contour points by Radial method in the field.

KEY COMPETENCIES TO BE ACHIEVED BY THE STUDENT

S.NO.	Experiment Title	Key Competency
1	**Field Exercises in Chain Surveying**	
	Ex 1.1	Practice unfolding and folding a chain.
	Ex 1.2	Perform direct ranging on level ground and measure the distance between two given stations and record the measurements in the field book.
	Ex 1.3	Set out a right angle to a given chain line by using chain only.
	Ex 1.4	Perform triangulation survey of a given area with chain and cross staff and record all necessary details.
	Ex 1.5	Calculate the area bounded by the given points by chain triangulation and compare the result with the area calculated from plotting.
	Ex 1.6	Calculate the area bounded by the given points by chain and Cross staff compare the result with the area calculated from plotting.
	Ex.1.7	Carry out chain traversing to survey an area bounded by more than three stations and plot the Survey from field book measurements.
2	**Field Exercises in Compass Surveying**	
	Ex 2.1	Identify the parts of a prismatic Compass
	Ex 2.2	Set up the compass at a station and carry out temporary adjustments.
	Ex 2.3	Take bearings of two points from instrument station and calculate the included angle.

	Ex 2.4	Perform an open traverse with Compass and Chain.
	Ex 2.5	Perform a closed traverse with compass and chain.
3	**Field Exercises in Levelling**	
	Ex 3.1	Identify the component parts of a dumpy level or Auto level and Study different types of levelling staves.
	Ex 3.2	Perform temporary adjustments of a dumpy level or Auto level for taking observations and practice taking staff readings and recording them in level field book.
	Ex 3.3	Take staff readings for differential levelling and compute the difference in elevation between two stations (take invert levels also).
	Ex 3.4	Conduct profile levelling along a route and compute the RLs at various stations.
	Ex 3.5	Conduct profile levelling by taking cross sections across a route and compute the reduced levels at various stations.
	Ex 3.6	Conduct profile levelling along a route by taking readings along both longitudinal sections and cross sections and compute the reduced levels.
	Ex 3.7	Conduct block levelling for the given area.
	Ex 3.8	Locate the contour points by Radial method in the field.

REFERENCE BOOKS:

1) Surveying - I &II, - Dr. B.C. Punmia, Lakshmi Publications Pvt Ltd
2) Surveying-I &II, - Dr. K. R. Arora, Standard Book House
3) Surveying and levelling - I & II, T. P Kanetkar & S.V. Kulakarni, Pune Vidhyardhi Griha Prakashan
4) Textbook of surveying, Dr. C. Venkatramaiah, Universities Press
   Surveying & Levelling, N. N. Basak,TMH

Table specifying the scope of the Syllabus to be covered for Unit Tests

Unit Tests	Learning Outcomes to Be Covered
Unit Test - 1	**1.1 TO 1.20**
Unit Tests - 2	**2.1 TO 2.13**
Unit Tests -3	**3.1 TO 3.17**

PHYSICS LAB

Course Code	Course title	No. of Periods/ week	Total no of periods	Marks For FA	Marks For SA	Credits
26CE109L	Physics Lab	3	90	20	30	1.5

Note: For the Physics laboratory, half of the first-year students of each programme will attend, while the remaining half will attend the Chemistry laboratory. Thus, both laboratories will be engaged simultaneously during the 3-hour lab session.

TIME SCHEDULE

S. No	List of experiments	No. of Periods	COs
1.	Vernier calipers	03 + 03	CO1
2.	Micrometer (Screw gauge)	03 + 03	
3.	Verification of Lami's theorem using concurrent forces	03 + 03	
	Revision	03 + 03	
4.	Determination of 'g' using simple pendulum	03 + 03	CO2
5.	Focal length and focal power of convex lens by distant object method and U-V method	03 + 03	
6.	Verification of Boyle's law using Quill tube	03 + 03	
	Revision	03 + 03	
7.	Drawing of magnetic lines of force	03 + 03	CO3
8	Resonance apparatus–Determination of velocity of sound in air	03 + 03	
9	Refractive index of a solid using travelling microscope	03 + 03	
	Revision	03 + 03	
	Experiments for demonstration		
10	Meter bridge–Determination of resistance and specific resistance of material of given wire	03 + 03	CO4
11	Projectile motion- study the range of a projectile for different launch angles	03 + 03	
12	Generation of Beats using water columns	03 + 03	
	Total:	**45+ 45**	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to

(i)	Apply practical physics principles to operate, troubleshoot, and optimize engineering devices.
(ii)	Develop scientific skills through designing, conducting, and evaluating industry-relevant experiments to enhance technical proficiency.

COURSE OUTCOMES

CO1	CE109.1	Apply measurement techniques to improve accuracy; Explain forces maintaining equilibrium in physical systems.
CO2	CE109.2	Determine acceleration due to gravity experimentally; Investigate refraction of light at curved surfaces; Relate the gas pressure to volume variations at constant temperature.
CO3	CE109.3	Analyze the combined effect of magnetic fields (Earth and artificial magnet); Determine velocity of sound in air using resonance; Demonstrate U-V method to understand the refraction of light at curved surfaces.
CO4	CE109.4	Apply Kirchhoff's laws to compute the resistivity of a wire; Examine the projectile motion parameters; Observe and Interpret beat generation phenomenon.

LEARNING OUTCOMES

Upon completion of the course the student shall be able to

1. **Apply** measurement techniques using Vernier Calipers to **determine** the volumes of a cylinder and a sphere.
2. **Use** a screw gauge to **measure** and **determine** the thickness of a glass plate and the cross-sectional area of a wire.
3. **Verify** Lami's Theorem by **analysing** a system of concurrent forces.
4. **Conduct** simple pendulum experiment to **calculate** the acceleration due to gravity (g) and **interpret** the result through an L–T^2 graph.
5. **Determine** the focal length and power of a convex lens using distant object method and U–V method and **compare** the results.
6. **Verify** Boyle's Law using a Quill tube by noting pressure (P) and length of air column(L).
7. **Illustrate** the behaviour of lines of magnetic field around a bar magnet using magnetic compass.
8. **Determine** the velocity of sound in air at room temperature and at 0°C using resonance apparatus.
9. **Determine** the refractive index of a solid by **using** the measurements taken with a travelling microscope.
10. **Demonstrate** the use of a meter bridge to **determine** the resistance and specific resistance of a given wire.
11. **Simulate** projectile motion and **observe** the range of the projectile for different launch angles using appropriate experimental setup.
12. **Demonstrate** the phenomenon of beats by **creating** beat patterns using water columns.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	1	1	1	1
CO2	3	1	1	1	1	1	1
CO3	3	1	1	1	1	-	1
CO4	3	1	1	2	1	-	1
Average	3	1	1	1.25	1	1	1

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

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

(i) Seminars
(ii) Viva-voce
(iii) Assignments
(iv) Quiz competitions
(v) Industrial visits
(vi) Techfest
(vii) Mini project
(viii) Group discussions
(ix) Virtual labs
(x) Library visit for e-books, etc.

COURSE CONTENT

Name of the Experiment	Competencies (Revised Bloom's Taxonomy)	Key Competencies (Revised Bloom's Taxonomy)
1. Practice on Vernier Callipers	• Determine the least count • Place the object in accurate position. • Interpret scale readings • Calculate volume of cylinder and sphere	• Interpret Vernier readings • Compute volume using appropriate formulae • Apply measurement data to calculate physical quantities
2. Practice on Screw Gauge	• Determine the least count and zero error • Place the object in accurate position. • Interpret scale readings • Calculate thickness and cross-sectional area	• Analyze scale readings for zero error • Compute thickness and area from measurements • Apply micrometer data to solve practical problems
3. Verification of Lami's Theorem	• Setup experimental arrangement • Apply appropriate weights • Measure angles between forces • Analyse data to verify theorem	• Interpret directions and angles of forces • Evaluate force relationships • Validate Lami's Theorem using experimental data
4. Simple Pendulum	• Arrange the pendulum properly • Measure the time taken for 20 oscillations • Compute time period and acceleration due to gravity • Plot $L–T^2$ graph	• Measure oscillation intervals accurately • Calculate g using experimental data • Interpret $L–T^2$ graph to confirm relationship
5. Focal Length and Power of Convex Lens	• Place the object and convex lens in proper positions.	• Determine focal length using both methods • Validate optical formulae using experiment

	• Measure image distance • Compute focal length and power	
6. Boyle's Law Verification	• Record atmospheric pressure • Measure air column length and calculate the enclosed pressure • Analyse data for PxL consistency	• Setup quill tube in different positions for multiple readings • Interpret pressure–length data
7. Drawing of Magnetic Lines of force	• Draw meridian and set magnet orientation • Sketch the lines of magnetic field using compass.	• Visualize field pattern accurately • Analyse field symmetry
8. Velocity of Sound – Resonance Method	• Assemble apparatus and adjust reservoir • Identify resonating lengths • Calculate velocity of sound at room temperature and at $0^{o}C$.	• Detect resonance points • Compute velocity using resonance data • Extrapolate to standard temperature
9. Refractive Index of a solid using Taveling Microscope	• Determine least count • Measure real and apparent thickness • Calculate refractive index	• Analyse scale readings • Apply refraction formula • Interpret refractive index of a solid.
10. Meter Bridge	• Connect circuit properly • Measure balancing length, radius of given wire • Compute resistance and specific resistance	• Analyse circuit behavior • Calculate unknown resistance • Interpret experimental values for resistivity
11.Projectile motion-study the range of a projectile for different launch angles	• Setup and align launcher • Adjust launch angles • Measure range	• Observe the variations in horizontal range for different angles of projection. • Evaluate trajectory data
12. Generation of Beats using water columns	• Setup beat source using glasses or online tone generator • Generate close frequencies • Detect and analyse beat pattern	• Observe frequency interference • Interpret beat frequency data • Analyse patterns using mobile sensors/ software

SCHEME OF VALUATION FOR END PRACTICAL EXAMINATION

Activity	Marks
Aim, Apparatus, Formulae	6
Tabulations and Readings	12
Calculations	4
Precautions, Results	3
Viva-voce	5
Total marks	**30**

REFERENCE BOOKS

1. NCERT Physics Laboratory Manual for Class XI.

2. NCERT Physics Laboratory Manual for Class XII.

3. Experiments in Physics: A Laboratory Manual by Daryl W. Preston, Joseph W. Kane, Morton M. Sternheim

TABLE SHOWING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit test	Experiments to be covered
Unit test - 1	From 1 to 3
Unit test - 2	From 4 to 6
Unit test - 3	From 7 to 9

CHEMISTRY LAB

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for FA	Marks for SA	Credits
26CE110L	CHEMISTRY LAB	3	90	20	30	1.5

NOTE : For the Physics laboratory, half of the first-year students of each programme will attend, while the remaining half will attend the Chemistry laboratory. Thus, both laboratories will be engaged simultaneously during the 3-hour lab session.

TIME SCHEDULE

S. No.	Name of the Experiment	No. of Periods	COs Mapped
1.	Introduction to Fundamentals of Analytical Chemistry.	03+03	CO1
2.	Chemical Recognition by Sensory Cues.	03+03	CO1
3.	Preparation of Standard Na_2CO_3 Solution.	03+03	CO1
4.	Estimation of HCl Using Standard NaOH Solution.	03+03	CO2
5.	Determination of Alkalinity of Water Sample.	03+03	CO2
	Revision	03+03	
6.	Estimation of Mohr's Salt Using Standard $KMnO_4$ Solution.	03+03	CO3
7.	Determination of Total Hardness of Water Using Standard EDTA Solution.	03+03	CO4
8.	Estimation of Chlorides Present in Water Sample Using Standard $AgNO_3$ Solution.	03+03	CO4
9.	Analyzing pH of Common Compounds Using Visual and Instrumental Methods.	03+03	CO5
	Revision	03+03	
	Demonstration Experiments		
10.	Demonstration of Copper Deposition on an Object by Using Electrolysis Process.	03+03	CO5
11.	Demonstration of Construction and Working of a Galvanic Cell.	03+03	CO5
12.	Open Ended Experiments/Micro Projects – I.	03+03	CO5
13.	Open Ended Experiments/Micro Projects – II.	03+03	CO5
	TOTAL	**45+45**	

COURSE OBJECTIVES

Upon completion of the course the shall be able to:	
(i)	To Perform fundamental analytical chemistry techniques, identify chemical substances using sensory cues and accurately prepare standard solutions.
(ii)	To Evaluate and judge the neutralization point in acid base titration.
(iii)	To Evaluate the endpoint of reduction and oxidation reaction.
(iv)	To Judge the stable end point of complex formation, stable precipitation.
(v)	To Determine the pH of compounds, demonstrate copper deposition using electrolysis, and the working of a galvanic cell.

COURSE OUTCOMES

CO1	CE110.1	Perform fundamental analytical chemistry techniques, identify chemical substances using sensory cues and accurately prepare standard solutions.
CO2	CE110.2	Evaluate and judge the neutralization point in acid base titration.
CO3	CE110.3	Evaluate the endpoint of reduction and oxidation reaction.
CO4	CE110.4	Judge the stable end point of complex formation, stable precipitation.
CO5	CE110.5	Determine the pH of compounds, demonstrate copper deposition using electrolysis, demonstrate the working of a galvanic cell.

LEARNING OUTCOMES

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 Identify the chemical compounds and solutions by senses.

3.0 Practice making standard Na_2CO_3 solutions.

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

5.0 Conduct titrations adopting standard procedures to determine the alkalinity of given samples of water (one ground water and one surface / tap water) using standard H_2SO_4 solution.

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

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

8.0 Conduct titrations adopting standard procedures to determine the chlorides present in the given samples of water (one ground water and one surface / tap water) and waste water by using standard $AgNO_3$ solution.

9.0 Conduct the test on given samples of water / solutions (like soft drinks, sewage etc.,) to determine their pH using pH paper, Universal indicator, digital pH meter.

10.0 Demonstrate the electrolysis process of Copper deposited on an object.

11.0 Understand the construction and working principle of a Galvanic cell and identify how chemical energy is converted into electrical energy through redox reactions.

12.0 Collect water sample from nearby water body and test for any two parameters.**[Parameters – Alkalinity, Hardness, Chloride and pH]**

13.0 Collect water sample from nearby sewage/industrial effluent and test for any two parameters. **[Parameters – Alkalinity, Hardness, Chloride and pH]**

CO – PO/PSO MAPPING

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

3 = Strongly Mapped 2 = Moderately Mapped 1 = Slightly Mapped

Note: The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following: (i).Assignments (ii).Tutorials (iii). Guest Lectures (iv). Seminars (v). Quiz Competitions (vi).Industrial Visit (vii). Tech Fest (viii). Mini Projects (ix). Group Discussions (x). Virtual Classes and (xi). Library Visits.

COMPETENCIES AND KEY COMPETENCIES TO BE ACHIEVED BY THE STUDENT

Name of the Experiment (No of Periods)	Competencies	Key Competencies
Introduction to Fundamentals of Analytical Chemistry. (03)	• Develop a foundational understanding of analytical chemistry principles and demonstrate proficiency in basic laboratory techniques, data analysis, and safety protocols.	• Students will master the foundational principles and laboratory techniques of analytical chemistry.

Chemical Recognition by Sensory Cues. (03)	• Develop skills in conducting simple tests and making accurate observations. • Interpret results to draw conclusions about the nature of chemical compounds.	• Develop skills in conducting simple tests and making accurate observations. • Interpret results to draw conclusions about the nature of chemical compounds.
Preparation of Standard Na_2CO_3 Solution. (03)	• Weighing the salt to the accuracy of 0.01mg • Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette.	• Weighing the salt to the accuracy of 0.01 mg. • Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette.

Estimation of HCl Solution Using Standard NaOH Solution. (03)	• Cleaning the glass ware 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 endpoint. • 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 endpoint. • Making accurate observations.
Determination of Alkalinity of Water Sample (03)		
Estimation of Mohr's Salt Using Standard $KMnO_4$ Solution. (03)		
Determination of Total Hardness of Water Using Standard EDTA Solution. (03)		
Estimation of Chlorides Present in Water Sample by Using Standard $AgNO_3$ Solution. (03)		

Analyzing pH of Common Compounds Using Visual and Instrumental Methods. (03)	• Know pH range (0 – 14) and classify substances as acidic, neutral and basic. • Accurately measure pH using pH paper and universal indicator. • Note color changes and interpret pH values correctly. • Perform precise pH tests to ensure reliable results. • Record pH data and observations clearly. • Connect pH results to real- world contexts. • Familiarize with instrument. • Choose appropriate 'Mode'/ 'Unit'. • Prepare standard solutions/buffers, etc. • Standardize the instrument with appropriate standard solutions. • Make measurements accurately.	• Accurately measure pH using pH paper and universal indicator. • Perform precise pH tests to ensure reliable results. • Prepare standard solutions/buffers, etc. • Standardize the instrument with appropriate standard solutions. • Make measurements accurately.

Demonstration of Copper Deposition on an Object by Using Electrolysis Process. (03)	• Prepare standard solutions. • Selection of electrodes. • Set up and perform an electrolysis experiment accurately and safely. • Analyze the deposition of Copper on an object.	• Set up and perform an electrolysis experiment accurately and safely. • Analyze the deposition of Copper on an object.
Demonstration of Construction and Working of Galvanic Cell. (03)	• Prepare standard solutions. • Selection of electrodes. • Making of salt bridge. • Construct a simple galvanic cell using appropriate electrodes and electrolyte solutions. • Explain the working principle of a galvanic cell, including electron flow, redox reactions, and the function of the salt bridge	• Construct a simple galvanic cell using appropriate electrodes and electrolyte solutions. • Explain the working principle of a galvanic cell, including electron flow, redox reactions, and the function of the salt bridge.
Open Ended Experiments /Micro Projects – I. (03)	• Identifies a relevant chemical problem or question based on prior knowledge. • Demonstrates proficiency in basic chemistry lab techniques (e.g., titration, preparation). • Prepares solutions accurately (Molarity, dilutions, standardizations). • Handles chemicals safely following MSDS guidelines and standard lab practices. • Uses instruments relevant to the experiment (e.g., pH meter, and digital balance) correctly.	• Prepares solutions accurately (Molarity, dilutions, standardizations). • Uses instruments relevant to the experiment (e.g., pH meter, and digital balance) correctly. • Calibrates and maintains instruments when needed. • Makes accurate, timely and detailed observations of • chemical reactions (e.g., color changes, precipitate formation).

Open Ended Experiments/ Micro Projects – II. (03)	• Calibrates and maintains instruments when needed. • Interprets instrumental output with understanding of underlying chemical principles. • Makes accurate, timely and detailed observations of chemical reactions (e.g., color changes, precipitate formation). • Records quantitative and qualitative data systematically. • Maintains an organized and complete lab notebook. • Works effectively in pairs or groups; shares responsibilities and discusses findings collaboratively. • Presents results through oral discussion, lab reports, or visual presentations using proper chemical terminology.	

SCHEME OF VALUATION FOR END PRACTICAL EXAMINATION

Activity	Marks
Aim, Apparatus, Formulae	6
Tabulations and Readings	12
Calculations	4
Precautions, Results	3
Viva-voce	5
Total marks	**30**

REFERENCE BOOKS

1. VOGEL's Textbook of Quantitative Analysis, Sixth Edition, Pearson Education Limited.
2. VOGEL's Textbook of Qualitative Analysis, Seventh Edition, Pearson Education Limited.
3. Y. Bharathi Kumari & Jyotsna Cherukuri - Laboratory Manual of Engineering Chemistry for Engineering Students of JNT Universities.
4. Instrumental Methods of Chemical Analysis.
5. NCERT Chemistry Laboratory Manual for Class XII.
6. Practical Chemistry by the Royal Society of Chemistry Education.

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST –I ,II & III

Unit Test	Learning Outcomes to be Covered
Unit Test – 1	From Experiment 1 to 3
Unit Test – 2	From Experiment 4 to 6
Unit Test – 3	From Experiment 7 to 9

COMPUTER & DIGITAL SKILLS LAB

Course code	Course Title	No. of Periods / Week	Total No. of periods	Marks for FA	Marks for SA
26CE111L	COMPUTER & DIGITAL SKILLS LAB	3	90	40	60

TIME SCHEDULE:

Chapter No.	Chapter/Unit Title	No of sessions each of 3 periods duration	No of Periods	CO's Mapped
1.	Computer hardware and Software Basics	1	3	CO1
2.	Windows Operating System	1	3	CO1
3.	MS Word	6	18	CO2
4.	MS Excel	7	21	CO3
5.	MS Power Point	6	18	CO4
6.	AI ,ML& Quantum computing Tools	9	27	CO5
Total periods		30	90	

COURSE OBJECTIVES

i. To familiarize with basics of Computer Hardware and Software
ii. To familiarize operating systems
iii. To familiarize with Microsoft word
iv. To familiarize with Microsoft Excel
v. To familiarize with Microsoft Power point
vi. To Familiarize With AI, ML, Quantum Computing Tools

COURSE OUTCOMES

At the end of the course students will be able to		
CO1	CE111.1	Identify hardware and software components
CO2	CE111.2	Prepare documents with given specifications using word processing software
CO3	CE111.3	Use Spread sheet software to make calculation and to draw various graphs/charts.
CO4	CE111.4	Use Power point software to develop effective presentation for a given theme or topic.
CO5	CE111.5	To use basic AI, ML& Quantum Computing Tools

LEARNING OUTCOMES:

I. COMPUTER HARDWARE AND SOFTWARE BASICS

1. a) To get familiarized with Computer system and hardware connections
b). To start and Shut down Computer correctly
c) To explore Windows Desktop
2. To check the software details of the computer
3. To check the hardware present in your computer Windows's operating system
4. To work with Files and Folders
5. To use Windows Accessories: Calculator –Notepad –WordPad–MS Paint

II. MS-WORD

6. To get familiarized with Ribbon layout of MSWord.
7. To perform basic word processing
8. To use basic 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

III. MS-EXCEL

13. To get familiarized with MS-EXCEL ribbon layout
14. To access and enter data in the cells
15. To edit a spread sheet-Copy, Cut, Paste, and selecting Cells
16. To use built in functions and Data Formatting
17. To create Excel Functions, use auto fill feature
18. To enter a Formula for automatic calculations
19. To sort and filter data in sheet.
20. To present data using Excel Graphs and Charts.
21. To format a Work sheet in Excel for printing using Page layout
22. To develop lab report formats of respective discipline.

IV. PRACTICE WITH MS-POWERPOINT

23. To get familiarized with Ribbon layout features of Power Point.
24. To create a simple Power Point Presentation
25. To set up a Master Slide in Power Point
26. To insert Text and Objects
27. To insert Flow Charts
28. To insert Tables
29. To insert Charts/Graphs
30. To insert video and audio
31. To animate text, objects and slides.
32. To Review Presentations

V. AI, ML & QUANTUM COMPUTING TOOLS

33. To get familiarized with AI Tools
34. To get familiarized with working of Chat GPT
35. Identify Objects using AI Tools based on CNN, YOLO, SSD,R-CNN
36. To paraphrase text using AI Tools (PEGASUS,GPT, T5)
37. To use text-to-Image Generation AI Tools (DALL-E,MID JOURNEY)
38. To use voice command simulation AI Tools (SPEECH-TO-TEXT)
39. To get familiarized with ML Tools
40. To get familiarized with Quantum Computing Tools
41. To familiarize with quantum bits (qubits) using Dirac notation
42. To familiarize the behavior of single and multiple qubit gates.
43. To familiarize with Qubit as a Coin / Spin Analogy

KEY COMPETENCIES

Exp / Task / Ex No	Name of Experiment /Task /Exercise	Objectives	Key competencies
1 (a).	To get familiarized with Computer system and hardware connections	a. Connect cables to external hardware and operate the computer	a. Identify the parts of a computer system: i). CPU ii). Mother Board iii) Monitor iv)CD/DVD Drive v) Power Switch vi)Start Button vii) Reset Button viii) RAM ix) SSD /HDD b. Identify and connect various peripherals c. Identify and connect the cables used with computer system d. Identify various ports on CPU cabinet and connect Keyboard, Mouse and peripherals

1(b).	Start and Shut down Computer correctly	a. Login and logout as per the standard procedure b. Operate mouse & Keyboard	a. Login using the password b. Start and shut down the computer c. Use Mouse and Keyboard
1 (c).	Explore Windows Desktop	a. Access application programs using Start menu b. Use taskbar and Task manager	a. Familiarity with Start Menu, Taskbar, Icons and Shortcuts b. Access application programs using Start menu, Task manager c. Use Help support
2.	Check the software details of the computer System	a. Access the properties of computer and to find the details	a. Finding the details of operating system being used b. Finding the details of edition/version Service Pack installed

3.	Check the hardware present in your computer	a. Access device manager and to find the details b. Type /Navigate the correct path and Select icon related to the details required	a. Finding the CPU name and clock speed b. Finding the details of RAM and hard disk present c. Accessing Device manager using Control Panel and check the status of devices like mouse and key board d. Using My Computer to check the details of Hard drives and partitions
4.	Working with Files and Folders	a Create files and folders b Rename, arrange and search for the required folder/file c Restore deleted files from Recycle bin	a. Create folders and organize files indifferent folders b. Use cut, copy and paste commands to organize files and folders c. Arrange icons by name, size, type and Modified d. Search for a file or folder and find its path e. Create short cut to files and folders (in other folders) on Desktop f. Familiarity with the use of My Documents g. Familiarity with the use of Recycle Bin
5.	Use Windows Accessories like Calculator–Notepad–WordPad –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	a. Access Calculator using Run command b. Familiarity with the use of Calculator c. Create Text Files using Notepad, WordPad and observe the difference in file sizes d. Use MS paint to create .jpeg, .bmp files
6.	Get familiarized with Ribbon layout of MS word.	a. Create a Document and name appropriately and save it c. Set paper size and print options	a. Create/Open a document b. Use Save and Save as features c. Work on two Word documents simultaneously d. Choose correct Paper size and Printing options

7.	Perform basic Word Processing	a. Use key board and mouse to enter/edit text in the document. b. Use short cuts c. use Spell /Grammar Check features for auto corrections	a. Typing text b. Keyboard usage c. Mouse Usage (Left click/Right click/Scroll) d. Using Keyboard shortcuts e. Using Find and Replace features in MS-word f. Use Undo and Redo Features g. Use spell check to correct Spellings and Grammar
8.	Use basic formatting techniques	a. Format Text and paragraphs and using various text styles. b. Use bullets and numbers to create lists. c. Use Templates/Themes d. Insert page numbers, date, headers and footers	a. Formatting Text b. Formatting Paragraphs c. Setting Tabs d. Formatting Pages e. Use various Font Styles f. Insert bullets and numbers g. Using Themes and Templates h. Insert page numbers, header and footer
9.	Insert a table of required number of rows and columns	a. Insert table in the word document and edit b. Use sort option for arranging data.	a. Editing 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 back ground color of the table c. Using table design tools d. Using auto fit – fixed row/column height/length – Even distribution of rows /columns feature e. Converting Text to table and Table to Text f. Use Sort feature of the Table to arrange data in ascending/descending order
10.	Insert objects, clipart and Hyperlinks	a. Insert hyperlinks & Bookmarks b. Create organization charts/flow charts	a. Creating a 2-page document and Insert hyperlinks and Bookmarks. b. Creating an organization chart c. Preparing an Examination schedule notice with a hyper link to Exam schedule table.

11.	Use Mail merge feature of MSWord	Using Mail merge feature	a. Using mail merge to prepare individually addressed letters b. Using mail merge to print envelopes.
12.	Use Equations and symbols features.	Enter Mathematical symbols and Equations in the word document	a. Exploring various symbols available b. Inserting a symbol in the text c. Inserting mathematical equations in the document
13.	Get familiarized with MS Excel Ribbon layout	a. Get familiarized with excel layout b. Use various features available in toolbar	a. Open /create an MS Excel spread sheet and familiarity with MS Excel layout b. Use Quick Access Tool bar, Title Bar, Worksheets, Formula Bar, Status Bar
14.	Access and Enter data in the cells	a. Access and select the required cells by various addressing methods b. Enter and edit data	a. Moving around a Work sheets using Quick access toolbar b. Selecting Cells, Entering Data-Editing a Cell, Wrapping of Text-Deleting a Cell Entry, Saving a File, Closing Excel
15.	Edit spread sheet select, Copy, Cut, Paste	Format the excel sheet	a. Inserting and Deleting Columns and Rows b. Creating Borders c. Merging and aligning center d. Adding back ground Color Changing the Font, Font Size, and Font Color e. Formatting text with Bold, Italicize, and Underline f. Working with Long Text, Change a Column's Width
16.	Use built in functions andFormat Data	Use built in functions in Excel	a. Performing Mathematical Calculations b. Verification AutoSum c. Perform Automatic Calculations d. Aligning Cell Entries

17.	Enter a Formula for automatic calculations	Enter formula for automatic calculations	a. Entering formulae b. Using Cell References in Formulae c. Using Automatic updating function of Excel Formulae d. Using Mathematical Operators in Formulae **e.** Using Excel Error Message and Help
18.	Create Excel Functions, Fill Cells	a. To Create Excel sheets involving cross references and equations b Using the advanced functions for conditional calculations	a. Using Reference Operators b. Working with sum, Sum if, Count and Count If Functions c. Filling Cells Automatically
19.	Sort and filter data in sheet.	a. Refine the data in a worksheet and keep it organized b. Narrow a worksheet by selecting specific choice	a. Sorting data in multiple columns b. Sorting data in a row c. Sorting data using Custom order Filter data in work sheet
20.	Practice Excel Graphs And Charts	a. Use data in Excel sheet to Create technical charts and graphs b. Prepare various graphs from data.	a. Using data in sheets for getting charts. b. Producing various charts.
21.	Format a and print features Work sheet in Excel, use page setup	Format Excel sheet Insert headers &footers and print	a. Shading alternate rows of data b. Adding currency and percentage symbols c. Changing height of a row and width of a column d. Changing data alignment e. Inserting Headers and Footers Set Print Options and Printing.

22.	Develop lab report formats of respective discipline	Use Headers/Footers/ Page Numbers for preparing reports	Creating Lab reports using MS Excel
23.	Get familiarized with Ribbon layout &features Of PowerPoint.	Access required options in the toolbar	Explore and use various options in PowerPoint a. Home b. Insert c. Design d. Animation e. Slideshow f. View g. Review
24.	Create a simple Power Point Presentation	a. Create simple Power Point presentation with photographs /Clip Art and text boxes b. Use bullets option	a. Inserting a New Slide into Power Point b. Changing the Title of a Power Point Slide c. Using Bullets in PowerPoint d. Adding an Image to a Power Point Slide e. Adding a Text box to a Power Point slide

25.	Set up a Master Slide in PowerPoint and add notes	a. Setup Master slide and format b. Add notes to master slide.	a. Creating a PowerPoint Design Template b. Modifying themes c. Switching between Slide master view and Normal view d. Formatting a Design Template for Master Slide e. Adding a Title Slide to a Design Template f. Using the Slide Show g. Adding Notes to a Power Point Presentation slide
26.	Insert Text and Objects	a. Insert Text and Objects b. Use 3D features	a. Inserting Text and objects b. Setting Indents and line spacing c. Inserting pictures/clipart d. Formatting pictures e. Inserting shapes and word art f. Using 3d features to Arrange objects
27.	Create Flow Charts /Organizational Charts	a. Create organizational charts and flow charts using smart art	a. Creating a Flow Chart in PowerPoint b. Grouping and Ungrouping Shapes c. Use smart art
28.	Insert Tables	a. Insert tables and format	a. Using Tables in PowerPoint b. Formatting the Table Data c. Changing Table Background
29.	Insert Charts/Graphs	a. Create charts and Bar graphs, Pie Charts and format.	a. Creating 3D Bar Graphs in PowerPoint b. Working with the Power Point Datasheet c. Formatting a PowerPoint Chart Axis d. Formatting the Bars of a Chart e. Creating Power Point Pie Charts f. Using Pie Chart Segments g. Creating 2D Bar Charts in Power Point h. Formatting the 2D Chart d. Formatting a Chart Background
30.	Insert audio & video, Hyperlinks in a slide and Add narration to the slide	a. Insert Sounds and Video in appropriate format. b. Add narration to the slide c. Use hyperlinks to switch to different slides and files	a. Inserting sounds in the slide and hide the audio symbol b. Adjusting the volume in the settings c. Inserting video file in the format supported by PowerPoint in a slide d. Using automatic and on click options e. Adding narration to the slide Insert Hyperlinks

31.	Create Animation effects	a. Add animation effects	a. Applying transitions to slides b. Using special animation effects like Entrance, Emphasis, Motion Paths & exit as per requirement.
32.	Reviewing presentation	a. Use Spell and Grammar check feature b. Setup slideshow c. Add timing to the slides d. Setup automatic slide show	a. Checking spelling and grammar b. Previewing presentation c. Setting up slideshow d. Setting up resolution e. Using Rehearse Timing feature in PowerPoint f. Using PowerPoint Pen Tool During slideshow g. Saving h. Printing presentation Slides as Hand-out
33	Familiarizing with AI Tools	Introductions of AI tools and their applications. Understand the basic use cases and functionality of AI tools (like Chat GPT, Google Gemini, Teachable Machine, etc.).	a) Grasping the concept of Artificial Intelligence and how tools mimic human thinking or behavior. b) Identifying and interacting with AI tools such as: **Chat GPT** (natural language processing), **Google Teachable Machine** (image/audio classification), **DALL·E / Bing Image Creator** (AI art), **Grammarly / Quillbot** (AI-based writing assistants).
34	Usage of ChatGPT	a) Introduction to ChatGPT, an AI-powered conversational assistant. b) To explore ChatGPT's capabilities in answering questions, generating content, and solving problems.	a) Operating the ChatGPT interface (web or app), input prompts, and interpret outputs. b) Using ChatGPT to generate summaries, ideas, code snippets, explanations, emails, etc. c) Evaluating the relevance and accuracy of ChatGPT's responses.

35	Object identification using AI Tools based on CNN,YOLO,SSD, R-CNN	a. Get awareness about object detection techniques using AI. b. To explore how AI tools based on **CNN, YOLO, SSD, and R-CNN** detect and classify objects in images/videos.	a) Differentiating object detection from image classification. b) Using web-based AI tools or platforms that demonstrate object detection (e.g., Teachable Machine, Roboflow, Edge Impulse, Hugging Face Demos). c) Observing and comparing the speed, accuracy, and bounding box behavior of different models.
36	Paraphrase text using AI Tools (PEGASUS,GPT,T5)	a. Get awareness about AI-powered text paraphrasing techniques. b. To explore the usage and functioning of transformer-based models like **PEGASUS**, **GPT**, and **T5**	a) Recognizing of Natural Language Processing (NLP) tasks and how transformer models like PEGASUS, GPT, and T5 can be used. b) Using AI tools to generate reworded versions of sentences or paragraphs while retaining the original meaning. c) Interacting with user-friendly interfaces like: • Hugging Face demos • ChatGPT • Quillbot • Parrot.ai
37	Text-to-Image Generation using AI Tools (DALL-E, MIDJOURNEY)	a) Get awareness about **text-to-image generation** using advanced AI models. b) To explore the usage of tools like **DALL·E** and **Mid journey** convert text prompts into realistic or artistic images.	a. Learning usage of how AI models generate visual content from natural language prompts. b. Formulating effective, clear, and creative text prompts to generate meaningful images. c. Enhancing creative thinking by translating ideas into visual representations using AI. d. Analysing and comparing output quality, style, and relevance between DALL·E and Mid journey.

38	Voice Command Simulation using AI Tools (SPEECH-TO-TEXT)	a) Get awareness about **Speech-to-Text (STT)** technology and its role in AI-powered voice recognition systems.	a. Using AI tools to generate text from speech. b. Reading prompts and commands to analyze how accurately the tool transcribes voice. c. Using voice to simulate commands such as opening files, dictating emails, or interacting with virtual assistants.
39	Usage of ML Tools	a) To use ML tools for suitable real-world applications b) To use **popular ML tools and platforms** through simple, hands-on demonstrations .	a. Understanding key ML terms like dataset, training, testing, classification, prediction, and accuracy. b. Learning to use beginner-friendly ML tools such as: • **Teachable Machine by Google** (image/audio recognition) • **Microsoft Lobe** (no-code image classification) • **Weka** (GUI-based ML toolkit) • **IBM Watson Studio** (visual data workflows)
40	Usage of Quantum Computing Tools	a. To explore and interact with **quantum computing simulation tools** and platforms.	a. Understanding key terms: **Qubit**, **Superposition**, **Entanglement**, **Quantum Gate**, **Quantum Circuit**. b. Navigate and use beginner-friendly quantum computing tools: • **IBM Quantum Experience (IBM Q / Qiskit)** • **Microsoft Quantum Development Kit** • **Quirk (online quantum circuit simulator)** • **Quantum Playground by Google**

41	To familiarize with quantum bits (qubits) using Dirac notation	a) To introduce the concept of a **qubit** as the fundamental unit of quantum information.
		b) To understand the representation of qubits using **Dirac (bra-ket) notation**.
			• Identify and interpret the basic qubit states:
			  • $\|0\rangle = \begin{bmatrix}1\\0\end{bmatrix}$
			  • $\|1\rangle = \begin{bmatrix}0\\1\end{bmatrix}$
			• Understand that a qubit can exist in a **superposition**:
			  • $\|\psi\rangle = \alpha\|0\rangle + \beta\|1\rangle$, where α and β are complex numbers and $\|\alpha\|^2 + \|\beta\|^2 = 1$
			
			a) Learn how to write and read quantum states using the ket ($\|\rangle$) and bra ($\langle\|$) notations.
			b) Understand the purpose of $\langle\psi\|$ and how it represents a dual vector in quantum mechanics.

42	To familiarize the behavior of single and multiple qubit gates.	a) To understand the concept of **quantum gates** and their role in quantum circuits.	a) Recognize the function and matrix representation of:
			
			• **Single-qubit gates**:
			  ○ **Pauli-X (NOT)**: flips $\|0\rangle \leftrightarrow \|1\rangle$
			  ○ **Hadamard (H)**: creates superposition
			  ○ **Pauli-Z**: applies a phase flip
			• **Multi-qubit gates**:
			  ○ **CNOT**: flips target qubit based on control
			  ○ **Toffoli (CCNOT)**: controlled-controlled NOT
			  ○ **SWAP**: exchanges the states of two qubits

43	To familiarize with Qubit as a Coin / Spin Analogy	a) To introduce the concept of a **qubit** using intuitive physical analogies. b) To help students understand **quantum superposition** through the **coin toss** or **spin-½ particle** analogy.	a. Relate a **qubit in superposition** to a **coin spinning in the air**: • Classical coin: heads (0) or tails (1) • Spinning coin: both until observed ($\|0\rangle$ and $\|1\rangle$ at once) b. Use **spin analogy**: a particle with spin "up" ($\|0\rangle$) or "down" ($\|1\rangle$), or in between (superposition)

CO-PO/PSO MATRIX

CO NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CE111L.1	**1**	**2**	**1**	**1**	**2**	**1**	**2**	**3**	**1**	**1**
CE111L.2	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**1**
CE111L.3	**2**	**2**	**3**	**3**	**2**	**1**	**2**	**3**	**3**	**3**
CE111L.4	**2**	**2**	**3**	**3**	**2**	**1**	**2**	**3**	**2**	**1**
CE111L.5	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Average	**2**	**2.2**	**2.4**	**2.6**	**2.2**	**1.6**	**2.2**	**3**	**2.2**	**1.8**

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

REFERENCE BOOKS

1.FUNDAMENTALS OF COMPUTERS --V. RAJARAMAN, NIHARIKA ADABALA, 7TH EDITION, PHI PUBLICATION.

2.INTRODUCTION TO COMPUTERS -- PETER NORTON, 7TH EDITION, MCGRAWHILL.

3.MICROSOFT OFFICE (OFFICE 2021 & MICROSOFT 365) – JOAN LAMBERT, CURIS FRYE BY PEARSON PUBLICATION.

4.INTRODUCTION TO MS OFFICE BY INDIRA GANDHI NATIONAL UNIVERSITY.

5.EMERGING TECHNOLOGIES FOR ENGINEERS --REEMA THAREJA, WILEY EMERGING TECHNOLOGY SERIES.

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TESTS

Unit Test	Learning outcome to be covered
Unit test-1	From 1 to 12
Unit test-2	From 13 to 32
Unit test-3	From 33 to 43

III Sem

DIPLOMA IN CIVIL ENGINEERING
SCHEME OF INSTRUCTION AND MODEL BLUEPRINT FOR EVALUATION
III SEMESTER

Course Code	Course Title	No. of Periods/week		Practicum (Y/N)	Total No. of Periods/Year	Credits	Scheme Of Examination			
		Theory	Practical				Duration (Hours)	FA (Marks)	SA (Marks)	Total Marks
THEORY COURSES										
26CE301T	Mechanics of Solids & Theory of Structures	5	---	N	75	4	3	30	70	100
26CE302T	Hydraulics	5	---	N	75	3	3	30	70	100
26CE303T	Construction Materials & Practice	6	---	N	90	4	3	30	70	100
ELECTIVE COURSES										
26CE304E	Engineering Mathematics-II	3	---	N	45	2	3	30	70	100
26CE305E	Concrete Technology	3	---	N	45	2	3	30	70	100
26CE306E	Building Services and Maintenance	3	---	N	45	2	3	30	70	100
AUDIT COURSE										
26CE307A	Green Building Technologies	2	---	N	30	--	-	-	-	-
PRACTICAL COURSES										
26CE308D	Civil Engineering Drawing-I Integrated with CAD	---	6	N	90	2.5	3	40	60	100
26CE309L	Surveying Theory & Practice - II	---	6	Y	90	2	3	40	60	100
26CE310L	Material Testing & Hydraulics Practice	---	6	N	90	2	3	40	60	100
26CE311C	Student Centric Activities	---	3	N	45	0.5	---	---	---	---
	TOTAL	**21**	**21**		**630**	**20**	**-**	**240**	**460**	**700**

Note 1: 0.5 credits will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NCC/Clean and Green or Sports/Games

Note 2: 26CE304E is common elective to all programmes.

MECHANICS OF SOLIDS AND THEORY OF STRUCTURES

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE301T	Mechanics of solids & Theory of structures	05	75	30	70	4

TIME SCHEDULE

S. No.	Chapter/Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	COs Mapped
1.	Theory of simple bending	15	25	3	2	CO1
2.	Deflection of beams	15	22	2	2	CO2
3.	Columns and Struts	10	14	2	1	CO3
4.	Dams and Retaining walls	10	14	2	1	CO3
5.	Statically indeterminate beams	15	14	2	1	CO4
6.	Stresses in frames	10	11	1	1	CO5
	TOTAL	75	100	12	8	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able to	
(i)	Understand the concepts of bending stresses, shear stresses and deflection induced in beams.
(ii)	Understand the effect of loading on columns and their behaviour under loading, stability of Dams and Retaining walls under the action of lateral loads, effects of Loading on statically determinate beams and frames.

COURSE OUTCOMES

CO1	CE301.1	Solve the problems pertaining to Bending equation and Shear stress distribution across the depth of various cross sections.
CO2	CE301.2	Compute the Slope & Deflection in beams using double integration, Macaulay's & Mohr's Moment-Area methods.
CO3	CE301.3	Compute 1. The load carrying capacity of columns and 2. Intensity of base pressure acting on dams and retaining walls.

CO4	CE301.4	Explain the effects of Loading on propped cantilevers, fixed and continuous beams and sketch Shear force and Bending Moment diagram.
CO5	CE301.5	Calculate the forces in trusses using method of joints and sections.

LEARNING OUTCOMES

1. THEORY OF SIMPLE BENDING

1.1 Define simple / pure bending

1.2 Explain the process of simple bending and Define Neutral layer ,Neutral axis and Radius of curvature

1.3 List the assumptions made in the theory of simple bending and derive the bending equation for simple bending

1.4 Define Bending stress and Moment of resistance

1.5 Explain and Sketch bending stress distribution across the depth of the beam for standard cross section.

1.6 Define Modulus of section and Flexural rigidity and derive the formula for section modulus of Square section, Rectangular section and Circular section for solid sections only.

1.7 Solve problems on theory of simple bending for Symmetrical and Unsymmetrical sections to calculate Moment of Resistance, Load carrying Capacity and Dimensions of cross section.

1.8 State formula for calculation of Shear Stress in any layer of a cross section (Derivation of formulae not required) and Draw shear stress distribution across rectangular section, Solid circular section, I section and T section

1.9 Determine shear stress at any layer and draw shear stress distribution diagram across rectangular section and I-section

1.10 Determine the maximum shear stress in circular, rectangular and square sections (Derivation of formulae not required)

2. DEFLECTION OF BEAMS

2.1 Draw the deflected shapes of simply supported, cantilever and fixed beams and Define -Elastic curve, slope and Deflection

2.2 Derive relation between slope, deflection and radius of curvature

2.3 Derive the equations for maximum slope and deflection by double integration method for: a) Cantilever beams with point loads and uniformly distributed loads b) Simply supported beams with central point load or uniformly distributed load throughout.

2.4 Calculate the maximum slope and deflection in simply supported and cantilever beams using the above formulae

2.5 Explain Macaulay's method (for Simply supported beams) to find the slope and deflections

2.6 Compute the maximum slope and deflection for Simply Supported beam carrying point loads and uniformly distributed loads by Macaulay's method

2.7 Explain the moment area method for slope and deflection and Define Mohr's theorem-I and Mohr's theorem-II

2.8 Derive formulae for maximum slope and deflection of standard cases by moment area method.

2.9 Compute the maximum slope and deflections for Cantilever and Simply Supported Beams by Mohr's theorem-I and Mohr's theorem-II (moment area method)

3. COLUMNS AND STRUTS

3.1 Define: i) Compression member ii) Axial Loading iii) eccentric loading

3.2 Define: i) Buckling/Critical/Crippling Load ii) Actual length iii) Least radius of gyration iv) Safe load v) Factor of safety

3.3 List types of compression members

3.4 Calculate least radius of gyration for solid circular, square and rectangular sections.

3.5 List different end conditions used for a column

3.6 Define i) Effective/equivalent length ii) Slenderness ratio

3.7 List the effective lengths of columns for different end conditions, Calculate the slenderness ratio for a given column/strut and Classify columns based on slenderness ratio or length and lateral dimensions, Distinguish between Long and short columns.

3.8 State Euler's formula for crippling load of a column/strut (derivation not required) Calculate crippling and safe loads on a column/strut with simple section using Euler's formula.

3.9 Explain the Rankine's formula for short and long columns and calculate crippling or safe loads on a column/strut with simple sections using Rankine's formula.

4. DAMS AND RETAINING WALLS

4.1 Define a dam/retaining wall; List the forces acting on a dam/retaining wall.

4.2 Derive the formula for maximum and minimum stress intensities at the base of a rectangular/Trapezoidal dam with vertical water face and sketch the stress distribution at the base of a dam for different conditions, Calculate the stress intensity at base of a rectangular/Trapezoidal dam with and without free board.

4.3 List the conditions for stability of a dam define middle third rule, define minimum base width of a dam, Derive the formula for minimum base width of a dam with and without free board to avoid tension at the base for Trapezoidal section & Rectangular section.

4.4 Explain the procedure to find the stresses at the base of a dam with battered water face and calculate the stresses at the base of a dam Solve the problems on checking the stability of a dam with vertical / inclined water face

4.5 Define: i) Angle of repose of soil ii) Angle of Surcharge iii) Active earth pressure iv) Passive earth pressure

4.6 Compute the lateral earth pressure on a retaining wall having soil face vertical.

4.7 Calculate the stresses at the base of a retaining wall having soil with vertical face, the minimum base width of to avoid tension and sliding at base, the stresses at the base of a retaining wall with levelled earth.

4.8 Check the stability of a retaining wall with soil face vertical

4.9 State Rankine's formula for minimum depth of foundation.

5. STATICALLY INDETERMINATE BEAMS

5.1 Differentiate between a statically determinate and indeterminate structure, define degree of static indeterminacy and Calculate degree of static indeterminacy for Propped cantilever, Fixed beam and Two span continuous beam

5.2 Calculate the prop reaction of propped cantilever subjected to UDL throughout OR a single point load between fixed and propped ends and Calculate SF and BM values and draw SFD and BMD with above type of loading only, Calculate the location of point of contra flexure in propped cantilever for above loading.

5.3 State the merits and demerits of fixed beams

5.4 State the merits and demerits of continuous beams and the effect of continuous supports

6. STRESSES IN FRAMES

6.1 Define a frame.

6.2 Classify the frames based on a) Number of members and b) Number of joints.

6.3 Show the sign convention for different types of stresses in members of a truss/frame.

6.4 Explain the rules for assuming the direction of stresses in the members.

6.5 Explain the method of calculating stresses/forces in the members of a truss/frame by the method of joints.

6.6 Calculate the forces in the members of a simply supported or cantilever truss/frame subjected to loads at nodal points by the method of joints and prepare force table.

6.7 Differentiate method of joints and method of sections.

6.8 Calculate the forces in the members of a simply supported or cantilever truss / frame subjected to loads at nodal points by the method of sections and prepare force table.

CO-PO MAPPING

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	2					2	3	1
CO2	2	2	2					2	3	1
CO3	2	2	2					2	3	1
CO4	3	2						2	3	1
CO5	3	2						2	3	1
Average	2.4	2.2	2					2	3	1

Note : The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc

COURSE CONTENT

1. THEORY OF SIMPLE BENDING

Theory of simple bending – assumptions – Neutral axis – Bending stress distribution – Moment of resistance – curvature of beams – Bending equation – strength of beams – Rectangular, circular, and L sections practical applications – simple problems- Shear stress in beams – Equation for shear stress in a layer of a beam (Derivation of

formula not required) – Shear Stress distribution diagrams for various beam sections such as rectangular, solid circular and I sections – Problems.

2. DEFLECTION OF BEAMS

Deflected shapes of beams with different support conditions – Strength and stiffness of beams – Relation between curvature, slope and deflection - Double integration method – Derivation of standard cases – Problems - Macaulay's method for slope and deflection – Simply supported beam under concentrated and uniformly distributed loads – Problems - Mohr's theorems for slope and deflection – Cantilevers and simply supported beams with symmetrical loading – Problems.

3. COLUMNS AND STRUTS

Short and long columns – Axial loading only – solid circular, , Rectangle and I-section and Built up columns – different end conditions – Effective length, radius of gyration and slenderness ratio – calculation of safe load on columns by Euler's and Rankine's formula - limitation of Euler's formula – strength of columns – problems.

4. DAMS AND RETAINING WALLS

Introduction – rectangular dams – trapezoidal dams having water face vertical and inclined – Conditions for the stability of a dam – conditions to avoid tension in the masonry dam at its base, to prevent the over – turning of the dam, the sliding of dam and to prevent the crushing of masonry at the base of the dam – Minimum base width of a dam - Active and passive earth pressure – Angle of internal friction – Angle of surcharge – calculation of active earth pressure by Rankine's formula without surcharge - General conditions of stability of retaining walls – middle third rule – Distribution of pressure on foundation of retaining walls – calculation of minimum base width.

5. STATICALLY INDETERMINATE BEAMS

Statically determinate and indeterminate structures – definition – degree of static indeterminacy - Cantilever beam with UDL on whole span and propped at free end – cantilever beams with point load between fixed and propped ends – Calculation of prop reaction – SFD and BMD -Fixed Beams: Introduction-Sagging and hogging Bending moments – merits and demerits - Continuous Beams: Merits and demerits – Continuous beams – effect of continuous supports.

6. STRESSES IN FRAMES

Frames – Definition – classification based on number of members and number of joints – Determination of forces in members of statically determinate pin jointed frames – method of sections and method of joints – Application to simple frames and trusses (simply supported and cantilever) under loads at joints.

REFERENCE BOOKS:

1) Strength of Materials, R.K. Rajput, S.Chand Publishers, New Delhi
2) Strength of Materials, S. Ramamurtham, Dhanpat Rai Publishers, New Delh
3) Strength of Materials, B.C.Punmia, Lakshmi Publications, New Delhi
4) Strength of Materials, R.S. Khurmi, S.Chand Publishers, New Delhi
5) Strength of Materials, R.K. Bansal, Lakshmi Publications, New Delhi
6) Theory of structures, R. S. Khurmi & N. Khurmi, S. Chand Publishers, New Delhi
7) Theory of structures, G. S Pandit, S P Gupta & R Gupha, McGraw Hill Education,New Delhi

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.9
Unit Test – II	From 4.1 to 6.8

HYDRAULICS

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE302T	Hydraulics	05	75	30	70	3

TIME SCHEDULE

S. No.	Chapter/Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	COs Mapped
1.	Properties of Fluids	05	3	1	-	CO1
2.	Fluid pressure and its measurements	09	14	2	1	CO1
3.	Flow of Fluids	13	22	2	2	CO2
4.	Flow through orifices and mouth pieces	10	14	2	1	CO3
5.	Flow over notches and weirs	09	11	1	1	CO3
6.	Flow through pipes	09	11	1	1	CO4
7.	Flow through open channels	14	19	1	2	CO4
8.	Pumps and Turbines	03	3	1	-	CO5
9.	Hydroelectric power plants	03	3	1	-	CO5
	Total	75	100	12	8	

COURSE OBJECTIVES:

Upon completion of the course, the student shall be able to	
(i)	Understand the properties of liquids, water pressure and its measurement, principles of flow of water, flow through orifices and mouth Pieces, flow over notches & weirs, flow through pipes, open channels.
(ii)	Understand the types of pumps & turbines and general lay-out of Hydro-electric Power Plants.

COURSE OUTCOMES

CO1	CE302.1	Solve simple problems on properties of fluids and pressure measurements using various instruments.
CO2	CE302.2	Solve the problems using the equation of continuity and energies of liquid in motion.
CO3	CE302.3	Calculate the coefficients of discharge of a small orifice, mouthpiece, notches &weirs and venturi meter.
CO4	CE302.4	Solve the problems of the major and minor losses of head of water flowing through pipes and design the cross sections of different types of channels using relevant formulae
CO5	CE302.5	Understand the different types of pumps & turbines and sketch the layout of Hydro-electric power plant.

LEARNING OUTCOMES

1. PROPERTIES OF FLUIDS

1.1 Explain the term fluid and give an example
1.2 Distinguish between solids & fluids.
1.3 Differentiate ideal and real fluids.
1.4 Define the terms - Mass density, Specific weight, Specific gravity, Specific volume, Cohesion, Adhesion, Surface tension, Capillarity, Compressibility, Viscosity and Vapour pressure.
1.5 State formulae of dynamic viscosity, surface tension of water drop & soap bubble and capillarity rise/depression with simple problems.

2. FLUID PRESSURE AND ITS MEASUREMENT

2.1 Define the terms: Atmospheric pressure, Gauge pressure and Absolute pressure.
2.2 State the relation between the above three pressures.
2.3 Describe the following pressure measuring instruments: Piezometers, U-tube manometers, Differential manometers and mechanical gauges.
2.4 Calculate the pressure of a flowing fluid given the readings on Piezometers, simple manometers, differential U-Tube and inverted U-Tube differential manometers.
2.5 Define Total Pressure and Centre of Pressure. State the formulae for total pressure and centre of pressure on the following plane surfaces immersed in a liquid at rest:
    1. Horizontal plane
    2. Vertical plane and
    3. Inclined plane
2.6 Calculate total pressure and centre of pressure for the above plane surfaces for the given conditions.
2.7 List the practical applications of plane surfaces (No numerical problems)

3. FLOW OF FLUIDS

3.1 State the different types of flow of liquids
3.2 Define:
    i) Steady flow and Unsteady flow
    ii) Uniform flow and Non-uniform flow,
    iii) Laminar flow and Turbulent flow.
3.3 Distinguish between different types of flow of liquids.
3.4 Define discharge, State units of discharge

3.5 State one dimensional continuity equation.
3.6 Calculate the discharge/velocity at a section of flowing liquid in pipe for the given conditions.
3.7 Explain the following energies of liquid in motion
1. Datum head,
2. Pressure head and
3. Velocity head.
3.8 State Bernoulli's theorem of total energy of a liquid in motion.
3.9 List the limitations of Bernoulli's theorem.
3.10 Compute the pressure/velocity at a section of flowing liquid in pipe for the given conditions using Bernoulli's equation.
3.11 List three practical applications of Bernoulli's theorem.
3.12 Describe the working principle of i) Venturi meter, ii) Orifice meter and iii) Pitot tube.
3.13 State the formulae to calculate the actual discharge of flowing liquid through Venturi meter and Orifice meter and calculate the actual discharge of flowing liquid through Venturi meter and Orifice meter.

4. FLOW THROUGH ORIFICE AND MOUTH PIECES

4.1 Define orifice and list different types of orifices. Differentiate large orifice and small orifice.
4.2 Define the terms: Vena-contracta, Cc, Cv, Cd and Cr (Hydraulic coefficients). State the relation between the above coefficients.
4.3 State the formula for theoretical discharge through small orifice
4.4 Calculate the discharge, Cc, Cv, Cd and Cr for given conditions-Numerical Problems
4.5 State the formula for discharge through the large rectangular orifice for given conditions (No derivation) – Numerical problems
4.6 State the equations with standard notations for discharge through Fully submerged Orifice and Partially submerged Orifice. (No Problems)
4.7 State the formula for time of emptying a prismatic tank by an orifice. Calculate the time of emptying a prismatic tank by an orifice.
4.8 Define mouthpiece. Differentiate mouthpiece and orifice. List different types of mouth pieces.
4.9 State the formulae for discharge for different types of mouth pieces.
4.10 Calculate discharge through a mouthpiece for given data-Numerical Problems.

5. FLOW OVER NOTCHES AND WEIRS

5.1 Define a notch. List different types of notches.
5.2 State the formulae for the discharge through Rectangular Notch, Triangular notch and Trapezoidal notches. Calculate the discharge through the above notches from the given data.
5.3 Define weir. List different types of weirs. State the formulae for discharge over Sharp crested weir and Broad crested weir – Numerical problems
5.4 Write the formulae to determine the discharge for rectangular weir - 1. Francis and 2. Bazin's empirical formula (No Derivations, No Problems)

6. FLOW THROUGH PIPES

6.1 List various losses that occur when water flow through pipes.
6.2 Differentiate Major loss and Minor losses.
6.3 State formulae to compute loss of head due to friction using Chezy's formula and Darcy's Weisbach equation.
6.4 Solve numerical problems in pipes based on the above two formulae for given data.
6.5 State formulae for head loss due to various minor losses.

6.6 Calculate the minor losses of head for given data–Numerical problems.
6.7 Define the terms: Hydraulic gradient line and Total energy line.
6.8 Calculate the discharge through Parallel and Compound (series) Pipes connected to a reservoir for given data - Numerical Problems.

7. FLOW THROUGH OPEN CHANNELS

7.1 Define open channel flow. Differentiate open channel flow and pipe flow.
7.2 Define the terms: Wetted perimeter and Hydraulic mean depth.
7.3 State Chezy's formula and Manning's formula for uniform flow through open channels.
7.4 List the values of 'C' for different surfaces. State the following formulae to calculate 'C'.
(i) Kutter's, formula
(ii) Manning's formula and
(iii) Bazin's formula
7.5 Calculate Velocity and Discharge in a channel using Chezy's and Manning's formulae for given conditions-Numerical problems.
7.6 Define most economical section of a channel.
7.7 List the conditions for most economical section of Rectangular channel and Trapezoidal channel.
7.8 Design Rectangular section for the given conditions
7.9 Design Trapezoidal section for the given conditions

8. PUMPS AND TURBINES

8.1 Define a Pump. List different types of Pumps.
8.2 Name the component parts of Reciprocating pump and Centrifugal Pump.
8.3 List the pumps to be used for the condition of low head and maximum discharge and vice versa.
8.4 Define Turbine. List types of turbines with examples.

9. HYDRO-ELECTRIC POWER PLANTS

9.1 Sketch a typical layout of hydro-electric power plant installation and indicate the different parts in it.
9.2 List different components of hydro-electric power plant installation
9.3 Define a surge tank and state the functions of a surge tank.

CO-PO MAPPING

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	1					2	2	3
CO2	3	3	1	1				3	2	3
CO3	3	2	2	2				3	3	3
CO4	3	2	2	2				3	3	3
CO5	3	2	1	1				3	3	2
Average	3.0	2.4	1.4	1.5				2.8	2.6	2.8

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc

COURSE CONTENT

1. PROPERTIES OF FLUIDS

Scope and importance of Hydraulics in Civil Engineering - Fluids – Classification - Ideal and Real fluids - Difference between solids and fluids - Properties of fluids - Formulae for Dynamic viscosity, Kinematic viscosity, surface tension of water and soap bubble, capillarity – Numerical problems on properties of fluids.

2. LIQUID PRESSURE AND ITS MEASUREMENT

Atmospheric pressure, gauge pressure and absolute pressure and relationship - Pressure measuring Instruments – Piezometer- Manometer – U-tube and inverted U-tube differential manometers –Description - Measurement of the Pressure of a flowing liquid – Piezometer - simple, differential and inverted differential manometers - Total pressure and Centre of pressure on plane surface immersed in liquid – Horizontal, Vertical& Inclined plane surfaces – Numerical Problems on Total pressure and Centre of pressure - Practical applications of plane surfaces (No problems)

3. FLOW OF LIQUIDS

Types of Flow-Uniform flow, non-uniform flow, laminar flow, turbulent flow, steady flow and unsteady flow - Rate of flow or discharge-continuity equation – One-dimensional – Principle -Numerical Problems - Energies of liquid in motion – Datum head – Pressure head and Velocity head - Total energy of liquid in motion – Bernoulli's theorem (without proof) - Limitations of Bernoulli's theorem - Numerical Problems - Practical applications of Bernoulli's theorem - Venturi meter - Orifice meter - Pitot tube - Numerical Problems on venturi meter and orifice meter.

4. FLOW THROUGH ORIFICES AND MOUTH PIECES

Orifice-types of Orifices-difference of small and large orifice-Determination of discharge through small Orifice - Vena Contracta-Hydraulic coefficients (Cv,Cc,Cd and Cr) – Relation between Hydraulic coefficients(No derivation) - Numerical Problems - Large Rectangular Orifice- Formula for discharge (No Derivation)-Numerical Problems - Flow through fully submerged and partially submerged orifices-explanation- formula for discharge (No Problems) - Time of emptying of a prismatic tank by an orifice- Numerical Problems - Mouth piece-Difference between Orifice and Mouth piece - Types of Mouth pieces – Formulae for discharge through mouth pieces -Determination of discharge through a Mouth piece from the given data(Numerical problems).

5. FLOW OVER NOTCHES AND WEIRS

Notches - types of notches - Rectangular, triangular and trapezoidal notches - Formulae for the discharge over rectangular, triangular and trapezoidal notches(Derivation of formulae not required)-Numerical problems – Weirs - types of weirs – Sharp crested and broad crested weirs - Formulae for the discharge over a sharp crested and broad crested weirs(Derivation of formulae not required) - Numerical problems - Empirical formulae for discharge over rectangular weir-Francis formula-Bazin's formula (Derivation of formulae& Numerical problems not required).

6. FLOW THOROUGH PIPES

Major and minor losses - Frictional loss in pipes - Chezy's formula and Darcy's Weisbach equation (without proof) - Numerical problems - Minor Losses - Loss of

head at entrance and exit of pipe, loss of head due to sudden enlargement, sudden contraction – Formulae - Simple problems - Hydraulic gradient and total energy line - Discharge through parallel pipes and compound pipes (series) connected to a reservoir –Numerical problems.

7. FLOW THROUGH OPEN CHANNELS

Open channel flow - Differences between open channel flow and pipe flow - Geometric properties of channel - Wetted perimeter and hydraulic mean depth - Discharge through open channel – Chezy's formula& Manning's formula (derivation not necessary) - Numerical problems - Value of 'C' for different surfaces - Empirical formulae for value of 'C' - Kutter's formula, Manning's formula, Bazin's formula - Conditions for Most economical section of a channel - Rectangular and trapezoidal sections - Design of cross sections- Problems.

8. PUMPS AND TURBINES

Pumps - types -Reciprocating pumps and centrifugal pumps – Component parts of Reciprocating & Centrifugal Pumps – Turbines - Classification of turbines – Impulse and Reaction Turbines - Examples.

9. HYDRO-ELECTRIC POWER PLANTS

Sketch a typical layout of a hydroelectric power plant - components – Intake works, Pressure tunnel, Penstock, surge tank, anchor blocks and tailrace - Functions of surge tank.

REFERENCE BOOKS:

1. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Publications.
2. Hydraulics and Fluid Mechanics Including Hydraulics Machines by P. N. Modi & S.M. Seth, Rajson's publications Pvt. Ltd.
3. Hydraulics, Fluid Mechanics & Hydraulic Machines, R.S Khurmi & N. Khurmi, S. Chand Publications.
4. Fluid Mechanics, Frank white, SIE

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 4.10
Unit Test – II	From 5.1 to 9.3

CONSTRUCTION MATERIALS AND PRACTICE

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE303T	Construction Materials and Practice	06	90	30	70	4

TIME SCHEDULE

S. No.	Chapter/Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	COs Mapped
1.	Basic Construction Materials	18	22	2	2	CO1
2.	Cementitious Materials & Admixtures	20	22	2	2	CO2
3.	Timber, Glass & Asbestos	06	06	2		
4	Building Components & Planning	16	14	2	1	CO3
5	Building Elements	20	22	2	2	CO4
6.	Scaffolding, Formwork & Finishes	10	14	2	1	CO5
	TOTAL	90	100	12	8	

COURSE OBJECTIVES

Upon completion of the Course, the student shall be able to	
(i)	To provide knowledge about natural and manufactured construction materials such as stones, bricks, tiles, and sand, including their properties, classification, and suitability for different construction needs.
(ii)	To explain the composition, properties, testing, and applications of cementitious materials, mortars, concretes, admixtures, timber, glass, and asbestos used in civil engineering construction.
(iii)	To introduce the essential components and planning aspects of buildings, foundation systems, and construction elements like masonry, doors, windows, flooring, roofs, and staircases.
(iv)	To develop understanding of temporary construction supports such as scaffolding and formwork, and to describe various protective and decorative finishing techniques used in building works.

COURSE OUTCOMES

CO1	CE303.1	Identify and describe the physical properties, types, and testing methods of basic construction materials including alternatives like AAC blocks and fly ash bricks
CO2	CE303.2	Explain the properties, classifications, and applications of cementitious materials, admixtures, timber, glass, and asbestos and describe their relevance in modern construction.
CO3	CE303.3	Describe building components, planning principles and classifications of buildings.
CO4	CE303.4	Describe various building elements including masonry, doors, windows, lintels, roofs, floorings, and staircases with respect to construction procedures and usage.
CO5	CE303.5	Explain the purpose and types of scaffolding, formwork, and surface finishes, and outline methods for painting, plastering, and termite proofing.

LEARNING OUTCOMES

1. BASIC CONSTRUCTION MATERIALS

1.1. Classify rocks based on physical characteristics (igneous, sedimentary, metamorphic).
1.2. Identify and explain the essential properties of good building stones.
1.3. Understand the purpose and importance of dressing of stones in construction.
1.4. Describe the desirable characteristics of good quality bricks.
1.5. Explain and interpret results of brick tests (water absorption and compressive strength) as per IS:3495-2019.
1.6. Distinguish between traditional bricks and modern alternatives such as Autoclaved Aerated Concrete (AAC) blocks and fly ash bricks and explain their advantages and applications.
1.7. Identify different types of tiles (Mangalore, ceramic, vitrified, floor, Morbonite) and evaluate their suitability for various building applications.
1.8. Describe the uses and properties of stoneware pipes in drainage and sewerage systems.
1.9. Explain the characteristics and functions of good sand used in construction.
1.10. Understand the concept of bulking of sand and its impact on mix design.
1.11. Recognize the potential of crushed stone powder as a partial or full substitute for natural sand

2. CEMENTITIOUS MATERIALS & ADMIXTURES

2.1. Explain the chemical composition of cement and how each compound influences its properties.
2.2. Understand the basic field tests to assess the quality of cement.
2.3. Classify different types of cement (e.g., OPC, quick-setting, white, rapid hardening, low heat, high alumina, blast furnace slag, pozzolana) and explain their specific uses.
2.4. Explain the standard laboratory tests for cement as per IS 4031: fineness, standard consistency, initial and final setting times, and soundness

2.5. Understand the properties of fine and coarse aggregates used in mortar, including water absorption and grading through sieve analysis.
2.6. Differentiate between various types of mortar: lime, cement, surkhi, and blended, and identify their appropriate applications.
2.7. Identify and describe the ingredients of concrete and their roles in achieving desired properties.
2.8. Explain the significance of the water-cement ratio and the factors affecting it.
2.9. Understand the chemical properties of steel relevant to reinforced concrete structures.
2.10. Explain the workability of concrete and methods to improve it.
2.11. Describe the advantages and limitations of Ready-Mix Concrete (RMC).
2.12. Identify different types of construction chemicals including waterproofing compounds and their uses.
2.13. Identify different types of special concretes
2.14. Classify and explain the role of chemical admixtures (plasticizers, superplasticizers, accelerators, retarders, bonding agents) in modifying concrete properties.
2.15. Understand the purpose and benefits of mineral admixtures such as fly ash, GGBS, silica fume, rice husk ash, and metakaolin.
2.16. Describe various curing methods, curing compounds, and selection criteria based on construction conditions.

3. TIMBER, GLASS & ASBESTOS

3.1. Identify the characteristics of good quality timber used in construction.
3.2. Explain the importance of seasoning of timber and its effects on durability and strength.
3.3. Understand the applications and advantages of engineered wood products in building works.
3.4. Understand the types of glass (e.g., plain, laminated, tempered, frosted, wired) and their construction applications (e.g., windows, partitions, facades).
3.5. Understand the uses and applications of asbestos.

4. BUILDING COMPONENTS & PLANNING

4.1. Identify the various components of a building (e.g., foundation, plinth, walls, roof, doors, windows) and describe their functions.
4.2. Classify buildings based on occupancy and usage as per National Building Code (NBC).
4.3. Understand the principles of planning (e.g., roominess, circulation, privacy, economy) to the design of residential and public buildings.
4.4. Understand the orientation factors and criteria suited for Indian climatic conditions to ensure thermal comfort and energy efficiency.
4.5. Understand the importance and methods of ventilation and HVAC (Heating, Ventilation & Air Conditioning) systems in buildings.
4.6. Identify the causes and effects of dampness, particularly at the basement level, and suggest appropriate preventive measures.
4.7. Define safe bearing capacity (SBC) and ultimate bearing capacity of soils.
4.8. Classify and describe various types of foundations
4.9. Understand loads on foundations as per IS 875:2015 guidelines.

4.10. State Rankine's formula to determine the depth of spread footings.

5. BUILDING ELEMENTS

5.1. Identify and differentiate types of stone masonry: Ashlar, Random Rubble, and Coursed Rubble.
5.2. Understand English bond in brick masonry for various wall thicknesses.
5.3. Explain the general construction principles for both stone and brick masonry to ensure structural integrity and durability.
5.4. Identify the parts and proper positioning of doors and windows for functional and aesthetic considerations.
5.5. Classify and describe various types of doors: Panelled, Glazed, Flush, and special types such as Revolving, Collapsible, Rolling, and Sliding.
5.6. Describe types of windows including Panelled and Glazed windows and their applications in building design.
5.7. Explain the functions and types of lintels used in construction (RCC, wood, stone, steel), and determine appropriate use based on structural requirements.
5.8. Describe the functions and types of roofs (flat, pitched) and identify their components and construction techniques.
5.9. Explain the requirements of good flooring and flooring types
5.10. Define key staircase terms such as rise, tread, landing, going, handrail, newel post, and baluster.
5.11. Classify different types of staircases (straight, quarter turn, half turn, dog-legged, open well, bifurcated, spiral, circular) and identify their suitability in various building layouts.

6. SCAFFOLDING, FORMWORK & FINISHES

6.1. Explain the purpose of scaffolding in construction and identify different types of scaffolding.
6.2. Describe the component parts of tubular scaffolding and their roles in ensuring safety and stability.
6.3. Classify and explain different types of formworks used for columns, beams, and slabs.
6.4. Understand the features and advantages of aluminium shuttering (Mivan technology) in modern construction practices.
6.5. State the objectives and importance of plastering and describe various types and procedures of plastering.
6.6. Understand the purpose and types of pointing, and where they are applicable in construction.
6.7. Identify painting methods for different surfaces such as: New and old walls, Wooden surfaces, Metal surfaces
6.8. Distinguish between whitewashing, colour washing, and distempering, and explain their application for internal and external walls.
6.9. Describe termite proofing methods and understand their importance in preserving structural materials.

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2		2	2		1	3	2	1
CO2	3	2		2	2		1	3	2	2
CO3	3				2	2	2	3	2	3
CO4	3				1	2	2	3	2	2
CO5	3				2	2	2	3	2	3
Average	3	2		2	1.8	2	1.6	3	2.0	2.2

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc

COURSE CONTENT

1. BASIC CONSTRUCTION MATERIALS

Stones: Classification of rocks (physical), Characteristics of good building stones, Dressing of stones – purpose.
Bricks: Characteristics of good bricks, IS:3495-2019 – Brick testing (water absorption & compressive strength), Autoclaved Aerated Concrete blocks, Fly ash bricks.
Clay Products & Sand: Tiles: Roofing (Mangalore), floor, ceramic, vitrified, Morbonite, Characteristics of good tiles, Stoneware pipes – uses, Characteristics & functions of good sand, Bulking of sand, Crushed stone powder as sand substitute.

2. CEMENTITIOUS MATERIALS & ADMIXTURES

Cement: Chemical composition, Field tests for cement, Classification-OPC, quick setting, white, rapid hardening, low heat, high alumina, blast furnace slag, pozzolana cement, Tests as per IS Code: fineness, consistency, setting time, Compressive Strength.
Mortars: Fine & coarse aggregates – water absorption, sieve analysis-Mortar classification: lime, cement, surkhi, blended.
Plain Concrete & Reinforced concrete: Ingredients of concrete, Water-cement ratio – influencing factors, Chemical Properties of steel, Workability of concrete, Ready mix concrete – Advantages & Disadvantages, Special concretes: High strength, normal strength, Fibre reinforced concrete, FAL-G concrete, Light weight, high density, Polymer, self healing concrete, self-compacting, micro concrete, shotcrete (Special concretes discuss in brief-Definitions only).
Admixtures: Chemical – plasticizers, superplasticizers, accelerators, retarders, bonding admixtures, Water proofing chemicals, Construction chemicals, Mineral admixtures – fly ash, GGBS, silica fume, rice husk ash, metakaolin, Curing – methods, compounds, suitability.

3. TIMBER, GLASS & ASBESTOS

Timber: Characteristics of good timber, Seasoning – importance, Wood products – veneer, plywood, particle board, laminated board, straw board.
Glass & Asbestos: Asbestos – uses & applications, Glass – types & uses.

4. BUILDING COMPONENTS & PLANNING

Classification & Planning of Buildings: Components of a building and their functions, Classification of buildings (as per NBC), Principles of planning,

Orientation – factors & criteria for Indian conditions, Ventilation, HVAC, Dampness: causes, effects, and prevention at basement level.

Foundations: Bearing capacity of soils – safe & ultimate, Types of foundations: Spread footing for columns & walls, Raft foundation, Pile foundation, well foundation, Loads on foundation (as per IS 875:2015), Spread footing: depth by Rankine's formula, width, concrete bed thickness.

5. BUILDING ELEMENTS

Masonry: Stone masonry - Ashlar, Random rubble and Coursed Rubble Masonry- Brick Masonry - Bonds in brick masonry (English bond only) for various wall thicknesses - General principles to be observed in construction of stone masonry and brick masonry.

Doors, Windows & Lintels: Parts & positioning of doors/windows, Types of doors: Panelled, Glazed, Flush, Special doors: revolving, collapsible, rolling, sliding, Windows: Panelled & glazed, Lintels – functions & types: RCC, wood, stone, steel.

Roofs, Floorings & Staircases: Roofs – functions, types: flat, pitched, Floorings: components, requirements, types – concrete, stone slab (Kadapa, Shahabad), plaster, tile, mosaic, Staircases-Terms: rise, tread, landing, going, handrail, newel post, baluster, Types: straight, quarter turn, half turn, dog-legged, open well, bifurcated, spiral, circular.

6. SCAFFOLDING, FORMWORK & FINISHES

Scaffolding & Formwork: Scaffolding – purpose, types, component parts of tubular scaffolding, Formwork – types and arrangements for columns, beams, slabs, aluminium shuttering (Mivan technology).

Protective & Decorative Finishes: Plastering: purpose, types, procedure, Pointing – purpose & types, Painting: Objectives, methods for old/new walls, wood, metal surfaces, Whitewashing, colour washing, distempering (internal & external walls), **Termite Proofing:** Methods of termite proofing.

REFERENCE BOOKS

1. Engineering Materials by Rangwala, Charotar Publishing House Pvt. Ltd
2. Building Materials by S.K. Duggal, New age International Publishers.
3. Building materials by M.L Gambhir, Neha Jamwal, Mc.Graw Hill Publications
4. Building Materials by P.C Varghese, PHI Learning.
5. Building Materials by Ravi Kumar Sharma, I.K International Publishing House Pvt. Ltd.
6. Building Construction by Dr. B.C Punmia, Er. Ashok K.Jain, Dr. Arun K.Jain, Laxmi Publications.
7. Building Construction by Rangwala, Charotar Publications.
8. Building Construction by Sushil Kumar, Standard Publishers Distribution.
9. Building Construction by S.P. Arora & S.P. Bindra, Dhanpat Rai Publications.

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.5
Unit Test – II	From 4.1 to 6.9

ENGINEERING MATHEMATICS-II

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA	Credits
26CE304E	Engineering Mathematics-II	3	45	30	70	2

TIME SCHEDULE

S.No.	Unit Title	No. of periods	COs mapped
1	Applications of Definite Integrals.	15	CO1
2	Differential Equations	15	CO2
3	Probability & Statistics	15	CO3
	Total Periods	**45**	

S.No.	Chapter/Unit title	No. of Periods	Marks Allotted	No. of Short Questions	No. of Essay Questions	COs mapped
Unit – I: Applications of Definite Integrals						
1	Area of curves	4	7	1	½	CO1
2	Volumes of Solids of Revolution	3	4	0	½	CO1
3	Mean and RMS values	4	11	1	1	CO1
4	Numerical Integration	4	8	0	1	CO1
Unit – II: Differential Equations						
5	Introduction to Differential Equations	4	6	2	0	CO2
6	Solution of first order differential equations	6	14	2	1	CO2
7	Solution of second order homogeneous and non-homogeneous linear differential equations	5	14	2	1	CO2
Unit – III: Probability and Statistics						
8	Probability	5	14	2	1	CO3
9	Measures of Dispersion	6	14	2	1	CO3
10	Correlation	4	8	0	1	CO3
	Total	45	100	12	8	
			Marks	36	64	

COURSE OBJECTIVES

(i)	To apply integral techniques to solve various engineering problems.
(ii)	To solve first-order and first-degree differential equations and second-order homogeneous and non-homogeneous linear differential equations.
(iii)	To analyse data using the concepts of probability and statistical techniques.

COURSE OUTCOMES

CO1	CE304.1	Apply definite integrals in engineering applications.
CO2	CE304.2	Solve first-order and first-degree differential equations and second-order homogeneous and non-homogeneous linear differential equations.
CO3	CE304.3	Apply various probability and statistical techniques for data analysis.

LEARNING OUTCOMES

C.O.1 Apply definite integrals in engineering applications.

L.O.1.1 Find the area bounded by a curve and axes.

1.2 Determine the volumes of solids of revolution along the x-axis.

1.3 Obtain the Mean and R.M.S values of simple functions.

1.4 Solve the problems of areas using Numerical Integration.

C.O.2 Solve first-order and first- degree differential equations and second-order homogeneous and non-homogeneous linear differential equations.

L.O.2.1 Define a Differential equation, its order and degree.

2.2 Find order and degree of a given differential equation.

2.3 Form a differential equation by eliminating arbitrary constants.

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

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

2.6 Solve Differential equations of the type $(a\mathrm{D}^2+b\mathrm{D}+c)y=0,$ where $a\neq 0, b$ and c are real numbers.

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

2.8 Describe the method of solving $f(\mathrm{D})y=e^{ax}$, where $f(\mathrm{D})$ is a polynomial of second order.

C.O. 3 Apply various probability and statistical techniques for data analysis.

L.O.3.1Recall the basic probability principles.

3.2 State addition theorem of probability for two mutually exclusive and exhaustive events.

3.3 Solve simple problems on addition theorem.

3.4 Explain conditional event and conditional probability.

3.5 Solve simple problems on conditional probability.

3.6 Explain dependent, independent events and state multiplication theorem.

3.7 Solve simple problems on multiplication theorem.

3.8 Recall the measures of central tendency.

3.9 Explain the significance of measures of dispersion to determine the degree of heterogeneity of the data.

3.10 Find the measures of dispersion, Range, Mean Deviation and Standard Deviation for ungrouped data.
3.11 Explain the merits and demerits of these measures of dispersion.
3.12 Explain bivariate data.
3.13 Explain the concept of covariance and correlation between two variables.
3.14 Find Spearman's rank correlation coefficient.

CO/PO – MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	3				3	3	1
CO2	3	1	1	1				3	1	1
CO3	3	3	3	3				3	3	3
Avg.	3	2.33	2.33	2.33				3	2.33	1.66

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

ForPO5: Appropriate quiz programmes may be conducted at intervals and duration as decided by concerned faculty.
For PO6: Seminars on applications of mathematics in various engineering disciplines are to be planned and conducted
For PO7: Plan activities in such a way that students can visit the library to refer standard books on Mathematics and access the latest updates in reputed national and international journals. Additionally, encourage them to attend seminars and learn mathematical software tools.

COURSE CONTENT

1. Applications of Definite Integrals:
Area bounded by a curve and axes. Volume of Solids of Revolutions. Mean and RMS values of a function on a given interval. Numerical Integration.

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

3. Probability & Statistics:
Addition theorem of probability, conditional probability, dependent and independent events with multiplication theorem. Measures of dispersion, range, mean deviation and standard deviation of ungrouped data, merits and demerits. Bivariate data, correlation, Spearman's rank correlation coefficient.

TEXTBOOK

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

REFERENCE BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Schaum's Outlines Differential Equations, Richard Bronson & Gabriel B. Costa
3. Schaum's Outline: Introduction to Probability and Statistics, Seymour Lipschutz& John J.Schiller.
4. M.Vygodsky, Mathematical Handbook: Higher Mathematics, Mir Publishers, Moscow.

SUGGESTED E-LEARNING REFERENCES

1. https://www.khanacademy.org/
2. https://www.wolframalpha.com/
3. https://onlinecourses.nptel.ac.in/
4. http://tutorial.math.lamar.edu/

UNIT TEST SYLLABUS

Unit Test	Learning Outcomes to be Covered
Unit Test-I	From L.O 1.1 to L.O 2.5
Unit Test-II	From L.O 2.6 to L.O 3.14

CONCRETE TECHNOLOGY

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE305E	CONCRETE TECHNOLOGY	03	45	30	70	2

TIME SCHEDULE

S. No.	Chapter/Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	COs Mapped
1.	Ingredients of concrete	10	25	3	2	CO1
2.	Concrete Mixing and Placement Methods	10	25	3	2	CO2
3.	Concrete Testing and Quality Evaluation	8	14	2	1	CO3
4.	Types of concretes	7	14	2	1	CO4
5.	Concrete Mix Proportioning and Design	10	22	2	2	CO5
	TOTAL	45	100	12	8	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able to	
(i)	To enable students to understand the properties and functions of various ingredients used in concrete and the principles of concrete mix design.
(ii)	To equip students with the knowledge and skills required for proper mixing, placing, testing, and evaluating the quality of concrete in construction practices.

COURSE OUTCOMES

CO1	CE305.1	Identify and explain the role of cement, aggregates, water, and admixtures in concrete production and performance.
CO2	CE305.2	Demonstrate appropriate methods of batching, mixing, transporting, placing, compacting, and curing of concrete as per field practices.
CO3	CE305.3	Conduct workability and strength tests on fresh and hardened concrete and interpret the test results as per standard codes.
CO4	CE305.4	Classify and describe different types of concrete and their applications based on construction requirements.

CO5	CE305.5	Apply the principles of mix proportioning and carry out basic mix design for various concrete grades using IS: 10262-2019 guidelines.

LEARNING OUTCOMES

1. INGREDIENTS OF CONCRETE

1.1 Identify and describe the ingredients of concrete and their roles in achieving desired properties.
1.2 Identify different types of cement and their uses.
1.3 Explain the physical properties and storage methods of cement.
1.4 Differentiate between natural and manufactured fine aggregates.
1.5 Interpret grading requirements and their impact on workability.
1.6 List desirable properties of coarse aggregates.
1.7 Relate aggregate properties to strength and durability of concrete.
1.8 State the role of water in hydration and setting of cement.
1.9 List quality standards for mixing and curing water.
1.10 Define different types of admixtures (chemical and mineral).
1.11 Explain the purpose and effects of admixtures on concrete behavior.
1.12 Understand 'Grades' of concrete.
1.13 State the grades of concrete recommended for different types of works

2. CONCRETE MIXING AND PLACEMENT METHODS

2.1 Differentiate between volume and weight batching.
2.2 Understand the importance of accurate batching.
2.3 Describe the procedure for hand and machine mixing.
2.4 Evaluate effectiveness of each method.
2.5 Identify common concrete transport methods.
2.6 State precautions during transportation.
2.7 Explain correct methods of placing concrete.
2.8 List do's and don'ts in placing.
2.9 State the importance of compaction in concrete.
2.10 Describe types of vibrators and their use.
2.11 List various curing methods and their applications.
2.12 Understand the impact of curing on strength development.
2.13 Explain the concept of ready-mix concrete and its advantages

3. CONCRETE TESTING AND QUALITY EVALUATION

3.1 Perform slump and compaction factor tests.
3.2 Interpret results to assess workability.
3.3 Prepare and test concrete specimens.
3.4 Interpret strength test results.
3.5 Understand basic principles of NDT methods.
3.6 Identify where and why NDT is used.
3.7 Explain durability-related parameters.
3.8 State importance of low permeability in concrete.
3.9 Interpret acceptance criteria for concrete strength.
3.10 Apply criteria to judge test results.

4. TYPES OF CONCRETE

4.1 Differentiate between PCC, RCC, and PSC.
4.2 State suitable applications for each.
4.3 Understand the following special concretes
(a) Fiber Reinforced Concrete,
(b) Fal-G-Concrete,
(c) Light weight concrete,

(d) High density concrete,
(e) Polymer concrete and
(f) Self Compacting concrete.

4.4 Understand concreting under special exposure conditions like
(a) Under- water concreting,
(b) Cold weather concreting,
(c) Hot weather concreting and
(d) Concreting in high rise buildings

4.5 Explain 'Micro concrete' and 'Shotcrete'.

5. CONCRETE MIX PROPORTIONING AND DESIGN

5.0 Differentiate between nominal and design mix.
5.1 State typical ratios for nominal mixes.
5.2 List factors influencing mix design.
5.3 Explain effect of water-cement ratio.
5.4 Understand step-by-step IS method of mix design procedure.
5.5 Interpret a sample mix design sheet.

CO-PO MAPPING

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3							2	3	1
CO2	2							2	3	1
CO3	3							2	3	1
CO4	2							2	3	1
CO5	3	2						2	3	1
Average	2.6	2						2	3	1

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc.

COURSE CONTENT

1. INGREDIENTS OF CONCRETE:

Cement: Types, properties, functions, storage precautions – Fine Aggregates: Sources, grading, characteristics – Coarse Aggregates: Size, shape, surface texture, strength –Water: Quality standards, permissible limits as per IS – Admixtures: Classification and uses – plasticizers, retarders, accelerators, air entrainers, mineral admixtures (fly ash, silica fume etc). Grade of concrete - Mix proportions recommended for construction of buildings, CC roads and watertight structures

2. CONCRETE MIXING AND PLACEMENT METHODS:

Batching of materials: Volume and weight batching –Mixing: Hand and machine mixing –Transportation: Buckets, barrows, transit mixers, pumps –Placing of concrete: Procedures and precautions –Compaction methods: Hand tamping, vibrators (internal, surface) – Curing methods: Ponding, sprinkling, membrane, steam curing.

3. CONCRETE TESTING AND QUALITY EVALUATION:

Workability tests: Slump cone test, compaction factor test – Strength tests: Compressive strength test on cubes, split tensile strength test – NDT (only

concepts): Rebound hammer, Ultrasonic pulse velocity –Durability basics: Permeability, Water absorption –Acceptance criteria: As per IS:456 – 2000.

4. TYPES OF CONCRETE:

Plain Cement Concrete (PCC) –Reinforced Cement Concrete (RCC) –Prestressed Concrete –Precast Concrete – High Strength and High-Performance Concrete (concepts only) – Special concretes: fibre reinforced Concrete – Fal G-Concrete, high density Concrete, Light weight Concrete, polymer Concrete and micro-Concrete – Self Compacting Concrete-Properties – uses. Concreting under special exposure condition – cold weather Concreting – hot weather Concreting – under water concreting – Shotcrete – Concreting in high rise buildings

5. CONCRETE MIX PROPORTIONING AND DESIGN:

Nominal mix and design mix – definition and differences –Factors affecting mix design: W/C ratio, strength, workability –Mix design steps (as per IS 10262-2019 – simplified explanation) –Nominal mix ratios: M5 to M25 (1:4:8, 1:3:6, 1:2:4, etc.) – Trial mix, adjustments on site, importance of quality control.

REFERENCE BOOKS:

1) Concrete Technology by M.S. Shetty
2) Concrete Technology by A.M. Neville and J.J. Brooks
3) IS: 456-2000 – Code of Practice for Plain and Reinforced Concrete
4) IS: 10262-2019 – Recommended Guidelines for Concrete Mix Design

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.4
Unit Test – II	From 3.5 to 5.6

BUILDING SERVICES AND MAINTENANCE

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE306E	BUILDING SERVICES AND MAINTENANCE	03	45	30	70	2

TIME SCHEDULE

S. No.	Chapter/Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	COs Mapped
1.	Introduction to Building Services	3	6	2	--	CO1
2	Water Supply and Sanitary systems in Buildings	6	11	1	1	CO1
3.	Electrical Services and Lighting in Buildings	8	14	2	1	CO2
4.	Mechanical Services and HVAC Systems in Buildings	9	22	2	2	CO2
5.	Fire Safety and Building Security Systems	6	14	2	1	CO3
6.	Acoustics and Sound Insulation in buildings	5	11	1	1	CO3
7.	Maintenance and Repairs	8	22	2	2	CO4
	Total	45	100	12	8	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able to	
(i)	Understand various building services and their importance for the functioning of buildings.
(ii)	Familiarise with modern systems and technologies used in different building services.
(iii)	Gain knowledge of maintenance and repair practices for building services

COURSE OUTCOMES

CO1	CE306.1	Understand different building services, various water supply and sanitary systems in buildings.
CO2	CE306.2	Identify and explain suitable electrical, mechanical and HVAC systems for a particular requirement of buildings and describe vertical transportation systems like lifts and escalators in buildings.
CO3	CE306.3	Explain fire safety & building security measures, sound insulation and acoustics in buildings
CO4	CE306.4	Explain appropriate maintenance techniques for various building elements and services

LEARNING OUTCOMES

1. INTRODUCTION TO BUILDING SERVICES

1.1 Explain the importance of building services
1.2 State the objectives of services in buildings
1.3 List different types of building services
1.4 Select appropriate services for a particular type of building.

2. WATER SUPPLY AND SANITARY SYSTEMS IN BUILDINGS

2.1 State sources and quality of water
2.2 Explain various components of internal water supply in buildings with layout
2.3 Describe the working of storage and distribution systems
2.4 Explain basic principles to be followed in the design of water supply layout for a building
2.5 State the advantages of various pipe material used in water supply system in buildings
2.6 List various sanitary fittings and plumbing traps
2.7 Explain the principles of drainage and sewage removal
2.8 Explain One-pipe and two-pipe drainage systems in buildings
2.9 Explain the effectiveness of septic and soak pit design in rural/urban contexts
2.10 Explain the storm water management and rainwater harvesting systems in buildings

3. ELECTRICAL SERVICES AND LIGHTING IN BUILDINGS

3.1 State various electrical services used in a building
3.2 Explain basic electrical layout and safety rules
3.3 State various technical terms and symbols for different electrical installations.
3.4 State the requirements of a good electrical wiring.
3.5 List the different types of electrical wirings.
3.6 State the objectives of electrical earthing.
3.7 Explain various types of earthing systems
3.8 State the requirements of good lighting in a building.
3.9 Define the terms 1. Glare and 2. Day light factor
3.10 State the precautions to be taken to avoid glare in buildings.

4. MECHANICAL SERVICES AND HVAC SYSTEMS IN BUILDINGS

4.1 State HVAC systems
4.2 Explain various components of HVAC systems
4.3 State different types of Air conditioning systems used in a building.
4.4 Explain the hot water supply distribution using solar water heating system.

4.5 State different modes of vertical transportation systems in a building.
4.6 Explain Lift and Escalator systems with layouts.

5. FIRE SAFETY AND BUILDING SECURITY SYSTEMS

5.1 State the principles of fire protection in buildings.
5.2 State the causes of fire in buildings.
5.3 State different fire-resistant building materials to be used in building construction.
5.4 Explain Fire detection and Alarm systems
5.5 Explain Fire extinguishers and sprinklers
5.6 State the need of Emergency exits and Escape routes in a building
5.7 Explain various types of security systems in buildings.

6. ACOUSTICS AND SOUND INSULATION IN BUILDINGS

6.1 State the requirements of good acoustic system in a building
6.2 List various factors to be considered for noise control in residential and public buildings.
6.3 Explain different methods of acoustics used in a building
6.4 State the necessity of sound insulation in buildings
6.5 List various methods of sound insulation used in buildings
6.6 Explain methods of sound insulation used in buildings

7. MAINTENANCE AND REPAIRS

7.1 List common building defects and their remedies
7.2 State different types of maintenance in buildings
7.3 Explain Predictive, Routine and Emergency maintenance to be carried out for building services in a building.
7.4 Explain various maintenance activities to be done for water supply systems in buildings
7.5 State and explain common maintenance problems in drainage systems and their preventive measures in buildings
7.6 List various preventive measures in the maintenance of electrical and mechanical services in buildings
7.7 State the uses of maintenance logbooks and schedules in maintenance of building service.
7.8 Explain the role of Building Management systems (BMS)

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3				2	2		3	3	1
CO2	2			2	1	2		3	3	2
CO3	2				1	1	2	3	3	1
CO4	2			2	2	1	2	3	3	1
Average	2.25			2.00	1.50	1.50	2.00	3.00	3.00	1.25

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits. etc

COURSE CONTENT

1. INTRODUCTION TO BUILDING SERVICES

Definitions, Objectives and uses of services, Applications of services for different types of buildings, Classification of building services and selection of appropriate services for given project.

2. WATER SUPPLY AND SANITARY SYSTEMS IN BUILDINGS

Water Sources and quality of water – Layout of internal water supply in buildings – Storage and distribution systems – Design of water supply layout for buildings – Different types of pipe material – Sanitary Fittings and Plumbing traps – One-pipe and two-pipe drainage systems – Principles of Septic tank and soak pit design for a building – Storm water management and Rainwater harvesting systems in buildings.

3. ELECTRICAL SERVICES AND LIGHTING IN BUILDINGS

Electrical services in the building–Basics of electricity supply in buildings - Technical terms and symbols for various electrical installations – Basic electrical layout and safety rules – Requirements of good electrical wiring – Different types of electrical wirings – Electrical earthing – Objectives – Types of Earthing systems – Requirements of good lighting in a building – Glare and Day light factor – Precautions for getting good lighting in buildings.

4. MECHANICAL SERVICES AND HVAC SYSTEMS IN BUILDINGS

Heating, Ventilation and Airconditioning (HVAC) Systems –Types of air conditioning systems – Hot water supply using solar heating system – Vertical transportation systems in a building – Lifts and Escalators.

5. FIRE SAFETY AND BUILDING SECURITY SYSTEMS

Fire safety in buildings and its principles – Causes of fire – Fire-resistant building materials – Fire detection and Alarm systems – Fire extinguishers and sprinklers – Emergency exits and escape routes in a building – Building Security systems – CCTV – Access control –Intercoms.

6. ACOUSTICS AND SOUND INSULATION IN BUILDINGS

Acoustic systems in a building – Requirements of good acoustic system – Methods of acoustics – Sound insulation and its necessity in buildings – Methods of sound insulation

7. MAINTENANCE AND REPAIRS

Common building defects – Types of maintenance in buildings – Predictive Maintenance – Routine Maintenance – Emergency maintenance – Maintenance of water supply and drainage systems – Maintenance of electrical and mechanical services – Maintenance logbooks and schedules – Building Management Systems (BMS).

REFERENCE BOOKS:

1. Building Construction Dr. B. C. Punmia Laxmi Publications (P) Ltd., New Delhi.
2. Building Construction P. C. Varghese PHI Learning (P) Ltd., New Delhi.
3. “Building Maintenance and Services” S.M. Patil

4. Building repair and Maintenance Management P. S. Gahlot CBS Publishers & Distribution(P) Ltd.
5. A textbook on Building Services R. Udaykumar Eswar Press, Chennai
6. Croome,.D.J.,.&.Roberts,. B.M.,"Air conditioning And Ventilation of Buildings", Pe by atheesh Gopirgamon Press, Oxford, 1981.
7. National Building Code of India - 2005 Bureau of Indian Standards, BIS, New Delhi

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 4.3
Unit Test – II	From 4.4 to 7.8

GREEN BUILDING TECHNOLOGIES

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Credits	Marks for Formative Assessment	Marks for Summative Assessment
26CE307A	GREEN BUILDING TECHNOLOGY	02	30	-	-	-

TIME SCHEDULE

S. No.	Chapter/Unit Title	No. of Periods	COs Mapped
1.	Introduction to Green Buildings	4	CO1
2.	Energy Sources & Carbon Emissions	4	CO2
3.	Green Building Materials & Planning	8	CO3
4	Design of Green Buildings	8	CO4
5	Construction and Maintenance of Green buildings	6	CO5
	TOTAL	30	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able to	
(i)	To provide an understanding of the concept, necessity, and fundamental principles of green buildings.
(ii)	To familiarize students with sustainable energy sources, eco-friendly materials, and energy-efficient design and construction techniques in green buildings.
(iii)	To familiarize students green building rating systems, environmental impacts, and explore innovations in sustainable construction.

COURSE OUTCOMES

Upon completion of the course the student shall be able to		
CO1	CE307.1	Define the meaning, features, and importance of green buildings and explain their role in addressing global environmental challenges.
CO2	CE307.2	Identify and compare renewable and non-renewable energy sources and explain the use of solar energy and HVAC systems in buildings.
CO3	CE307.3	Select appropriate green materials and recommend planning strategies that enhance sustainability and energy efficiency in buildings.
CO4	CE307.4	Understand basic design principles of sustainable buildings including site planning, energy conservation, indoor environmental quality, and life cycle assessment.
CO5	CE307.5	Understand the construction and maintenance practices of green buildings and compare them with conventional systems using case studies.

LEARNING OUTCOMES

1. INTRODUCTION TO GREEN BUILDINGS

1.1 Define the concept and explain the need for green buildings in the context of sustainable development.
1.2 List and describe the basic features and principles that characterize a green building.
1.3 Identify and differentiate among major green building rating systems such as LEED, IGBC, and GRIHA.
1.4 Explain the environmental, economic, and health benefits associated with green buildings.
1.5 Discuss the merits and limitations of adopting green building technologies.
1.6 Recognize the contribution of buildings to global warming and the need for sustainable practices to mitigate climate impact.

2. ENERGY SOURCES & CARBON EMISSIONS

2.1 Differentiate between renewable and non-renewable energy sources with examples like solar, wind, and coal.
2.2 Explain the methods of utilizing solar energy in buildings, including active and passive solar heating and cooling concepts.
2.3 Identify the major sources of carbon emissions and suggest basic control measures.
2.4 Describe the concepts of carbon footprint, carbon credit, and their role in improving air quality.
2.5 Outline the basic working and significance of HVAC (Heating, Ventilation, and Air Conditioning) systems in energy-efficient buildings.

3. GREEN BUILDING MATERIALS & PLANNING

3.1 Identify and classify various renewable and recyclable materials used in green buildings, with relevant examples.
3.2 Describe energy-efficient and low-pollution construction materials such as green cement and smart materials.
3.3 Explain the advantages of using natural and locally available materials in sustainable construction.
3.4 Explain basic green planning concepts related to energy saving, waste management, and water reuse in building design.
3.5 Introduce simple eco-friendly building systems such as solar lighting, natural ventilation, and green plumbing solutions.

4. DESIGN OF GREEN BUILDINGS

4.1 Explain the concept of sustainable site selection and its importance in green building design.
4.2 Understand the process and significance of Life Cycle Assessment (LCA) in evaluating building sustainability.
4.3 State the principles of sustainable development to the planning and design of buildings.
4.4 Assess key design considerations such as energy and water usage, system reliability, indoor air quality, noise control, occupant comfort, and cost efficiency.
4.5 Identify and summarize recent advanced technologies and innovations used in green building design.

5. CONSTRUCTION AND MAINTENANCE OF GREEN BUILDINGS

5.1 Describe various energy-efficient construction practices used in green building projects.

5.2 Explain the role of thermal insulation and natural lighting in improving building energy performance.
5.3 List basic maintenance practices for ensuring the sustainability of green buildings.
5.4 Compare the cost implications of green buildings versus conventional buildings.
5.5 Summarize key aspects of green project management and analyse simple case studies of successful green building implementations.

CO-PO MAPPING

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3				3	1	2	3	2	2
CO2	3		2	1	3	1	2	3	2	2
CO3	3		2		3	2	2	3	2	2
CO4	3		2	1	3	2	2	3	2	2
CO5	3		2	1	3	2	2	3	2	2
Average	3		2	2	3	1.6	2	3	2	2

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc

COURSE CONTENT

1. INTRODUCTION TO GREEN BUILDINGS

Meaning and need for green buildings, Basic features of green buildings, Green building rating systems (LEED, IGBC, GRIHA – brief overview), Benefits: environmental, economic, and health, Merits and Demerits of green buildings, Role of buildings in global warming (basic idea), Fundamental principles of green buildings.

2. ENERGY SOURCES & CARBON EMISSIONS

Renewable & non-renewable energy (solar, wind, coal – basic info), Solar energy utilization in buildings, Active-passive concepts of solar heating and cooling, Carbon emissions: sources and control, Simple concept of carbon footprint, carbon credit and air quality, HVAC concept.

3. GREEN BUILDING MATERIALS & PLANNING

Renewable and recyclable materials (with examples), Energy-efficient and low-pollution materials (green cement, smart materials – basics), Use of natural and local materials, Simple green planning ideas: energy saving, waste and water reuse, Introduction to eco-friendly building systems (solar light, ventilation, plumbing)

4. DESIGN OF GREEN BUILDINGS

Sustainable sites, Life cycle assessment, Principles of sustainable development in Building Design, Considerations of energy consumption, water use, and system reliability, indoor air quality, noise level, comfort, cost efficiency in building design-Advanced Green building technologies and innovations.

5. CONSTRUCTION AND MAINTENANCE

Energy-efficient construction practices, Thermal insulation and natural lighting methods, Green building maintenance – simple practices, Cost comparison: green vs conventional buildings (overview), Brief on green project management, Simple case studies of green buildings (example projects)

REFERENCE BOOKS:

1. Alternative Building Materials and Technologies – By K S Jagadeesh, B V Venkata Rama Reddy & K S Nanjunda Rao – New Age International Publishers.
2. Integrated Life Cycle Design of Structures – By AskoSarja – SPON Press
3. Non-conventional Energy Resources – By D S Chauhan and S K Sreevasthava – New Age International Publishers
4. Green Buildings (McGraw hill publication): by Gevorkian
5. Emerald Architecture: case studies in green buildings, The Magazine of Sustainable Design 6. Understanding Green Building Guidelines: For Students and Young Professionals, Traci Rose Rider, W. W. Norton & Company Publisher.
6. Understanding Green Building Materials, Traci Rose Rider, W. W. Norton & Company Publisher.

CIVIL ENGINEERING DRAWING-I INTEGRATED WITH CAD

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE308D	CIVIL ENGINEERING DRAWING-I INTEGRATED WITH CAD	06	90	40	60	2

TIME SCHEDULE

S. No.	Chapter/Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	COs Mapped
1	Introduction	6	4	1	-	CO1
2	Residential Buildings	30	29	1	1	CO1
3	Public Buildings	14	19	1	1	CO2
4	Working drawings	10	4	1	-	CO3
5	Building Drawings with Auto CAD	30	4	1	-	CO4
	Total	90	60	5	2	

ASSESSMENT

Formative Assessment: 40 Marks

- 20 Marks: Based on the sheets submitted by the students.
- 20 Marks: Awarded after conducting unit test on CAD Drawings.

Summative Assessment: 60 Marks

(Summative assessment to be done by External evaluation)

- Part–A: FIVE questions of 4 marks each (5 x 4 = 20 Marks)
  (One theory question from Chapter 5 on Auto CAD Commands)
- Part–B: One question of 25 marks from Chapter 2 (Residential Buildings) & One question of 15marks from the chapter-3 (Public Buildings) (25 + 15 =40 Marks)

COURSE OBJECTIVES

Upon completion of the Course, the student shall be able to	
(i)	Apply the standard practices in building drawing, understand setbacks, orientation of buildings and Vaastu Shastra.
(ii)	Prepare drawings of different components of building, site plans, single storeyed buildings, line drawings of public buildings with fire safety, working drawings manually.
(iii)	Prepare drawings of different components of building, site plans, single storeyed buildings, line drawings of public buildings by using CAD.

COURSE OUTCOMES

CO1	CE308.1	Draw different components of buildings and drawing site plans as per local bye laws, orientation of buildings and Vaastu Shastra.
CO2	CE308.2	Draw plan, elevation and section of residential buildings, framed structures from given line diagram and specifications.
CO3	CE308.3	Draw the line diagrams of Hospitals, Hostels, Schools for the given requirements with fire safety and provision for Physically disabled & aged people, lift and working drawings for foundation marking & electrical layout.
CO4	CE308.4	Draw the drawings of different components of building, site plans, single storeyed buildings & line drawings of public buildings by using CAD.

LEARNING OUTCOMES

1. INTRODUCTION

1.1 Sketch the conventional signs of Civil Engineering materials, Plumbing and Electrical fixtures.
1.2 Draw the cross section of load bearing wall and name all components below and above ground level.
1.3 Draw the cross section of an isolated column footing of a framed structure
1.4 Draw the plan of one Brick wall and 1½ brick wall meeting at corner showing alternative courses of header and stretchers in English bond.
1.5 Draw the following views of a fully panelled door and label the parts1. Elevation and 2. Sectional plan
1.6 Draw the following views of fully panelled window and glazed window and label the parts.1. Elevation and 2. Sectional plan
1.7 Draw the following views of flushed door and label the parts
1. Elevation and
2. Sectional plan

1.8 Draw the elevation of the following trusses and label the parts with the given data (details of joints not required)1. King post truss and 2. Queen post truss

2. RESIDENTIAL BUILDINGS

2.1 Draw the following views of single storeyed load bearing type residential building from the given line diagram and set of specifications for a) One room with veranda b) one-bedroom house c) two-bedroom house
1. Plan 2. Section and 3. Elevation

2.2 Draw the following views of single storied framed structure type residential building from the given line diagram and set of specifications for a) One-bedroom house b)Two-bedroom house
1. Plan, 2. Section and 3. Elevation

2.3 Draw the site plan of a residential building as per local byelaws and NBC (National Building Code)
2.4 Draw the following views of a dog legged staircase with given specifications.
1. Plan and 2. Section

2.5 Draw the following views of two- storied residential building (framed Structure) from the given the line diagram and set of specifications.
1. Plans of first and second floors and 2. Elevation

2.6 Understand the principles of Vaastu with Scientific approach in planning of a residential building.

3. PUBLIC BUILDINGS

3.1 Draw the plan of Rural hospital of 10 beds capacity
3.2 Draw the plan of Hostel building for 50 students' capacity
3.3 Draw the plan of Primary school building for 250 to 300 students' capacity
3.4 Draw the plan and sectional elevation of lift provision in high raised buildings
3.5 Understand the provisions of Fire Safety in a building
3.6 Understand the provisions to be made for Physically challenged and aged people in a building.

4. WORKING DRAWINGS

4.1 Prepare a working drawing for the purpose of marking the width of foundation for the given plan of a building
4.2 Calculate the following for the given plan of a building
   1. Plinth area,
   2. Carpet area and
   3. Floor area ratio/ Floor space Index.
4.3 Prepare a working drawing for electrical layout for a given residential building (Single storeyed two-bedroom building only).
4.4 Prepare a working drawing for plan of a Lift Shaft

5. BUILDING DRAWINGS WITH AUTO CAD

5.1 Learn 2D and 3D AutoCAD Commands
5.2 Practice drawing Plan, Elevation, section and site plan of one roomed building.
5.2 Practice drawing Plan, Elevation, section and site plan of 2BHKbuilding.
5.3 Practice drawing Plan of a primary school building.
5.4 Practice drawing Plan of a Rural Hospital.
5.5 Draw 3D view of wall foundation and isolated column footing

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	1	2				3	3	2
CO2	2	2	1	2				3	3	2
CO3	2	2	2	2				3	3	3
CO4	2	2	1	2				3	3	2
Average	2.0	2.0	1.25	2.0				3.0	3.0	2.25

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc

COURSE CONTENT

1. INTRODUCTION

1.1 Conventional signs for materials like bricks, stone, concrete, wood, glass, earth, steel and electrical fixtures like ceiling fan, bulb, main switch, bell push, buzzer, A.C motor, and water supply and sanitary fixtures like tap, wash basin, sink, W.C pan (Indian and European type), shower, flush tank, doors & window types
1.2 Cross section of a load bearing wall showing all the components below and above the ground level.
1.3 Cross section of an isolated column footing in a framed structure.

1.4 Plan of one brick wall and 1½ brick wall meeting at a corner showing odd and even courses in English bond.
1.5 Plan and Cross section of a Fully panelled door showing all the component parts
1.6 Plan and Cross section of a Fully panelled window and glazed window showing all the component parts
1.7 Plan and cross section of a flushed door showing all the component parts
1.8 Elevation of King post and Queen post trusses with the given data (details of joints not required)

2. RESIDENTIAL BUILDINGS

2.1 Setbacks and orientation principles for planning residential buildings as per local bye laws and NBC.
2.2 Single storied two-bedroom load bearing residential building with site plan
2.3 Single storied framed structure two-bedroom residential building
2.4 Two-storied residential building (framed structure type)
2.5 Dog legged staircase
2.6 Principles of Vaastu with Scientific approach

3. PUBLIC AND INDUSTRIAL BUILDINGS

Draw the line diagrams only showing the functional requirements of
3.1 Rural hospital of 10 beds capacity
3.2 Hostel for 50 students
3.3 Primary school of 250 to 300 students
3.4 Provision of lift in a raised building
3.5 Provisions of fire safety in a building
3.6 Provisions to be made for Physically challenged and aged people in a building

4. WORKING DRAWINGS

4.1 Working drawing for the purpose of marking from the given plan and width of foundation.
4.2 Calculate the following for the given plan of a building
1. Plinth area,
2. Carpet area and
3. Floor area ratio/ Floor space Index.
4.3 Working drawings for electrical layout for a given residential building (Single storeyed two bedroom building only)
4.4 Prepare a working drawing for plan of a Lift Shaft

5. BUILDING DRAWINGS WITH AUTO CAD

5.3 Learn 2D and 3D AutoCAD Commands
5.4 Plan, Elevation, section and site plan of 2BHK building introducing layers.
5.5 Plan of Primary school building.
5.6 Plan of Rural Hospital.
5.7 3D view of wall foundation and Isolated Column Footing

REFERENCE BOOKS:

1. Civil Engineering Drawing by Chakraborthy, UBS Publications.
2. Civil Engineering Drawing & House Planning by B.P Verma, Khanna Publishers.
3. Building Planning & Drawing by Dr.N.Kumara swamy, A.Kameswararao, Charotar Publishing House Pvt.Ltd.
4. Building Planning & Drawing by S.S Bhavikatti, M.V Chitawadagi, I.K International publishing house Pvt.Ltd.
5. Drafting and Design (Engineering Drawing Using Manual and CAD Techniques), Kicklighter & Brown – Goodheart-Willcox Publisher.

Table specifying the scope of the Syllabus to be covered for Unit Tests

Unit Tests	Learning Outcomes to Be Covered
Unit Test - 1	**1.1 TO 3.3**
Unit Tests - 2	**3.4 TO 5.5**

SURVEYING THEORY & PRACTICE – II

(Practicum-Practical)

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE309L	SURVEYING THEORY & PRACTICE-II	06	90	40	60	2

TIME SCHEDULE

S. No.	Major Topics	No. of Periods	COs Mapped
1.	Theodolite Survey	36	CO1
2.	Trigonometric Levelling	21	CO2
3.	Tacheometry	15	CO3
4.	Curves	18	CO4
	Total	**90**	
5.	A Survey camp, immediately after completion of all exercises, shall be conducted for 4 days during 6 AM to 12 noon & 2PM to 5 PM on each day followed by one day break and 2 days of plotting from 9AM to 5 PM, with one hour lunch break. (25% of total sessional marks shall be allocated to this activity. The skills learnt during class exercises during I year & III semester shall be demonstrated in a simulated field like situation and shall be assessed appropriately)	4 days (Additional instructional duration & NOT to be included in the above 90 periods)	CO1, CO2, CO3,CO4

COURSE OBJECTIVES

Upon completion of the Course, the student shall be able to	
(i)	To impart theoretical knowledge and practical skills related to theodolite surveying, enabling students to understand the instrument components, measurement techniques, traversing procedures, and traverse computations, essential for accurate land surveying and fieldwork.
(ii)	To develop an understanding of the principles and applications of trigonometric levelling for determining elevations and distances of objects under various field conditions.
(iii)	To provide students with knowledge of tacheometric principles and methods, enabling them to determine horizontal distances and elevations using stadia tacheometry and tacheometric constants.

(iv)	To enable students to understand the geometry and elements of horizontal curves and develop skills in setting out simple circular curves using chain, tape, and theodolite methods.

COURSE OUTCOMES

CO1	CE309.1	Students will be able to operate a transit theodolite, measure horizontal and vertical angles, conduct theodolite traversing, and perform traverse computations including latitudes, departures, closing error, and area calculation.
CO2	CE309.2	Students will be able to calculate horizontal and vertical distances of objects with accessible or inaccessible bases using trigonometric levelling methods in same or different vertical planes.
CO3	CE309.3	Students will be able to determine tacheometric constants and use stadia tacheometry to compute horizontal distances and elevations of staff stations in the field.
CO4	CE309.4	Students will be able to calculate elements of simple circular curves and set them out in the field using chain and tape as well as the theodolite method.

LEARNING OUTCOMES

1. THEODOLITE SURVEYING

1.1 Identify and describe the component parts and fundamental lines of a transit theodolite.
1.2 Understand and explain technical terms used in theodolite surveying such as face left/right, transiting, and swinging.
1.3 Perform temporary adjustments of the theodolite accurately.
1.4 Measure horizontal angles using repetition and reiteration methods.
1.5 Measure vertical angles and interpret the readings.
1.6 Record and book field observations correctly in a field book.
1.7 Determine magnetic bearings, deflection angles, and direct angles.
1.8 Apply methods of extending a straight-line using theodolite: single/double transiting and fore sighting.
1.9 Identify and minimize errors in theodolite work.
1.10 Execute theodolite traversing using included angle, deflection angle and magnetic bearing methods.
1.11 Perform checks for closed and open traverses.
1.12 List the omitted measurements of a closed traverse and calculate the omitted measurements when Length and bearing of one side only are omitted.
1.13 Compute latitude and departure, determine closing error, and calculate consecutive and independent coordinates.
1.14 Determine the area of a closed traverse.

2. TRIGONOMETRIC LEVELLING

2.1 Determine the Horizontal and Vertical Distance of an object whose base is accessible.
2.2 Determine the Horizontal and Vertical Distance of an object whose base is inaccessible and the two instrument stations and the object in the same vertical plane.
2.3 Determine the Horizontal and Vertical Distance of an object whose base is inaccessible and the two instrument stations and the object are not in the same vertical plane

3. TACHEOMETRY

3.1 Determine the Tacheometric constants 'K' and 'C'.
3.2 Determine Horizontal Distance and Elevation by principle of stadia Tacheometry.

4. CURVES

4.1 Sets out Simple Curve using Chain and Tape.
4.2 Sets out Simple Curve using One Theodolite.

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	3	1	3		3	3	3
CO2	3	2	2	3	1	3		3	3	3
CO3	3	2	2	3	1	3		3	3	3
CO4	3	2	2	3	1	3		3	3	3
Average	3	2	2	3	1	3		3	3	3

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc

COURSE CONTENT

1. THEODOLITE SURVEYING

THEORY:

Component parts of a transit theodolite and their functions – Definitions of technical terms – Station, face left, face right, swinging the telescope, transiting - Fundamental lines of a transit theodolite – Temporary adjustments of a transit theodolite - Measurement of horizontal angles by repetition and reiteration method - Measurement of vertical angles - Booking readings - Measurement of magnetic bearings, deflection angles, direct angles – Extending a straight line – by single transiting, double transiting and fore sighting methods -Errors in theodolite work - Theodolite Traversing - Traversing with theodolite by included angles method, deflection angles method and magnetic bearing method - Checks for closed and open traverse - Traverse computations – Latitude and departure – closing error – omitted measurements in a closed traverse, consecutive and independent coordinates - area of closed traverse.

PRACTICE:

1.1 Identification of the component parts of a theodolite
1.2 Performing temporary adjustment of theodolite.
1.3 Measurement of horizontal angle by repetition method and record the observations in the field book
1.4 Measurement of horizontal angles by reiteration method and record the observations in the field book
1.5 Measurement of Vertical angles and record the observations in the field book
1.6 Measurement of the horizontal distance between two inaccessible points using theodolite
1.7 Measurement of bearing of a survey line
1.8 Conducting (i) Theodolite traversing (closed) (ii) Compute latitudes and departures and (iii) Calculate the area of traverse.

2. TRIGONOMETRIC LEVELLING

THEORY:

Principle and necessity of Trigonometric levelling - Elevations and distances of objects whose base is accessible or inaccessible, with instrument station and object in the same vertical plane or in different vertical planes.

PRACTICE:

2.1 Determination of the Horizontal and Vertical Distance of an object whose base is accessible.

2.2 Determination of the Horizontal and Vertical Distance of an object whose base is inaccessible and the two instrument stations and the object in the same vertical plane.

2.3 Determination of the Horizontal and Vertical Distance of an object whose base is inaccessible and the two instrument stations and the object are not in the same vertical plane.

3. TACHEOMETRY

THEORY:

Tacheometry – principle – uses – types – stadia and tangential tacheometry -Stadia Tacheometry with staff held vertical and line of collimation horizontal or inclined – elevations and distances of staff stations – Determination of Tacheometric constants - Tachometric tables – problems.

PRACTICE:

3.1 Determination of Tacheometric constants.

3.2 Determination of Horizontal distance and elevation by Stadia Tacheometry.

4. CURVES

THEORY:

Curves – types of horizontal curves – simple, compound and reverse curves – degree of curve – formulae for degree of curve using 20m / 30m chain – elements of simple circular curve – Calculation of elements of simple circular curve -Method of curve setting – chain and tape methods – offsets from long chord method, successive bisection of arcs method, off sets from tangent (radial and Perpendicular offsets) method and off sets from chords produced method.

PRACTICE:

4.1 Setting out a simple curve by chain and tape method.

4.2 Setting out a simple curve by one Theodolite

REFERENCE BOOKS:

1. Surveying Vol.I & Vol.II by B.C Punmia, Ashok Jain & Arun Jain, Laxmi publications
2. Surveying Vol.I & Vol.II by Dr. K.R. Arora, Rajsons Publications Pvt.Ltd
3. Surveying Vol.I & Vol.II by T. P. Kanetkar and S.V. Kulakarni, Pune Vidyarthi GrihaPrakashan
4. Surveying Vol.I & Vol.II by S.S Bhavikatti, I.K International Publishing House.
5. Surveying Vol.I & Vol.II by S. K. Duggal, M. C. Graw Hill Publications.

Table specifying the scope of the Syllabus to be covered for Unit Tests

Unit Tests	Learning Outcomes to Be Covered
Unit Test - 1	**1.1 TO 2.2**
Unit Tests - 2	**2.3 TO 4.2**

MATERIAL TESTING & HYDRAULICS PRACTICE

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE310L	MATERIAL TESTING & HYDRAULICS PRACTICE	06	90	40	60	2

TIME SCHEDULE

S. No.	Topics	No. of periods	COs Mapped
1	Tests on bricks& cement	15	CO1
2	Tests on Aggregates& soils	27	CO2
3	Tests on Concrete & metals	18	CO3
4	Determination of Hydraulic Coefficients / factors / constants / verification of principles / laws	30	CO4 & CO5
Total		90	

COURSE OBJECTIVES:

Upon completion of the course, the student shall be able	
(i)	Familiarize with the knowledge of different materials, tools used in Material Testing Lab and hydraulics lab.
(ii)	Use various basic implements used in testing of various Civil Engineering construction materials.
(iii)	Critically observe/examine and measure the discharges through flow measuring devices.
(iv)	Reinforce theoretical concepts by conducting relevant experiments/exercises.

COURSE OUTCOMES

CO1	CE310.1	Determine water absorption of bricks, compressive strength of bricks, fineness of cement, setting times of cement and compressive strength of cement
CO2	CE310.2	Determine Bulking of sand ,Bulk density and percentage of voids in fine and coarse aggregate, Sieve analysis of fine and coarse aggregate ,Impact value, Flakiness index and Elongation index of coarse aggregate, Atterberg Limits, Field Density by Sand Replacement method and Proctors compaction test of soil.
CO3	CE310.3	Perform the Workability test of concrete by Slump Cone Test, Compaction factor test and determines the compressive strength of cement concrete cubes , Rebound hammer test Ultrasonic Tests on concrete and tension test on mild steel rod and deflection test on steel and wooden beam to know the young's modulus value.

CO4	CE310.4	Conduct Experiment to determine Hydraulic Coefficients of Orifices, Mouthpieces & notches.
CO5	CE310.5	Conduct a test on verification of Bernoulli's theorem (i) to observe head variation (ii) To determine discharges by varying the head

LEARNING OUTCOMES

MATERIAL TESTING LAB

1. TESTS ON BRICKS AND CEMENT

(A) WATER ABSORPTION TEST ON BRICKS

- Explain the importance of determining water absorption in bricks and its effect on durability, strength, and performance in construction.
- Identify and apply relevant standards (e.g., IS 3495 Part 2) governing the procedure for the water absorption test.
- Accurately perform all steps in the test procedure, including drying, weighing, immersion in water, and final weighing.

(B) CRUSHING STRENGTH TEST ON BRICKS

- Explain why compressive strength is a critical property for bricks and how it affects the structural performance and load-bearing capacity of masonry.
- Demonstrate proper preparation of brick specimens, including capping, surface levelling, and placement in the compression testing machine.
- Operate a compression testing machine safely and accurately to apply load until the brick fails.
- Analyse the test results and determine if the bricks meet the strength requirements for various grades (e.g., 3.5, 5.0, 7.5, 10.0 N/mm^2).

(C) FINENESS TEST ON CEMENT

- Explain the importance of fineness in cement and how it affects the rate of hydration, strength development, workability, and durability of concrete.
- Identify and apply the appropriate standards for determining the fineness of cement, such as IS 4031 (Part 1) using sieve analysis
- Accurately perform the test using a 90-micron IS sieve, including sample preparation, sieving, and weighing the residue.

(D) NORMAL CONSISTENCY TEST ON CEMENT

- Define normal consistency and explain its role in determining the amount of water required to prepare cement paste for further standard tests (e.g., setting time, soundness, compressive strength).
- Identify and follow relevant testing standards (e.g., IS 4031 Part 4) and guidelines for determining the normal consistency using the Vicat apparatus.
- Demonstrate proper preparation of cement paste, correct operation of the Vicat apparatus, and accurate observation of penetration depth (usually 5–7 mm from the bottom of the Vicat mould).
- Accurately determine and report the percentage of water by weight of cement required to achieve standard consistency.

(E) SETTING TIME TEST ON CEMENT

- Define initial and final setting time of cement and explain their significance in construction practices such as transportation, placing, and finishing of concrete.

- Identify and follow relevant standards (e.g., IS 4031 Part 5 or ASTM C191) for determining the setting time using the Vicat apparatus.
- Demonstrate the correct procedure to determine both initial and final setting time, including paste preparation, penetration observations, and time recording.
- Analyse test outcomes and compare them with standard values (e.g., OPC should have initial setting time ≥ 30 minutes and final setting time ≤ 600 minutes) to assess cement quality.

(F) COMPRESSIVE STRENGTH OF CEMENT

- Explain why compressive strength is a key performance indicator for cement and its role in the durability and load-bearing capacity of concrete and mortar.
- Recognize and apply testing standards such as IS 4031 (Part 6) or ASTM C109 for determining the compressive strength of cement.
- Demonstrate correct preparation of standard mortar cubes (1:3 cement-sand ratio), proper mixing, moulding, curing, and testing as per standard guidelines.
- Compare the obtained results with standard strength values for different curing ages (typically 3, 7, and 28 days) to assess the quality of cement.

2. TESTS ON AGGREGATES AND SOILS

(A) TEST ON BULKING OF SAND

- Explain what bulking of sand is and why it occurs due to moisture content forming a film around sand particles, leading to an apparent increase in volume.
- Describe the standard procedure (as per IS 2386 Part 3) for determining the percentage of bulking using a simple volume-measurement method.
- Demonstrate the ability to conduct the test using a graduated cylinder, sand sample, and water, and accurately observe and record volume changes.

(B) TEST ON DETERMINATION OF BULK DENSITY AND PERCENTAGE OF VOIDS IN COARSE AND FINE AGGREGATE

- Define bulk density, compacted bulk density, and percentage of voids and explain their relevance in concrete mix design and material handling.
- Apply standard testing procedures as per IS 2386 (Part 3) for determining the bulk density and voids in both fine and coarse aggregates.
- Perform the test method correctly using a cylindrical container, standard tamping, and weighing techniques for both loose and compacted conditions.

(C) SIEVE ANALYSIS OF COARSE AND FINE AGGREGATES

- Explain the significance of sieve analysis in determining the particle size distribution of coarse and fine aggregates.
- Identify and apply the correct standards (e.g., IS 2386 Part 1, ASTM C136) for conducting sieve analysis of aggregates.
- Demonstrate the correct method for stacking sieves, weighing aggregates, sieving (manual or mechanical), and cleaning sieves**.**

(D) IMPACT VALUE OF COARSE AGGREGATE

- Understand and explain the concept of the Impact Value and its significance in evaluating the Impact Strength of coarse aggregates.
- Recognize the apparatus used for the Impact Value test

- Accurately compute the Impact Value from test data using appropriate formulas.

(E) FLAKINESS INDEX OF COARSE AGGREGATE

- Understand and explain the concept of the Flakiness Index and its significance in evaluating the shape characteristics of coarse aggregates.
- Recognize the apparatus used for the Flakiness Index test (e.g., thickness gauge) and reference relevant standards (e.g., IS: 2386 Part I – 1963).
- Accurately compute the Flakiness Index from test data using appropriate formulas.

(F) ELONGATION INDEX OF COARSE AGGREGATE

- Understand and explain the concept of Elongation Index and its role in evaluating aggregate shape properties.
- Identify and correctly use the elongation gauge and refer to the relevant testing standard (e.g., IS: 2386 Part I – 1963).
- Accurately calculate the Elongation Index from experimental data using appropriate formulas.

(G) ATTERBERG LIMITS OF SOIL

- Study the significance of Atterberg limits of soil in civil engineering activities
- Study Atterberg limits of soils
- Use apparatus required for conducting tests to determine Atterberg limits of soil
- Explain the procedure for conducting (a) Liquid Limit (b) Plastic Limit (c) Shrinkage Limit tests
- Perform Limit Test, Plastic Limit Test & Shrinkage Limit Test over given sample of soil
- Compare the observations of tests conducted on different types of soils
- Calculate the Plasticity Index value of a given soil sample from the observations of test
- Classify given soil sample based on sieve analysis and Atterberg limits

(H) FIELD DENSITY TEST OF SOIL

- Explain the objective and importance of determining in-situ soil density for evaluating compaction quality and field performance.
- Recognize different field density test methods (e.g., Sand Replacement Method) and refer to relevant standards (e.g., IS: 2720 Part 28 & 29).
- Identify and use tools such as sand pouring cylinder, core cutter, balance, tray, and calibration equipment accurately.
- Compute bulk density, dry density, and degree of compaction using field measurements and moisture content data.

(I) STANDARD PROCTOR COMPACTION TEST

- Explain the objective and importance of the Proctor Compaction Test in determining the optimum moisture content (OMC) and maximum dry density (MDD) of soil.
- Recognize the equipment used (e.g., compaction mould, rammer, balance) and refer to relevant standards (e.g., IS: 2720 Part 7 and 8 or ASTM D698/D1557).
- Compute bulk density, dry density, and moisture content from test data, and determine OMC and MDD by plotting the compaction curve.

3. TESTS ON CONCRETE AND METALS

(A) SLUMP CONE TEST

- Understanding Concrete Workability
- Determining the Consistency of Concrete
- Assessing Mix Proportions
- Standardization of Concrete Mixtures

(B) COMPACTION FACTOR TEST

- Understanding Concrete Workability in Terms of Compaction
- Relationship Between Compaction and Concrete Strength
- Measuring the Degree of Compaction of Concrete
- Evaluation of Concrete Placement and Handling

(C) CASTING OF CEMENT CONCRETE CUBES

- Understanding the Importance of Concrete Strength Testing
- understanding the significance of properly filling the moulds and compacting the concrete to avoid air voids or segregation, which could affect the cube's strength.
- Calculating the compressive strength of concrete cubes based on the applied load and the cross-sectional area of the cube, which is fundamental for structural analysis and design.

(D) TESTING OF CEMENT CONCRETE CUBES FOR COMPRESSION

- Understanding the significance of compressive strength of cubes is directly related to the structural performance of concrete. Concrete structures, including buildings, bridges, and pavements, rely on adequate compressive strength to resist loads.
- Explain classification of concrete based on compressive strength (e.g., M20, M30, M40) and how these classifications affect material selection, mix design, and construction practices.
- Calculating compressive strength by dividing the maximum load sustained by the cube (in Newtons) by the cross-sectional area of the cube (in mm^2).

(E) NON-DESTRUCTIVE TESTS ON CONCRETE

- Understanding NDT techniques help determine the quality of concrete without compromising the structure, which is especially useful in critical infrastructure like bridges, dams, and high-rise buildings.
- Measuring the surface hardness of concrete by using Rebound hammer which correlates with compressive strength. This method is quick and widely used for field testing**.**

(F) TENSION TEST ON MILD STEEL ROD

- Understanding the Mechanical Properties of Mild Steel
- Determining the Stress-Strain Relationship
- Understanding Material Strength and Ductility
- Evaluating the Behaviour of Steel Under Tensile Load

(G) DEFLECTION TEST ON BEAM

- Understanding Beam Deflection and Its Importance
- Understanding the Relationship Between Load and Deflection
- Practical Application of Deflection Tests in Design

HYDRAULICS LAB PRACTICE

4. DETERMINATION OF HYDRAULIC COEFFICIENTS/ FACTORS / CONSTANTS / VERIFICATION OF PRINCIPLES / LAWS

(A) DETERMINATION OF COEFFICIENT OF DISCHARGE OF A SMALL ORIFICE BY CONSTANT HEAD METHOD.

- Understanding the Principle of Constant Head Flow
- Determining the Coefficient of Discharge (Cd)
- Impact of Flow Conditions on Cd
- Measurement of Head Losses

(B) DETERMINATION OF COEFFICIENT OF DISCHARGE OF A SMALL ORIFICE BY VARIABLE HEAD METHOD.

- Understand the concept of discharge through an orifice
- Apply Bernoulli's principle and continuity equation
- Perform an experiment using the variable head method
- Calculate the coefficient of discharge (Cd)

(C) DETERMINATION OF THE HYDRAULIC COEFFICIENTS OF AN ORIFICE.

- State the Relationship between hydraulic coefficients.
- Conduct test and record observations.
- Draw Conclusions

(D) DETERMINATION OF COEFFICIENT OF DISCHARGE OF A MOUTHPIECE BY CONSTANT HEAD METHOD.

- State the principle/law /apparatus/equipment required for testing.
- Perform test and record observations.
- Draw inferences on the relationship between parameters.
- Draw a graph between Q vs $H^{1/2}$.

(E) DETERMINATION OF COEFFICIENT OF DISCHARGE OF A RECTANGULAR NOTCH.

- State the Aim /apparatus/equipment required for testing.
- Perform test and record observations.
- State field application.
- Draw a graph between Q vs $H^{3/2}$.

(F) DETERMINATION OF COEFFICIENT OF DISCHARGE OF A TRIANGULAR NOTCH.

- State the Aim /apparatus/equipment required for testing.
- Perform test and record observations.
- State Field application.
- Draw a graph between Q vs $H^{5/2}$.
- Compare results with rectangular notch**.**

(G) VERIFICATION OF BERNOULLI'S THEOREM.

- States the principle/law /apparatus/equipment required.

- Perform test and record observations.
- State Inference and application.
- Plot Hydraulic gradient line and Total energy line.

(H) DETERMINATION OF COEFFICIENT OF DISCHARGE OF A VENTURI METER.

- State the Aim /apparatus/equipment required.
- Perform test and record observations.
- State Practical application.
- Draw a graph between Q vs $H^{1/2}$.

(I) DETERMINATION OF FRICTION FACTOR IN PIPE FLOW

- State the Aim /apparatus/equipment required.
- Perform test and record observations.
- State Practical application.
- Observe the significance of friction factor in pipe flow

CO-PO MAPPING

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	1	1			2	3	3
CO2	3	3	-	2	1			2	3	2
CO3	3	2	1	2	1			2	3	2
CO4	3	3	-	2	1			2	3	2
CO5	3	2	-	2	1			2	3	3
Average	3	2.4	1	1.8	1			2	3	2.4

Note : The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc

COURSE CONTENT

MATERIAL TESTING LAB

1. TESTS ON BRICKS& CEMENT

Water absorption - Crushing strength -Fineness test - Normal consistency test - Setting times of cement - Compressive strength of cement.

2. TESTS ON AGGREGATES& SOILS

Bulking of Sand - Bulk density and Percentage of voids in Coarse and fine aggregates - Sieve analysis of coarse and fine aggregates **-** Impact value of coarse aggregate- Flakiness Index of coarse aggregate- Elongation Index of coarse aggregate – Atterberg Limits – Field Density Test (Sand Replacement method) – Proctor's compaction Test.

3. TESTS ON CONCRETE& METALS

Slump cone test- Compaction factor test- Casting of Cement concrete cubes- Testing of cement concrete cubes for compression- Non-Destructive Tests on

concrete using Rebound hammer test-Tension test on mild steel rod - Deflection Test on beam (Steel beam or wooden beam)

HYDRAULICS LAB PRACTICE

4. DETERMINATION OF HYDRAULIC COEFFICIENTS / FACTORS / CONSTANTS / VERIFICATION OF PRINCIPLES / LAWS

a) Determination of coefficient of discharge of a small orifice by constant head Method
b) Determination of coefficient of discharge of a small orifice by variable head Method
c) Determination of Cc of an orifice by finding C_v and C_d.
d) Determination of coefficient of discharge of a mouthpiece by constant Head method.
e) Determination of coefficient of discharge of a triangular notch.
f) Determination of coefficient of discharge of a rectangular notch.
g) Verification of Bernoulli's theorem.
h) Determination of coefficient of a discharge of a venturi meter.
i) Determination of friction factor in pipe flow.

REFERENCE BOOKS:

1. Laboratory manual of strength of materials, SBTET, A.P.
2. Laboratory manual of Hydraulics, SBTET, A.P.

Table specifying the scope of the Syllabus to be covered for Unit Tests

Unit Tests	Learning Outcomes to Be Covered
Unit Test - 1	**1(A) TO 2 (G)**
Unit Tests - 2	**3 (A) TO 4 (I)**

IV SEM

DIPLOMA IN CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND MODEL BLUEPRINT FOR EVALUATION

IV SEMESTER

Course Code	Course Title	No. of Periods/week		Practicum (Y/N)	Total No. of Periods/Year	Credits	Scheme Of Examination			
		Theory	Practical				Duration (Hours)	FA (Marks)	SA (Marks)	Total Marks
THEORY COURSES										
26CE401T	Design and Detailing of R.C. Structures	6	---	N	90	4	3	30	70	100
26CE402T	Estimation, Costing and Valuation	7	---	N	105	4	3	30	70	100
26CE403T	Irrigation Engineering	5	---	N	75	3	3	30	70	100
ELECTIVE COURSES										
26CE404E	Advanced Surveying Methods	3	---	N	45	2	3	30	70	100
26CE405E	Quality Control and Safety in Constructions	3	---	N	45	2	3	30	70	100
AUDIT COURSE										
26CE406A	Python Programming	2	---	N	30	--	-	-	-	-
PRACTICAL COURSES										
26CE407L	Civil Engineering Drawing-II Integrated with CAD	---	6	N	90	2.5	3	40	60	100
26CE408L	Communications And Employability skills	---	4	N	60	2	3	40	60	100
26CE409L	Surveying Theory & Practice - III	---	6	Y	90	2	3	40	60	100
26CE410C	Student Centric Activities	---	3	N	45	0.5	-	-	-	-
	TOTAL	**23**	**19**		**630**	**20**	**-**	**240**	**460**	**700**

Note1: 0.5 credits will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NCC/Clean and Green or Sports/Games

Note 2: 26CE408L is common laboratory to all programmes.

DESIGN AND DETAILING OF R.C. STRUCTURES

Course code	Course title	No. of periods /week	Total no. of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE401T	Design and Detailing of R.C. Structures	06	90	30	70	4

TIME SCHEDULE

S.No.	Chapter/Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	COs Mapped
1.	Introduction to R.C.C	05	06	2	-	CO1
2.	Philosophy of Limit State Design	05	03	1	-	CO1
3.	Analysis and Design of Rectangular Beams	25	25	3	2	CO2
4.	Design of Slabs	15	22	2	2	CO2
5.	Analysis of T-beams	13	14	2	1	CO3
6.	Design of columns	15	22	2	2	CO4
7.	Design of footings	12	08	-	1	CO4
	Total	90	100	12	8	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Make student to be familiar with the principles of methods of design of R.C. Elements subjected to flexure, compression, shear and torsion.
(ii)	Enable the student to design various R.C. Building Elements.

COURSE OUTCOMES

CO1	CE401.1	Explain fundamentals of RCC design and Philosophy of Limit State Design
CO2	CE401.2	Design singly reinforced & doubly reinforced R.C.C rectangular beams and slabs using Limit state method
CO3	CE401.3	Analysis of T-beams using Limit state method.
CO4	CE401.4	Design columns & footings using Limit state method

LEARNING OUTCOMES

1.0 INTRODUCTION TO R.C.C

1.1 Differentiate Cement concrete and Reinforced cement concrete. List the advantages and disadvantages of R.C.C.

1.2 List the materials used in R.C.C. and their functions in R.C.C. State the reasons for using steel as reinforcement.

1.3 List the different codes used in R.C.C. List the Loads to be considered in the design of R.C. elements.

1.4 State the different grades of concrete. Differentiate the nominal mix concrete and design mix concrete.

1.5 Write the equations of tensile strength and modulus of elasticity of concrete as per IS 456 – 2000. State properties of concrete viz., Poisson's ratio, Creep, Shrinkage, Workability and Unit weight.

1.6 List different types of steel used in RC structures. State modulus of elasticity and unit weight of steel.

1.7 State different methods of designing R.C. elements. State the differences between the Working stress method and Limit state method of design of R.C. elements.

2.0 PHILOSOPHY OF LIMIT STATE DESIGN

2.1 Define Limit State. State different limit states.

2.2 Distinguish 'strength' and 'service ability' limit states

2.3 List different IS: 456 – 2000 code provisions for Limit state method of design.

2.4 Define characteristic strength of materials and characteristic loads.

2.5 Explain the role of partial safety factors in limit state design.

2.6 Define Design strength of materials and Design loads.

2.7 State the assumptions made in the limit state design.

3.0 ANALYSIS AND DESIGN OF RECTANGULAR BEAMS

3.1 Sketch stress and strain diagrams for a singly reinforced rectangular beam indicating appropriate stress and strain values in compression zone and tension zone of the beam, also the strain value at the junction of parabolic and rectangular stress blocks. Calculate the depth of rectangular and parabolic stress blocks.

3.2 Calculate the total compressive force and total tensile force resisted by the singly reinforced rectangular beam. Calculate the depth of neutral axis from the equilibrium condition. Define lever arm. Write the equation for lever arm for a singly reinforced rectangular beam.

3.3 Explain – why the over reinforced sections are not recommended? Calculate the maximum depth of neutral axis. Calculate the limiting value of moment of resistance with respect to concrete and steel. Calculate the limiting percentage of steel.

3.4 State the general design requirements for beams in limit state design as per IS 456 – 2000 (Effective span, limiting stiffness, minimum tension reinforcement, maximum tension reinforcement, maximum compression reinforcement, spacing of main bars, Cover to reinforcement, side face reinforcement.)

3.5 Calculate the depth of neutral axis for a given section and decide whether the section is balanced or under reinforced or over reinforced and calculate the moment of resistance for the respective case. Calculate the area of steel for a given beam with given cross section and loading.

3.6 Design a singly reinforced beam as per IS 456 – 2000 for flexure only with the given grade of steel and concrete and check the designed beam for deflection as per IS 456 – 2000.

3.7 Explain the effect of shear on beam. Explain the shear stress distribution across a homogeneous section and reinforced concrete section with sketches. Explain the design shear strength and maximum shear stress in different grades of concrete as per IS 456 – 2000. Explain the need for shear reinforcement and different forms of shear reinforcement provided in beams. Explain the critical section for shear.

3.8 Calculate the shear strength of concrete, shear resistance of vertical stirrups, shear resistance of bent up bars as per IS 456 – 2000. State the minimum shear reinforcement and maximum spacing of shear reinforcement as per IS 456 – 2000. Calculate the nominal shear stress, shear resisted by bent up bars and spacing of vertical stirrups.

3.9 Design the shear reinforcement for beams. Design a singly reinforced beam as per IS 456 – 2000 with the given grade of steel and concrete and check the designed beam for shear and deflection as per IS 456 – 2000 and design the shear reinforcement as per 456 – 2000.

3.10 State the situations which require doubly reinforced beams.

3.11 Determine the moment of resistance for a given doubly reinforced section (given d'/d – f_{sc} values).

3.12 Calculate the allowable working load on singly reinforced beam

3.13 Calculate the development length of bars in compression, tension, and the curtailment position for main tension bars. State the importance of anchorage values of reinforcement.

3.14 Design a singly and doubly reinforced simply supported rectangular beams for the given grades of materials, span and loading for flexure including shear design with the curtailment of reinforcements and check for the deflection using simplified approach of the code.

4.0 DESIGN OF SLABS

4.1 Distinguish one-way slabs and two-way slabs.

4.2 List the types of slabs based on support conditions.

4.3 Explain the general design requirements of slabs as per IS 456 – 2000.

4.4 Explain the functions of distribution steel in slabs.

4.5 Sketch the general reinforcement details for a
1) One-way simply supported slab
2) Two way simply supported slab
3) One-way continuous slab
4) Cantilever slab continuous over a support

4.6 Explain the edge strip and middle strip of a two-way slab.

4.7 Sketch the general reinforcement details for a continuous two-way slab for its edge strip and middle strip using straight bars and bent up bars.

4.8 Design one-way slab for given grades of materials, loads and span for flexure and check for shear and deflection.

4.9 Explain Load distribution in two-way slabs. Design two-way slab with different end conditions for flexure using B.M coefficients. Calculate the area of torsional reinforcement in the restrained slabs. Check the deflection using simplified approach of stiffness criteria.

5.0 ANALYSIS OF T-BEAMS

5.1 Distinguish T- beam and L- beam.

5.2 List the advantages of a T- beam.

5.3 Write formula for effective width of flange of a T- beam and L- beam as per IS 456 – 2000.

5.4 Calculate the effective width of flange of an isolated T- beam as per IS 456 – 2000.

5.5 Describe the three cases of determining Neutral axis depth of T-beams with sketches and notations.
5.6 Calculate the depth of neutral axis and moment of resistance of the given T-section using the expressions given in the code.
5.7 State the minimum and maximum reinforcement in T- beams as per 456 – 2000.

6.0 DESIGN OF COLUMNS

6.1 Define a column/compression member. Differentiate among Column, Strut, Pedestal and Post
6.2 Explain the need for providing reinforcement in column.
6.3 State the effective length of column for different end conditions as per theory and as per code.
6.4 Classify the columns based on type of reinforcement, loading and slenderness ratio.
6.5 State the slenderness limits for column to avoid buckling of column.
6.6 State the minimum eccentricity of column.
6.7 Calculate the load carrying capacity of a short column with lateral ties and with helical reinforcement as per IS 456 – 2000.
6.8 Differentiate between short and long columns and understand their failure behaviour.
6.9 Explain the design requirements of columns as per IS 456 – 2000.
6.10 Design a Short Square, rectangular, circular column with lateral ties (subjected to axial load only).

7.0 DESIGN OF FOOTINGS

7.1 Define Footing
7.2 State different types of Footings (Square/ Rectangular Isolated footings of Uniform/Tapered sections).
7.3 State the Rankine's formula for minimum depth of foundation.
7.4 State the code provisions for the design of R.C.C footings.
7.5 Explain the procedure of checking the footing for one-way shear, two-way shear, bearing stress and for development length.
7.6 Design isolated square footing for square column of uniform thickness for flexure only.

Note: Students may be encouraged to use design aids SP-16, SP-34 and SP-23 for design of slabs, beams for general practice. I.S.456 – 2000 is allowed in the Examination.

CO-PO MAPPING

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	2		-	-	1	3	-	3
CO2	2	3	2		-	-	1	3	-	3
CO3	2	3	2	-	-	-	1	3	-	3
CO4	2	3	2	-	-	-	1	3	-	3
Average	2.0	3.0	2.0	-	-	-	1.0	3	-	3

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits ..etc.

COURSE CONTENT

1.0 INTRODUCTION TO R.C.C

Introduction - advantages and disadvantages of R.C.C - Loads to be considered in the design of RC elements - Introduction to I.S Codes -Different grades of concrete—Nominal Mix – Design Mix – differences-different methods of design of RC elements

2.0 PHILOSOPHY OF LIMIT STATE DESIGN

Codes of practice of R.C.C design - Characteristic compressive strength - Modulus of elasticity of concrete - Strength and serviceability limit states - Characteristic strength of materials and characteristic loads - Partial safety factors - Design strength of materials and design loads - Assumptions made in the limit state design.

3.0 ANALYSIS AND DESIGN OF RECTANGULAR BEAMS

Stress-strain diagram of singly reinforced R.C.C. beam - Depth of neutral axis, lever arm – M.R of Singly reinforced rectangular section – Balanced, under and over reinforced sections - Critical percentage of steel - Calculation of moment of resistance of the given section - Design of singly reinforced rectangular beam for the given load as per IS 456-2000 - Doubly reinforced sections – Necessity – use - Shear in singly reinforced beams - Nominal shear stress - Permissible shear stress - Methods of providing shear reinforcement in the form of vertical stirrups - combination of vertical stirrups and bent up bars - Code provisions for spacing of stirrups and minimum shear reinforcement (no derivation of equations) - Development of bond stress in reinforcing bars - Design bond stress - Development length – Bond and anchorage concepts and their importance - Curtailment of tension reinforcement - Simple problems on development length - Design of simply supported singly and doubly reinforced rectangular beams for flexure including shear and check for deflection using stiffness criteria - Use of design aids (SP-16).

4.0 DESIGN OF SLABS

Slabs as structural and functional members - One way and two way slabs - Minimum reinforcement and maximum spacing of reinforcement concrete cover - Stiffness criterion- stiffness ratios for simply supported, cantilever and continuous slabs - One way and two way slabs with various end conditions as per I.S:456 code - Design of one-way slab for flexure and shear for the given grades of concrete, steel, span and loading - Check for deflection using simplified approach of stiffness criteria - Design of two-way slabs with different end conditions, using B.M coefficients for the unrestrained and restrained conditions as per code - Design of torsion reinforcement for the restrained slabs - Deflection check using stiffness criteria.

5.0 DESIGN OF T-BEAM

Conditions needed for design of a beam as T-Section – Advantages - Code provisions for effective flange width - Three cases of T- beams - Neutral axis, lever arm and moment of resistance for under reinforced, balanced sections using the equations given in the code (no derivations of equations) - Calculation of the moment of resistance of T- section using the equations given in the code - Use of design aids (SP16).

6.0.DESIGN OF COLUMNS

Definition of column – Difference between Column and Pedestal - Types of columns (Long and Short) - Effective length for different end conditions - Code provisions for

design of columns - Square, rectangular and circular columns with lateral ties - Determination of Load carrying capacity of short column - Square, rectangular, circular, helically reinforced column subjected to axial load only - Design of short square, rectangular and circular columns (with lateral ties only).

7.0 DESIGN OF FOOTINGS

Footings - Need for footings - Footings under isolated columns - Loads on footings - Code provisions for design of footings - Size of footings for given bearing capacity - Procedure of checking the footing for one-way shear - Two-way shear - Bearing stress - Development length - Design of an isolated square footing of uniform thickness under a square column for flexure only.

REFERENCE BOOKS:

1. I.S:456- 2000 Code Book
2. I.S:875 – 1987 Code Book
3. SP-34 - Handbook on concrete reinforcement and detailing (1987).
4. Limit state design of R.C.C structures, Dr. B.C. Punmia, Ashok K.Jain, Laxmi Publication.
5. Design of Reinforced Concrete Structures, S. Ramamrutham, Dhanpatrai publishing company.
6. Design of Reinforced Concrete Structures, V.N. Vazirani and M.M. Ratwani – Khanna publishers.
7. Limit state design of reinforced concrete, P.C. Verghese, PHI Learning
8. Reinforced Concrete Design, N. Krishna Raju & R N Pranesh, New age international publishers.
9. Reinforced Concrete Design, S. Unni Krishna Pillai &Devdas Menon, McGrawHill Education.

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 4.9
Unit Test – II	From 5.1 to 7.6

ESTIMATION, COSTING AND VALUATION

Course code	Course title	No. of periods /week		Total no. of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE402T	ESTIMATION, COSTING AND VALUATION	Lectures	Tutorial	105	30	70	4
		04	03				

TIME SCHEDULE

Sl. No	Major Topics	No. of Periods	Weightage of Marks	Short Type	Essay Type	CO Mapped
1	Basics of Estimation	08	06	02	-	CO1
2	Detailed Estimate of Civil Works	22	44	04	04	CO1
3	Estimation of steel quantity in RCC works and trusses	08	14	02	01	CO1
4	Rate Analysis of Civil Works	16	22	02	02	CO2
5	Valuation of Property	06	14	02	01	CO3
6	Tutorial Sessions	45	-	-	-	CO1,CO2, CO3
	Total	105	100	12	08	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	To prepare estimates for various quantities of Civil Engineering Works as per specification of the work.
(ii)	To determine the rate of construction of the items of work as per the standard data and standard schedule of rates.
(iii)	To understand the methods of valuation and determine the rent of a building.

COURSE OUTCOMES

CO1	CE402.1	Apply mathematical and engineering principles to Estimate the quantities for items of work in Civil infrastructure duly following the specifications
CO2	CE402.2	Compute the rate for a given item of finished work using rate analysis
CO3	CE402.3	Determine the value of a building and fix the rent of building

LEARNING OUTCOMES

1.0 BASICS OF ESTIMATION

1.1 State the purpose of estimation and costing
1.2 State the units of measurements, data and payment for different items of work and materials
1.3 Explain the approximate and detailed methods of estimation
1.4 Explain and write down the specifications for various items of work in building construction

2.0 DETAILED ESTIMATE OF CIVIL WORKS

Prepare the detailed estimates for various Civil infrastructure works from the given drawings, specifications and site conditions viz.,
2.1 Residential buildings
2.2 Irrigation works
2.3 Pavements
2.4 Public health buildings

3.0 ESTIMATION OF STEEL QUANTITY IN RCC WORKS AND TRUSSES

3.1 Explain the procedure to estimate the quantity of steel in (i) RCC Footings (ii) RCC Slabs and (iii) Simple Steel Trusses

4.0 RATE ANALYSIS OF CIVIL WORKS

4.1 Explain the purpose of rate analysis
4.2 State the importance of Standard data book and Standard schedule of rates.
4.3 Prepare the lead statement for different materials
4.4 Prepare the data sheet for finished items of work using standard data and SSR

5.0 VALUATION OF PROPERTY

5.1 State the need for valuation.
5.2 Define the various terms used in valuation.
5.3 Explain the methods of valuation of a building and apply them.
5.4 Explain the methods of rent fixation of a building and determine the rent.

CO – PO MAPPING

C0 No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3			2	3	3	3	3	
CO2	1	1			2	3	3	1	1	
CO3	1	1			3	3	3	1	1	
Average	1.67	1.67			2.33	3	3	1.67	1.67	

COURSE CONTENT

1.0 BASICS OF ESTIMATION

Definition of estimate and its importance – units of measurements and units of payment of items of work – earthwork, brickwork, DPC, concrete and RCC works, painting, flooring, plastering, pointing, whitewash, distempering, woodwork – types of estimates – approximate and detailed methods - data required for preparation of an estimate – standard data – scheduled rates – lead statements – specifications.

1.0 DETAILED ESTIMATES OF CIVIL WORKS

Buildings – methods of estimation – long wall and short wall method – centre line method. estimation of quantities for a building-estimation of earthwork in irrigation channels and roads - estimation of quantities for bituminous and concrete roads estimation of quantities for water tank (OHSR) and septic tank with soak pit.

3.0 ESTIMATION OF STEEL QUANTITY IN RCC WORKS AND TRUSSES

Cover for reinforcement as per is 456 – standard hooks and cranks of reinforcement bars – estimation of steel quantity in footing, column, beam, lintel and slab – estimation of steel in trusses – preparation of bar bending schedule.

4.0 RATE ANALYSIS OF CIVIL WORKS

Factors affecting the analysis of rates – lead statement – standard data – standard schedule of rates – analysis of unit rates of building works and roads.

1.0 VALUATION OF PROPERTY

Definition – Purpose of valuation – Principles of valuation – Terms used in valuation – Value, Cost and Price, Scrap value, Salvage value, Market value, Book value, sinking fund and its meaning – purpose of valuation –factors governing valuation - Depreciation–Sinking fund–Annuity–Capitalized value - Methods of valuation – Land & building method, Development method, Depreciation method, Rental method, Capitalization method, Profit method, Simple problems on each of the above methods. Rent fixation – Rent fixation of building – Principles of rent fixation by CPWD–Fair rent method–simple problems.

TUTORIAL SESSION

Session No	Topics	Duration (Periods)
1	Plan a single room with attached washroom and write down its specifications	3
2	Using a plan and section of a residential building prepare the quantities of items using Long Wall and Short Wall method (Part -1)	3
3	Using a plan and section of a residential building prepare the quantities of items using Long Wall and Short Wall method (Part -2)	3
4	Using a plan and section of a residential building prepare the quantities of items using Long Wall and Short Wall method (Part -3)	3
5	Using a plan and section of a residential building prepare the quantities of items using Centre Line method (Part -1)	3
6	Using a plan and section of a residential building prepare the quantities of items using Centre Line method (Part -2)	3
7	Using a plan and section of a residential building prepare the quantities of items using Centre Line method (Part -3)	3
8	Prepare bar bending schedule for a slab, beam, column and footing	3
9	Prepare the detailed estimate for campus roads by conducting survey	3
10	Prepare the detailed estimate for water tank and septic tank	3
11	Prepare unit rate of various items estimated above (Part- 1)	3
12	Prepare unit rate of various items estimated above (Part- 2)	3

13	Prepare unit rate of various items estimated above (Part- 3)	3
14	Estimate the rate of construction of residential building, campus roads and septic tank	3
15	Prepare the valuation report for a given building and fix the rent.	3

REFERENCE BOOKS:

1. Datta, B.N., Estimating and Costing in Civil Engineering UBS Publishers Distributors Pvt. Ltd. , New Delhi
2. Birdie, G.S., Estimating and Costing, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
3. Standard data book and Standard Schedule of Rates of Government of Andhra Pradesh

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 2.4
Unit Test – II	From 3.1 to 5.4

IRRIGATION ENGINEERING

Course code	Course title	No. of periods/week	Total no. of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE403T	IRRIGATION ENGINEERING	05	75	30	70	3

TIME SCHEDULE

S.No.	Chapter/Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	COs Mapped
1.	Nature and scope of Irrigation Engineering	10	14	02	01	CO1
2.	Elements of Hydrology	10	14	02	01	CO2
3.	Head works	10	14	02	01	CO2
4.	Gravity dams and Earth dams	13	19	01	02	CO3
5.	Distribution works	12	14	02	01	CO4
6.	Soil Erosion, Water logging, River Training works	11	11	02	01	CO5
7.	Watershed Management	9	11	01	01	C05
	Total	75	100	12	08	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Understand the necessity and scope of Irrigation Engineering, Hydrology, calculation of average annual rainfall of an area and maximum flood discharge
(ii)	Describe the Storage and diversion Head Works, component parts, effect of percolation, Gravity dams and Earthen dams –failures of these dams and remedial measures.
(iii)	Explain Distribution works, maintenance of canals, uses of Cross drainage works, causes, effects and prevention of Soil erosion, Water logging, types and uses of river training works and Watershed Management.

COURSE OUTCOMES

CO1	CE403.1	Explain various methods of irrigation.
CO2	CE403.2	Describe the (i) Elements of Hydrology (ii) Diversion and storage head works.
CO3	CE403.3	Analyse different types of failures of dams in construction
CO4	CE403.4	Discuss the alignment of canals, cross drainage works and their maintenance
CO5	CE403.5	Describe 1.Soil erosion 2. Water logging 3. River Training Works and Watershed Management

LEARNING OUTCOMES

1.0 NATURE AND SCOPE OF IRRIGATION

1.1 Define Irrigation
1.2 State the necessity of irrigation.
1.3 List advantages and disadvantages of irrigation.
1.4 State different types of irrigation
1.5 Distinguish between
1. Perennial and inundation irrigation,
2. Flow and Lift irrigation
3. Storage and Direct irrigation.
1.6 State soil-water plant relationship.
1.7 Describe the following irrigation methods:
1.Border irrigation,
2. Check basin irrigation,
3. Furrow irrigation,
4. Sprinkler irrigation and
5. Drip irrigation
1.8 State Principal crops in India and their seasons and explain Kharif crops and Rabi Crops
1.9 Define the following terms:
1. Duty
2. Delta
3. Base period
4. Crop period
1.10 Explain different methods of expressing duty
1.11 State the relationship between duty and delta.
1.12 Explain the factors affecting duty
1.13 State the duty figures for principal crops and solve simple problems on duty

2.0 ELEMENTS OF HYDROLOGY

2.1 Describe Hydrological cycle
2.2 Explain the term Precipitation
2.3 State different types of rain gauges and explain the method of measurement of rainfall using Simon's Rain gauge and Float type automatic recording rain gauge
2.4 Explain precautions in setting and maintenance of rain gauges. State uses of rain fall records
2.5 Define the following:
1. Catchment,
2. Intercepted catchment,

3. Free catchment and
4. Combined catchment area

2.6 State the characteristics of
1. Good catchment,
2. Average catchment and
3. Bad catchment

2.7 Explain the term Run-off and factors affecting runoff

2.8 Explain methods of estimating runoff and solve the problems on estimating run-off

2.9 Understand the term maximum flood discharge and explain various methods of determining maximum flood discharge from rain fall records.

2.10 State Ryve's and Dicken's Formulae and solve simple problems on estimating maximum flood discharge

3.0 HEAD WORKS

3.1 Classify the head works and State the suitability of different types of head works under different conditions

3.2 State the factors for selecting suitable site for diversion head works

3.3 Describe the component parts of Diversion works with sketch

3.4 Distinguish between barrages and Weirs

3.5 Describe head regulator and scouring sluice with sketch

3.6 Describe flood banks and other protective works

3.7 Define the terms: Percolation, Percolation gradient, Uplift, scour and uplift pressure

3.8 Explain the effects of percolation on irrigation works

4.0 GRAVITY DAMS AND EARTH DAMS

4.1 Distinguish between Rigid dams and Non-rigid dams

4.2 State factors influencing selection of site for reservoirs and dams.

4.3 Define the terms: Full reservoir level, Maximum water level, Top bund level, Dead storage, Live storage, Free board, Gravity dam and Spillway.

4.4 Explain the causes of failure of gravity dams and their remedies.

4.5 Draw the elementary profile of a gravity dam for a given height and draw the practical profile of a low dam.

4.6 Explain uplift pressure and explain need for drainage galleries with sketches

4.7 Explain construction and contraction joints with sketches

4.8 State need and types of grouting of foundations and explain the method of grouting of foundations in gravity dams

4.9 State different types of spillways and their suitability and draw sketches

4.10 State the situations in which earth dams are suitable

4.11 State the three types of earth dams with sketches of typical cross sections

4.12 Explain causes of failure of earthen dams and their precautions

4.13 Explain drainage arrangements in earth dams with a neat sketch

4.14 Explain the maintenance of earth dams

5.0 DISTRIBUTION WORKS

5.1 State the Classification of canals.

5.2 State the different methods of canal alignment and the situations in which each is suitable.

5.5 Sketch typical cross sections of canals in cutting, embankment and Partial cutting.

5.6 Explain balanced depth of cutting and its necessity

5.7 State the need for canal lining and State advantages and disadvantages of canal linings.

5.8 Explain different types of canal linings

5.9 Explain the maintenance required for canals and their regulation
5.10 State need for cross drainage works and State different types of cross masonry works (cross regulator, drainage & communication) and their objectives.
5.9 Describe the following with sketches
1. Aqueduct,
2. Super passage,
3. Under tunnel, siphon,
4. Level crossing and
5. Inlet and outlet

6.0 SOIL EROSION, WATER LOGGING, RIVER TRAINING WORKS

6.1 Explain terms: Soil erosion, Reclamation and Water logging.
6.2 State causes of soil erosion and ill effects of soil erosion
6.3 Explain various methods of prevention of soil erosion.
6.4 State causes of water logging and ill effects of water logging
6.5 Explain various methods of prevention of water logging
6.6 State methods of land reclamation.
6.7 State different stages of flow of rivers
6.8 Explain characteristics of Delta Rivers
6.9 Explain term meandering of river
6.10 State objectives of river training works and Explain various types of groynes and bell's bunds with sketches

7.0 WATERSHED MANAGEMENT

7.1 Explain the concept of
1. Water shed and
2. Water shed management

7.2 State the need for watershed management
7.3 List the objectives of watershed management
7.4 State need for watershed development in India
7.5 Describe different approaches to water shed management
7.6 Explain water harvesting
7.7 Explain methods of 1. Rain water harvesting and 2. Catchment harvesting
7.8 Explain soil moisture conservation methods
7.9 Explain method water harvesting through check dams
7.10 Explain different methods of artificial recharge of ground water
7.11 Explain artificial recharges of ground water using percolation tanks

CO-PO MAPPING

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2		2	3		2	2	3	2
CO2	3	3		2	3		2	2	3	2
CO3	3	3			2		2	2	3	2
CO4	3	3			3	2	3	2	3	2
CO5	3				2	2	3	2	3	2
Average	3	2.75		2	2.6	2	2.4	2	3	2

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits ..etc.

COURSE CONTENT

1.0 NATURE AND SCOPE OF IRRIGATION ENGINEERING

Definitions- Necessity of irrigation - Advantages and disadvantages - Perennial and Inundation irrigation - Flow and Lift irrigation-Direct and Storage irrigation-Methods of Irrigation - Principal crops - Kharif and Rabi crops -Dry and wet crops - Definition of duty, delta, base period, and crop period, Duty-different methods of expressing duty-base period-relationship between duty and delta- factors affecting duty – Requirements for precise statement of duty - Duty figures for principal crops-simple problems on duty.

2.0 ELEMENTS OF HYDROLOGY

Precipitation – Types of rain gauges – Simon's rain gauge - Float type automatic - recording gauge – precautions in setting and maintenance – rain fall records – Hydrological cycle-Catchment basin in catchment area - Free catchment - combined catchment - Intercepted catchment – Run- off - Factors affecting run-off - Nature of catchment, run off coefficient - Methods of estimating run off - Empirical formulae - Maximum flood discharge - Methods of determining maximum flood discharge from rainfall records, Ryve's and Dicken's formulae, H.F.L – Simple problems on M.F.D.

3.0 HEAD WORKS

Classification of head works - Storage and diversion, head works - their suitability under different conditions - Suitable site for diversion works - General layout of diversion works-brief description of component parts of diversion works, brief description of component parts of a weir - Barrages and Weirs. Head Regulator-scouring sluice-flood banks and other protective works. Percolation -Percolation gradient-uplift pressures - Effect of percolation on irrigation works.

4.0 GRAVITY DAMS AND EARTH DAMS

Dams - Rigid and non-rigid dams - main gravity dams-failures of gravity dams and remedial measures - elementary profile – limiting height of dam - low dam and high dam - free board and top width – Practical profiles of low dam - uplift pressure - drainage gallery - Contraction joints - Grouting of foundations – spillways. Earth dams – situations suitable for Earth Dams - Types of earth dams - Causes of failure of earth dams and precautions -drainage arrangements - Construction details of earth dams - breaching sections - breach filling - Maintenance of earth dams.

5.0 DISTRIBUTION WORKS

Canals-classification-different methods of canal alignment-typical cross section of canal in cutting, embankment, partial cutting and embankment – Berms - standard dimensions - balancing depth of cutting - canal lining - Necessity - types – Maintenance of canals. Cross drainage works - Necessity – General description of aqueducts – Super passage – Under tunnel - siphon level crossing- Inlet and outlet.

6.0 SOIL EROSION, WATER LOGGING AND RIVER TRAINING WORKS

Soil erosion-methods of prevention of soil erosion-causes and effects- of water logging-preventing water logging methods-land reclamation - Different stages of flow of rivers-characteristics of Delta Rivers - Meandering - Object of river training - River training works- List out the various types of groynes and Bell's bunds.

7.0 WATERSHED MANAGEMENT

Introduction - Concept of Watershed Management – Objectives of watershed Management – Need for watershed development in India – Integrated and multidisciplinary approach for water shed management. Water Harvesting: Rainwater harvesting, Catchment harvesting – Soil moisture conservation – Check dams – Artificial recharges and percolation tanks.

REFERENCE BOOKS:

1. Irrigation and Water Power Engineering, B.C. Punmia, Dr. Pande B.B. Lal, Ashok Kumar Jain, Arun Kumar Jain – Laxmi Publication.
2. Irrigation and Water Power Engineering Das and Madan Mohan Das & Mimi Das Saikia , PHI Publication
3. Irrigation Engineering and Hydraulic structures, Santhosh Kumar Garg , KHANNA PUBLISHERS
4. Irrigation Engineering, N NBasak , McGrawHill Publications

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning outcomes to be covered
Unit Test-I	From 1.1 to 4.14
Unit Test-II	From 5.1 to 7.11

ADVANCED SURVEYING METHODS

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE404E	ADVANCED SURVEYING METHODS	03	45	30	70	2

TIME SCHEDULE

S. No.	Chapter/Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	COs Mapped
1	Introduction to Advanced Surveying methods	4	14	2	1	CO1
2	Geographic Information Systems (GIS)	12	25	3	2	C02
3	Differential Global Positioning System (DGPS)	13	25	3	2	CO3
4	Drone Surveying	11	25	3	2	CO4
5	LiDAR Technology	5	11	1	1	C05
	Total	45	100	12	8	

COURSE OBJECTIVES:

Upon the completion of the course, the student shall be able to	
(i)	Understand the advanced surveying systems methods
(ii)	Understand the applications of GIS in civil Engineering
(iii)	Understand the advanced surveying systems DGPS, Drone Surveying and LiDAR Technology their applications.

COURSE OUTCOMES:

CO1	CE404.1	Understand the advanced surveying techniques in civil Engineering
CO2	CE404.2	Describe the components and applications of GIS in civil Engineering
CO3	CE404.3	Explain the concept and working principle of DGPS
CO4	CE404.4	Describe the concept and principle of Drone Surveying
CO5	CE404.5	Explain the basic concept and applications of LiDAR in civil engineering

LEARNING OUTCOMES

1.0 INTRODUCTION TO ADVANCED SURVEYING METHODS

1.1. Understand the importance of advanced surveying techniques in civil Engineering
1.2. Differentiate between conventional and advanced surveying methods.
1.3. State the applications of various advanced surveying methods.
1.4. Select appropriate surveying methods based on project requirements.

2. GEOGRAPHIC INFORMATION SYSTEMS (GIS)

2.1. Define GIS
2.2. Explain the components of GIS
2.3. Explain the types of data used in GIS
2.4. State the merits and demerits of GIS
2.5. List the uses of GIS
2.6. Explain the applications of GIS in civil Engineering

3. DIFFERENTIAL GLOBAL POSITIONING SYSTEM (DGPS)

3.1. Understand the concept and working principle of DGPS.
3.2. Differentiate between GPS and DGPS.
3.3. Identify various components and types of DGPS.
3.4. Describe the methods and procedures for conducting a DGPS survey.
3.5. Explain the applications of DGPS in civil engineering.

4. Drone surveying

4.1. Understand the purpose and principle of Drone Surveying.
4.2. Understand the history of drones/UAAS/UAV's.
4.3. State the applications of drone in surveying, mapping, transportation, irrigation and Agriculture.
4.4. Compare drone survey with other surveys in respect of accuracy.
4.5. Explain the techniques for controlling errors.
4.6. Understand GCP (Ground Control Points) in vertical and horizontal accuracies.

5. LiDAR Technology

5.1 Understand the basic concept of LiDAR Technology.
5.2 Explain the working principle of LiDAR technology.
5.2 List the different types of LiDAR systems and their components.
5.3 Describe the methods of LiDAR data collection and processing.
5.4 Compare LiDAR with traditional surveying techniques.
5.5 State the applications of LiDAR in civil engineering

CO-PO MAPPING:

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2							1	2	2
CO2	2	3					1	1	2	2
CO3	2	3					1	1	2	2
CO4	2	3					1	1	2	2
CO5	2	3					1	1	2	2
Average	2	3					1	1	2	2

Note : The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc

COURSE CONTENT

1. INTRODUCTION TO ADVANCED SURVEYING METHODS

Understand the advanced surveying techniques - Differentiate between conventional and advanced surveying methods- applications of various advanced surveying methods-Select appropriate surveying methods based on project requirements.

2. GEOGRAPHIC INFORMATION SYSTEMS (GIS)

Define GIS -components of GIS- types of data used in GIS -merits and demerits of GIS-uses of GIS-Applications of GIS in civil Engineering.

3. DIFFERENTIAL GLOBAL POSITIONING SYSTEM (DGPS)

Understand the concept and working principle of DGPS- Differentiate between GPS and DGPS- Identify various components and types of DGPS-methods for conducting a DGPS survey. Applications of DGPS in civil engineering.

4. INTRODUCTION TO DRONE SURVEYING

Purpose and principle of Drone Surveying - History of drones/UAAS/UAVs - Application of drone in surveying, Mapping, Transportation, Irrigation and Agriculture - Application of drone in engineering, land survey and transportation - Comparison of drone survey with other surveys in respect of accuracy -Techniques for controlling errors - GCP (Ground control points) in vertical and horizontal accuracies.

5. LIDAR TECHNOLOGY

Understand the basic concept of LiDAR Technology- working principle of LiDAR technology- types of LiDAR systems and their components- methods of LiDAR data collection and processing-Compare LiDAR with traditional surveying techniques-applications of LiDAR in civil engineering.

REFERENCE BOOKS:

1) Surveying Vol.I&Vol.II by B.C Punmia, Ashok Jain & Arun Jain, Laxmi publications
2) Remote Sensing and GIS by B.B. Singh, T.S. Chouhan, Scientific Publishers
3) Geographic Information System and Science by Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind,Wiley
4) Advanced Surveying: Total Station, GIS and Remote Sensing by atheesh Gopi, R. Sathikumar, N. Madhu, Pearson Education

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.2
Unit Test – II	From 3.3 to 5.5

QUALITY CONTROL AND SAFETY IN CONSTRUCTIONS

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE405E	QUALITY CONTROL AND SAFETY IN CONSTRUCTION	03	45	30	70	2

TIME SCHEDULE

S. No.	Chapter/Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	COs Mapped
1	Specifications and Standards	5	14	2	1	C01
2	Quality control and Tolerance	11	22	2	2	C01
3	Introduction to safety in construction Activities	11	25	3	2	CO2
4	Causes of Accidents and Safety Measures	12	25	3	2	C03
5	Preventive measures for Accidents	06	14	2	1	CO4
	Total	45	100	12	08	

COURSE OBJECTIVES:

Upon completion of the course, the student shall be able to	
(i)	Understand the fundamentals of quality control in construction
(ii)	Familiarize with the fundamentals of safety aspects and preventive measures of accidents in construction

COURSE OUTCOMES

CO1	CE405.1	Explain the specifications and standards for various works
CO2	CE405.2	Explain the aspects of quality control, tolerance limits for different types of construction activities.
CO3	CE405.3	Explain the safety measures to be taken in constructions
CO4	CE405.4	Explain the causes and preventive measures of accidents

LEARNING OUTCOMES

1. SPECIFICATIONS AND STANDARDS

1.1. List different specifications of buildings.
1.2. Explain functional aspects of different structures.
1.3. Describe detailed specification for various items of work.
1.4. Prepare detailed specification from general description.
1.5. List relevant IS codes.
1.6. Identify sizes for building components and identify the standards.
1.7. Explain Management aspects of quality control.
1.8. State PWD & CPWD Guidelines for field officers.

2. QUALITY CONTROL AND TOLERANCE

2.1. Describe control aspects of batching and mixing.
2.2. Explain the inspection of reinforcement grills.
2.3. Explain the inspection and examination of formwork.
2.4. Describe the quality of the filler materials.
2.5. Explain sampling plan and sampling risks of acceptance and rejections.
2.6. State the tolerance levels in construction industry.
2.7. Explain visual appearance and dimensional accuracies.

3. INTRODUCTION TO SAFETY IN CONSTRUCTION ACTIVITIES

3.1. Describe the safety requirements against fire hazards
3.2. Describe the safety measures while using construction machinery
3.3. Describe the safety precautions to be taken during the demolition of buildings
3.4. Describe the preventive methods of accidents

4. CAUSES OF ACCIDENTS AND SAFETY MEASURES

4.1. Define accidents, List the causes of accidents.
4.2. Describe the General safety program, Prepare accidents reports
4.3. Explain the safety measures to be taken for storage and handling of building materials.
4.4. Explain the safety requirements in formwork and scaffolding.
4.5. Explain the safety measures to be taken in excavation & pile driving in foundation.
4.6. Describe the safety measures to be taken in construction of building elements
4.7. Explain the safety measures to be taken in demolition of buildings.
4.8. Describe the safety measures to be taken in supporting structural work.

5. PREVENTIVE MEASURES FOR ACCIDENTS

5.1. Define 1. Risk and 2. Risk management.
5.2. Explain the role of risk management.
5.3. Describe the planning for accident prevention.
5.4. Evaluate risks and losses and cost control works
5.5. Describe the management measures for controlling losses

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3						2	1	1
CO2	2	3						2	2	1
CO3	2	3						2	1	1
CO4	2	3						2	2	1
Average	2	3						2	1.5	1

Note : The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc

COURSE CONTENT

1. SPECIFICATIONS AND STANDARDS

Specification for buildings – functional aspects of residential, commercial and industrial structures – Detailed Specifications for various items of work – preparation of detailed specification from general description – relevant IS codes – Preferred size for building components – State PWD & CPWD guide lines for field officers

2. QUALITY CONTROL AND TOLERANCE

Production & quality control of concrete – general – batching – mixing – inspection of reinforcement grill and form work-Quality control in Masonry works – quality of filler materials – Brick – stone – quality of mortar – relation between strength of brick work Vs strength of bricks Vs strength of mortar - Tolerance levels in construction industry – Visual appearance – dimensional accuracies.

3. INTRODUCTION TO SAFETY IN CONSTRUCTION ACTIVITIES

Introduction – safety against fire hazards – Fire & fire fighting – Fire rating of building materials – fire prevention standards – safety in use of construction machinery – lifting machinery, earth moving machinery and conveyors, demolition of buildings – Loading standards for buildings – The safety programme – Accident due to fall – preventive methods.

4. CAUSES OF ACCIDENTS AND SAFETY MEASURES

Causes of accidents – Classification of construction accidents – safety measures for storage & handling of building materials – Safety Measure in construction of elements of building – Safety in excavation –foundations – form work – scaffolding – Safety Measure in demolition of buildings – Safety Measure for scaffolding, Ladders, formwork and other equipment – erection of steel structures – Safety measures for excavation.

5. PREVENTIVE MEASURES FOR ACCIDENTS

Planning for accident prevention – Evaluation of risk and loss potential in the work. Vis-a-vis cost control measures – loss control approach through accident prevention and other risk management measures for controlling losses due to personnel, legal, liability losses – property losses.

REFERENCES*:*

1. Specification Writing,A.J and C.J.Willis, Crossby Lockwood, London
2. Quality Control and Reliability ,Norbert L Enrick , Industrial Press Inc.,NY
3. Standards in Buildings ,R.Nagarajan,Pitman publishing
4. Safety in Construction Industry,VincentG.Bush, OSHA
5. Safety in Construction Industry, S. Purushotham & G. Vaidyanathan, Central Labour Institute, Bombay
6. Accident Prevention in Construction, Associated General Contractors of America:
7. Standards on safety ,BIS, New Delhi.

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.2
Unit Test – II	From 3.3 to 5.4

PYTHON PROGRAMMING

Course code	Course title	No of periods / week	Total No. of periods	Marks for formative assessment	Marks for summative assessment	Credits
26CE406A	PYTHON PROGRAMMING	02	30	-	-	-

TIME SCHEDULE

Sl. No	Major Topics	No. of Periods	CO Mapped
1	Getting started with Python	06	CO1
2	Control statement and functions	06	CO2
3	Lists, tuples and dictionaries	06	CO3
4	Files, introduction to python libraries and tools for civil engineers	06	CO4
5	Applications of python programming in civil engineering	06	CO5
TOTAL		30	

COURSE OBJECTIVES

Upon completion of course the student shall be able to	
(i)	Develop Civil Engineering applications using Python language.

COURSE OUTCOMES

CO1	CE406.1	Understand the different data types to design a Python program.
CO2	CE406.2	Explain tools for decision making and writing functions
CO3	CE406.3	Explain various data structures in Python
CO4	CE406.4	Understand the Python Libraries
CO5	CE406.5	Write simple programs using Python for Civil Engineering applications

LEARNING OUTCOMES

1. Explain installation of Python and introduction to Python
2. Understand control flows and Functions
3. Explain data handling using lists, tuples and dictionaries
4. List file operations and Python libraries and tools
5. Explain simple applications in Civil Engineering

CO – PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3						2	3		3
CO2		3					2			
CO3			3				2			
CO4				3		3	2			
CO5						3	3			
Average	3	3	3	3		3	2.2	3		3

COURSE CONTENT

1.0 Getting Started with Python

Installation of python in windows, keywords, identifiers, variables, comments, everything is an object. Data types, operators, expressions, statement, input and output, type conversion and debugging.

2.0 Control Statement and Functions

Conditional blocks using if, if..else and if ..elif..else, nested if, while loop, for loop, pass, continue and break statements, Built in functions, function definition and calling, return statement

3.0 Lists, Tuples and Dictionaries

Creating and accessing – lists, tuples and dictionaries

4.0 Files: Creating and reading a .txt and .csv files

Introduction to Python libraries and tools for Civil Engineers

NUMPY, SCIPY, PANDA AND MATPLOTLIB.

5.0 Applications of Python Programming in Civil Engineering

Area and volume calculator for various shapes, Plotting and cross section

From survey data, quantity calculator for wall, slab, footing,

REFERENCE BOOKS:

1. NCERT Textbook for Class XI – Computer Science
2. Think Python, Allen Downey, Green Tea Press
3. Learning Python, Mark Lutz.

CIVIL ENGINEERING DRAWING – II INTEGRATED WITH CAD

Course code	Course title	No of periods / week	Total No. of periods	Marks for formative assessment	Marks for summative assessment	Credits
26CE407L	CIVIL ENGINEERING DRAWING – II INTEGRATED WITH CAD	06	90	40	60	2

TIME SCHEDULE

S.No.	Chapter/Unit Title	No. of Periods	Weightage of marks	No. of Essay Questions	COs Mapped
1.	Culverts	25	30	1	CO1
2.	Public health engineering drawings	20			CO2
3.	Irrigation drawings	25	30	1	CO3
4.	Structural engineering drawings	20			
	Total	90	60	2	

Note: Assessment should be in **practical mode**. The question paper consists of two questions one question is from chapters I and 2 which is manual drawing and second question is from chapters 3 and 4 which is by using CAD.

COURSE OBJECTIVES

Upon completion of course the student shall be able to	
(i)	Draw to scale the different sectional views of culverts and public health engineering structures.
(ii)	Prepare different sectional views of Irrigation Engineering structures and structural engineering drawings using CAD.

COURSE OUTCOMES

CO1	CE407.1	Draw plan, Cross section and longitudinal section of Culverts from given data
CO2	CE407.2	Draw plan, cross section and longitudinal section of Public health engineering works viz., Septic tank, Sanitary block, Overhead tank for a given set of specifications
CO3	CE407.3	Draw Plan, cross section and Longitudinal section of Earthen bund, Tank surplus weir and canal regulator for a given set of specifications. Draw Plan, cross section and Longitudinal section of simply supported beam, one-way slab and isolated column footing using CAD.

LEARNING OUTCOMES

1.0 CULVERTS

1.1 Identify the component parts of the pipe culvert and R.C.C. slab culvert from the given set of specifications.

1.2 Draw the plan, cross sectional elevation and longitudinal sectional elevation of 1. Pipe culvert, 2. R.C.C slab culvert.

2.0 PUBLIC HEALTH ENGINEERING WORKS

2.1 Label the component parts of given Public health engineering structures

2.2 Draw the sectional elevation, plan and cross section of Public health Engineering works viz., septic tank, sanitary block, overhead tank, from the set of given specifications

3.0 IRRIGATION ENGINEERING STRUCTURES BY USING CAD

3.1 Label the component parts of given Irrigation Engineering structures from the given drawings

3.2 Draw the sectional elevation, plan and cross section of different Irrigation engineering structures from the set of given specifications

4.0 STRUCTURAL ENGINEERING DRAWINGS BY USING CAD

4.1 Draw the longitudinal section and cross sections of singly reinforced simply supported beam, prepare schedule of reinforcement and quantity of steel for singly reinforced simply supported beam

4.2 Draw the plan and longitudinal section of one-way slab showing reinforcement details, prepare schedule of reinforcement and quantity of steel for one-way slab showing reinforcement details

4.3 Draw the details of column and square footing (plan and sectional elevation)

CO-PO MAPPING:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	2	3					2	3	2
CO2	1	2	3					2	3	2
CO3	1	2	3					2	3	2
Average	1	2	3					2	3	2

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits ..etc.

COURSE CONTENT

1. SIMPLE CULVERTS

1.1. Pipe culvert (Single Pipe)

1.2. R.C.C slab culvert with square returns.

. 1.3. R.C.C slab culvert with splayed wings

2. PUBLIC HEALTH ENGINEERING DRAWINGS

2.1 Septic tank with details of connections to a dispersion trench/soak pit

2.2 Sanitary block for a public building

2.3 R.C.C. rectangular/square overhead tank

3 IRRIGATION ENGINEERING DRAWINGS BY USING CAD

3.1 Earthen bunds
(a) Homogeneous type (b) Zoned embankment type (c) Diaphragm type

3.2 Tank surplus weir with splayed wing walls.

3.3 Canal regulator

4.0 STRUCTURAL ENGINEERING DRAWINGS BY USING CAD

4.1. Singly reinforced simply supported beam – plan – cross section – longitudinal section – schedule of reinforcement

4.2 One-way slab – plan – cross section – longitudinal section – schedule of reinforcement

4.3 Column with square footing – plan -sectional elevation – schedule of reinforcement

REFERENCE BOOKS:

1. Civil Engineering Drawing-II by Chakraborty -UBS Publications
2. Civil Engineering Drawing-II by Bajaj, Kataria & Raheja -North publication
3. Designing and Detailing handbook SP-34
4. Structural Design and Drawing by N. Krishna Raju.
5. Hydraulic Structures and Irrigation Design and Drawing by N. Balasubramanya

Table specifying the scope of the Syllabus to be covered for Unit Tests

Unit Tests	Learning Outcomes to Be Covered
Unit Test - 1	**1.1 TO 2.2**
Unit Tests - 2	**3.1 TO 4.3**

COMMUNICATION AND EMPLOYABILITY SKILLS

Course code	Course Title	No. Of periods/ week	Total No. of periods	Marks for FA	Marks for SA	Credits
26CE408L	COMMUNICATION AND EMPLOYABILITY SKILLS	4	60	40	60	2

TIME SCHEDULE

S. No.	Chapter/ Unit Title	No. of Periods	COs Mapped
1.	ABC of Communication	6	CO1
2.	Let's Learn to Listen	6	CO2
3.	I am...	4	CO4
4.	Let's Talk About...	4	CO4
5.	JAM	6	CO4
6	Interpreting Data	6	CO3
7	Your Perfect Profile	4	CO5
8	Group Discussion	8	CO4, CO5
9	Interview Skills	8	CO4, CO5
10	Making Presentations	8	CO3
	Total	**60**	

COURSE OBJECTIVES

Upon completion of course the student shall be able to	
(i)	To impart verbal and non-verbal communication skills
(ii)	To foster employability skills among the students for career building

COURSE OUTCOMES

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

CO1	CE408.1	Practise appropriate body language and etiquette
CO2	CE408.2	Listen and comprehend the listening inputs related to different genres effectively
CO3	CE408.3	Interpret data and give oral and written presentations in academic and professional contexts
CO4	CE408.4	Communicate effectively in interpersonal interactions, interviews, and group discussions
CO5	CE408.5	Exhibit employability skills: job hunting, resume writing, and attending interviews

LEARNING OUTCOMES

UNIT 1: ABC of Communication

1.1. Understand and practice the process of communication.
1.2. Demonstrate appropriate body language traits for better communication.
1.3. Apply appropriate strategies to minimize various barriers of communication.
1.4. Communicate effectively in a given situation.

UNIT 2: **Let's Learn to Listen**

2.1. Identify and distinguish different phonic sounds in English language.
2.2. Practice active listening techniques for better comprehension.
2.3. Comprehend diverse listening inputs in academic, professional and everyday situations using appropriate strategies.

UNIT 3: I am...

3.1. Prepare an organised self-introduction for formal and informal situations.
3.2. Introduce yourself in job interviews effectively.
3.3. Demonstrate appropriate body language while introducing yourself.

UNIT 4: Let's Talk About...

4.1. Describe objects, places, events and people using appropriate adjectives.
4.2. Use appropriate sentences and expressions while describing.
4.3. Use suitable adjectives to convey mood or tone.

UNIT 5: JAM

5.1. Generate ideas on a given topic.
5.2. Organise the ideas sequentially for an effective JAM speech.
5.3. Speak spontaneously and fluently on a given topic within the stipulated time.

UNIT 6: Interpreting Data

6.1. Understand different forms of graphs, charts, diagrams and tables.
6.2. Analyse and interpret data.
6.3. Present the inferences and findings in spoken and written communication.

UNIT 7: Your Perfect Profile

7.1. Draft a customised professional resume.
7.2. Create a professional Applicant Tracking System (ATS) compliant Resume.
7.3. Draft a cover letter to communicate with prospective employers.

UNIT 8: Group Discussion

8.1. Understand the significance of group discussion and differentiate the various stages involved.
8.2. Practice various roles and skills involved in group discussion.

8.3. Demonstrate appropriate body language for effective participation in group discussion.

UNIT 9: Interview Skills

9.1. Practice proper interview demeanour.
9.2. Respond effectively to frequently asked interview questions (FAQs).
9.3. Demonstrate readiness for job opportunities.

UNIT 10: Making Presentations

10.1. Practise the principles of good presentation.
10.2. Use appropriate presentational aids.
10.3. Prepare and give presentations on various topics effectively.

CO-PO/PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PS01	PS02	PS03
CO1	POs 1 to 5 are not directly applicable to the English course.							Programme Specific Outcomes are programme-specific, with technical aspects that are not directly applicable to the English Language course.		
CO2										
CO3						2	2			
CO4						2	2			
CO5						2	2			
Average						2	2			

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

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

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quizzes (iv) Library Visits etc.,

COURSE CONTENTS

Sl. No.	Name of the Unit	Contents
1	ABC of Communication	• Aspects of Communication • Body language: Verbal & Nonverbal Communication • Communication Barriers • Strategies for effective communication
2	Let's Learn to Listen	• Basics of pronunciation: Vowel & Consonant sounds • Active vs Passive listening • Barriers to listening • Types of listening& Techniques for effective listening • Listening Comprehension Activities: Academic, Professional, Social conversations

3	I am…	• Significance of self-introduction in formal and informal contexts • Components and structure of self-introduction • Self-introduction in job interviews • Body language while introducing oneself
4	Let's Talk About…	• Describing objects, people, places and events • Using appropriate adjectives for different kinds of descriptions • Using right Tense and tone
5	JAM	• JAM – Structure and organisation • Generating and organising ideas for JAM speech • Dos and Don'ts of JAM • Strategies and techniques for effective JAM speech • Planning a perfect one-minute speech
6	Interpreting Data	• Presentation of data in Graphs, Charts, diagrams, and tables • Analysing and interpreting non-verbal data • Presenting non-verbal information in verbal form (spoken and written)
7	Your Perfect Profile	• Significance of a resume in career building • Resume, Curriculum Vitae (CV) and Bio-data • Applicant Tracking System (ATS) Resume – components and structure • Video Resume • Drafting a Cover letter
8	Group Discussion	• Significance of Group Discussion (GD) in job hunting • Process of Group Discussion • Sub skills of Group Discussion • GD Roles and Group dynamics • GD body language • Techniques for success in GD
9	Interview Skills	• Significance of Interviews in the Job Selection Process • Stages of Interview Preparation: Pre, While, and Post interview • Right demeanour and body language for interviews • Frequently Asked Questions (FAQs)
10	Making Presentations	• Principles of good presentation • Types of Presentational aids • Presentation etiquette • Giving effective presentations

REFERENCE BOOKS

1. T. Balasubramaian, "*A Textbook of English Phonetics for Indian Students*", Macmillan (2009)
2. J.D. O'Connor, "*Better English Pronunciation*", Cambridge (1980)
Anand. S. Ganguly, *Group Discussion for Admissions and Jobs* (2010)
3. E. Suresh Kumar and P. Sreehari, *Communicative English*, Orient Blackswan (2019)

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST I & II

UNIT TEST	Learning Outcomes to be Covered
UNIT TEST – I	From 1.1 to 5.3
UNIT TEST – II	From 6.1 to. 10.3

SURVEYING THEORY & PRACTICE -III

(Practicum-Practical)

Course code	Course Title	No. of periods/ week	Total No. of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE409L	SURVEYING THEORY & PRACTICE-III	06	90	40	60	2

TABLE CONTENTS

Survey Camp: *one of the following Surveying activity involving Total Station operations shall be allotted to one or two batches of the students:*

a) Land Survey
b) Road Survey
c) Contour Survey
d) Other Surveys

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Develop knowledge about Modern surveying instruments & methods adopted to carry out Field Survey with a professional approach.
(ii)	Develop skills in students in using Total Station, GPS and acquire knowledge in drone and digitization of Maps

COURSE OUTCOMES

CO1	CE409.1	Apply the knowledge of Total Station in different operations in Civil Engineering projects
CO2	CE409.2	Perform precise operations/skills involved in using GPS , Drones and digitization of Maps.

LEARNING OUTCOMES

1.0. INTRODUCTION TO TOTAL STATION

1.1 List components of total station
1.2 Explain working of Total station . Angle, Distance, Coordinate Calculation.
1.3 Explain data storage and processing
1.4 State the principles involved in total station, Triangulation, Trigonometry, EDM.
1.5 List Applications of total station.

2.0. FIELD EXERCISES USING TOTAL STATION

2.1 Setting of Total Station
2.2 Conduct traversing survey (closed Traverse).
2.3 Find the Height and width of an elevated object.
2.4 Determine the elevation of Instrument point.
2.5 Perform a station setup on a known point by back sighting.
2.6 Mark or establish points, Lines and Arcs on the ground.
2.7 Mark Centre line of a building on the ground.
2.8 Conduct survey for L.S and C.S of a proposed road/canal/pipe line on the ground.
2.9 Perform post processing.
2.10 Extracting data to CAD software and excel sheet.
2.11 Plot contour map of an area using surfer software.

3.0. GLOBAL POSITIONING SYSTEM

3.1 Identify the components and the functions of Global Positioning System.
3.2 Determine the Coordinates of various points on the ground.
3.3 Perform the linking the G.P.S data with Total Station.

4.0. DRONE SURVEY

4.1 Introduction to drone, regulations of DGCA, drone licence.
4.2 Pre and post flight planning
4.3 Flight execution , photography and data collection
4.4 Know about Software workflow for interpretation of data. Brief introduction to any tools like Pix4d, Agisoft metashape and Bentley context capture.
4.5 Application of drone in surveying , mapping and construction site monitoring.

5.0. DIGITIZATION OF MAPS

5.1 Study the concept of digitization.
5.2 Digitization of any given contour map Using the available soft wares
5.3 Digitization of given Town map and creating different layers for roads, railways, water supply lines and drainage lines etc., Using the available soft wares

CO-PO MAPPING:

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2	3	2	2	2	3	2	3
CO2	2	3	3	2	2	3	2	3	2	3
Average	2	2.5	2.5	2.5	2	2.5	2	3	2	3

Note : The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Techfests (ix) Mini project works (x) Library visits ..etc.

COURSE CONTENT

1.0 INTRODUCTION TO TOTAL STATION

a) Components of total station
b) Working of Total station. Angle, Distance, Coordinate Calculation.
c) Data storage and processing
d) Principles involved in total station, Triangulation, Trigonometry, EDM.
e) Applications of total station

2.0 FIELD EXERCISES USING TOTAL STATION

a) Study of component parts, accessories and functions Total Station, Initialization of Total Station over ground station and measure the distance between two given points, Measure area of given field.
b) Conduct traversing survey (closed Traverse).
c) To find Height and width of an elevated object.
d) To determine the elevation of Instrument point by making observation to point with known elevation, to measure multiple sets (rounds) of observations.
e) To perform a station setup on a known point by making observations to one or more back sight points and to establish the position of an occupied point relative to a base line or a boundary line.
f) To mark or establish points, Lines and Arcs on the ground.
g) To mark Centre line of a building on the ground.
h) L.S and C.S of proposed road/canal/pipe line on the ground.
i) Understand post processing.
j) To plot contour map of an area using surfer software.

3.0 GLOBAL POSITIONING SYSTEM

a) Identifies the components and the functions of Global Positioning System.
b) Determines the Coordinates of various points on the ground.
c) Linking the G.P.S data with Total Station.

4.0 DRONE SURVEY

a) Introduction to drone, regulations of DGCA, drone licence
b) Pre and post flight planning
c) Flight execution, photography and data collection
d) Know about Software workflow for interpretation of data. Brief introduction to any tools like Pix4d, Agisoft metashape and Bentley context capture.
e) Application of drone in surveying , mapping and construction site monitoring.

5.0 DIGITIZATION OF MAPS

a) Study the concept of digitization.
b) Digitization of any given contour map Using the available soft wares like QGIS.
c) Digitization of given Town map and creating different layers for roads, railways, water supply lines and drainage lines etc., Using the available soft wares

KEY COMPETENCIES TO BE ACHIEVED BY THE STUDENT

S.NO.	Experiment Title	Key Competency
1	Field Exercises using Total Station	• Places total station on tripod, checks batteries and switches on total station • Centering of total station over a given point and sighting reflecting prism to measure distance

		• Measure area of given field • Conduct traversing survey (closed Traverse) and gets plotting • Finds Height and width of an elevated object • Finds the elevation of Instrument point by making observation to point with known elevation • Understands errors by taking multiple sets (rounds) of observations • Knows station setup on a known point by making observations to one or more back sight points • Establish the position of an occupied point relative to a base line or a boundary line • Establish points, Lines and Arcs on the ground • Locates Centre line of a building on the ground • Collects data for L.S and C.S of proposed road/canal/pipe line on the ground • Understand post processing • Plots contour map of an area using SURFER software
2	Global Positioning System	• Identifies the parts and the functions and learns operating GPS • Determines the Coordinates of various points on the ground • Linking the G.P.S data with Total Station
3	Drone survey	• Identify different parts of drone and control module , check for battery • Executing the flight and photographing. • Data collection and interpretation
4	Digitization of Maps	• Understands software • Digitizes of any given contour map using available software. • Digitizes of given Town map and creating different layers for roads, railways, water supply lines and drainage lines etc., Using the available software.

Table specifying the scope of the Syllabus to be covered for Unit Tests

Unit Tests	Learning Outcomes to Be Covered
Unit Test - 1	**1.1 TO 3.3**
Unit Tests - 2	**4.1 TO 5.2**

V SEM

DIPLOMA IN CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND MODEL BLUEPRINT FOR EVALUATION

V SEMESTER

Course Code	Course Title	No. of Periods/week		Practicum (Y/N)	Total No. of Periods/Year	Credits	Scheme Of Examination			
		Theory	Practical				Duration (Hours)	FA (Marks)	SA (Marks)	Total Mar
THEORY COURSES										
26CE501T	Steel Structures	6	---	N	90	5	3	30	70	100
26CE502T	Water Supply and Sanitary Engineering	6	---	N	90	4	3	30	70	100
26CE503T	Transportation Engineering	5	---	N	75	3	3	30	70	100
ELECTIVE COURSES										
26CE504E	Construction Management & Entrepreneurship	3	---	N	45	2	3	30	70	100
26CE505E	Geotechnical Engineering	3	---	N	45	2	3	30	70	100
AUDIT COURSE										
26CE506A	Advanced Civil Engineering Technologies	2	---	N	30	--	-	-	-	-
PRACTICAL COURSES										
26CE507L	Field Practice	---	7	N	105	2	3	40	60	100
26CE508L	Computer Applications for Civil Engineering	---	6	N	90	2	3	40	60	100
26CE509P	Project work	---	4	N	60	1.5	3	40	60	100
26CE510C	Student Centric Activities	---	3	N	45	0.5	-	-	-	-
	TOTAL	**22**	**20**		**630**	**20**	**-**	**240**	**460**	**700**

Note: 0.5 credits will be awarded for student centric activities based on the participation in the extracurricular activities like NSS/NCC/Clean and Green or Sports/Games

STEEL STRUCTURES

Course code	Course title	No. Of period / week	Total no. Of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE501T	STEEL STRUCTURES	06	90	30	70	5

TIME SCHEDULE

S. No.	Chapter/ Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	CO's Mapped
1.	Fundamentals of Limit State Design of Steel structures	05	3	1	-	CO1
2.	Design of fillet welded joints	14	22	1	2	CO2
3.	Design of Tension members	14	22	2	2	CO3
4.	Design of Compression members, Columns &Column bases	23	25	3	2	CO4
5.	Design of Beams	22	25	3	2	CO5
6.	Roof Trusses	6	3	1	-	CO5
7	Portable Cabins / Prefab Modular Structures	6		1	-	CO5
	Total	90	100	12	8	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Understand the fundamentals of Limit state design of steel structures and design aspects of fillet welded joint.
(ii)	Design tension members, compression members and flexural members by following IS Codal provisions.

COURSE OUTCOMES

CO1	CE501.1	Explain the fundamentals of limit state design of steel structures.
CO2	CE501.2	Design Fillet Welded Joints
CO3	CE501.2	Design of Tension Members in Steel Structures
CO4	CE501.3	Design Compression Members, Columns and Column bases
CO5	CE501.4	Design Steel Beams and State different types of roof trusses, their suitability and Portable Cabins.

LEARNING OUTCOMES:

1.0 FUNDAMENTALS OF LIMIT STATE DESIGN OF STEEL STRUCTURES

1.1 State common types of steel structures, their merits and demerits.
1.2 List the loads considered in the design of steel structures as per I.S:875- 1987 and describe them
1.3 Understand the code of practice I.S. 800-2007
1.4 List physical and mechanical properties of structural steel.
1.5 Sketch different types of rolled steel sections and explain its classification based on their cross sections.
1.6 List types of elements.
1.7 Explain the concept of Limit State Design, define 'limit state' and state the types.
1.8 Define Characteristic action, Design action and Design strength.
1.9 State the partial safety factor values for loads in limit state of strength and serviceability and for materials in limit state.
1.10 State the deflection limits for Simply supported beam, Cantilever beam and Purlins

2.0 DESIGN OF FILLET WELDED JOINTS

2.1 State different types of joints.
2.2 Differentiate the welded joints and Riveted joints
2.3 Sketch the different forms of welded joints.
2.4 Explain the features of a fillet welded joint.
2.5 State stresses in welds as per I.S.800-2007.
2.6 State formula for design strength of a fillet welded joint.
2.7 Calculate the design strength of a fillet welded joint.
2.8 Design a fillet welded joint for a single angle and double angle sections.

3.0 DESIGN OF TENSION MEMBERS

3.1 Define 'tie'
3.2 State the applications of tension members.
3.3 Sketch different forms of tension members and understand their behaviour of tension members.
3.4 State and describe different modes of failures of tension members with sketches
3.5 State the maximum values of effective slenderness ratios as per code.
3.6 Determine the net effective area of single angle section connected to a gusset plate by welding.
3.7 Determine the design strength due to yielding of gross section, rupture of critical section and block shear failure of a single angle section connected by welding
3.8 Understand design procedure of tension members. Design a single angle tension member connected by welding only.

4.0 DESIGN OF COMPRESSION MEMBERS, COLUMNS AND COLUMN BASES

4.1 Understand, State and sketch different types of compression members (like column, strut)
4.2 Sketch different forms of compression members and understand their behaviour and state the classification of cross sections.
4.3 Define the terms 1. Least radius of gyration and 2. Slenderness Ratio and distinguish between actual length and effective length and also state effective lengths to be used for different end conditions.
4.4 Understand buckling class of cross section based on Imperfection factor, stress reduction factor and column buckling curves and state maximum values of effective slenderness ratios as per code

4.5 Understand the design compressive stress for different column buckling Classes, Determine the design strength of compression members
4.6 Understand design procedure of compression members and design of columns with I sections and built-up channel sections.
4.7 Understand design details , effective sectional area , codal provisions for angle struts and design single angle and double angle struts.
4.8 Understand codal provisions of lacing and battening systems for built-up columns.
4.9 Design a slab base along with a cement concrete pedestal and also design the welded connection.

5.0 DESIGN OF STEEL BEAMS

5.1 Understand the concept of limit state design of beams , Define the terms: Elastic moment of resistance, Plastic moment of resistance, Elastic section modulus, Plastic section modulus and Shape factor.
5.2 Determine the shape factor values for rectangular, Tee and I-sections.
5.3 Understand the behaviour of steel beams, classify beams based on lateral restraint of compression flange.
5.4 Determine the design strength in bending (flexure) and in shear for laterally supported beams and list the factors affecting lateral stability and influence of type of loading.
5.5 Distinguish between web buckling and web crippling and understand the failure of beams by flexural yielding and list the types of failure of beams by flexural yielding
5.6 Understand laterally supported beam, holes in tension zone, shear lag effects and design bending strength.
5.7 Understand laterally unsupported beam, lateral torsional buckling of beams (theoretical concept only – no problems) and explain effective length of compression flanges.
5.8 Understand concept of shear in beams and resistance to shear buckling., shear buckling design methods like Simple post critical method and Tension field method and also understand the design of simple beams with solid webs.
5.9 Understand component parts of plate girders with sketches and describe different types of Stiffeners with their suitability.
5.10 Design laterally supported simply supported beam considering all codal requirements.

6.0 ROOF TRUSSES

6.1 List types of trusses viz., Plane trusses and Space trusses.
6.2 Understand the situations where roof trusses are used.
6.3 Sketch different types of roof trusses with their suitability for a given span.
6.4 Sketch a roof truss and name the component parts.
6.5 Understand the configuration of trusses like Pitched roof and Parallel chord trapezoidal trusses.
6.6 Understand cross sections of truss members.
6.7 Understand the loads on roof trusses as per I.S – 875-2015
6.8 Calculate live load on roof covering and live load on truss.

7.0 PORTABLE CABINS / PREFAB MODULAR STRUCTURES

7.1 Explain Design considerations and Planning of portable cabins
7.2 List the different construction Techniques and Installation
7.3 Explain Safety and Regulations
7.4 State specific application of portable cabins
7.5 Explain Maintenance and Repair of portable cabins

CO-PO MAPPING:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	3					3		3
CO2	2	3	2					3		3
CO3	2	3	2					3		3
CO4	2	3	1					3		3
CO5	3	2	2					3		3
Average	2.4	2.6	2					3		3

Note : The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc

COURSE CONTENT

1. FUNDAMENTALS OF LIMIT STATE DESIGN OF STEEL STRUCTURES

Merits and demerits of steel structures – Loads considered in the design of steel structures as per I.S:875 -2015 – Introduction to I.S. 800-2007 – Mechanical properties of structural steel – yield stress (f_y), ultimate tensile stress (f_u) and maximum percent elongation (table -1 of IS:800-2007) – Standard structural sections – Classification of cross sections – class 1(plastic) class2(compact) class3(semi compact) and class4(slender) – types of elements – internal elements, outstands and tapered elements – Concept of Limit State Design – limit state of strength – limit state of serviceability – classification of actions – strength – partial safety factors for loads and materials – deflection limits.

2. DESIGN OF FILLET WELDED JOINTS

Different types of joints – lap joints – butt joints – Differentiation of welded joints and riveted joints – Different forms of welded joints – sketches of fillet and butt weld joints – Fillet welded joint – detailed sketch showing the component parts – Stresses in welds as per I.S.800-2007 – Codal requirements of welds and welding – Problems on calculation of strength of a fillet welded joint – Design of fillet welded joint for a given load, thickness of a plate and permissible stresses as per code – Design of fillet welded joint for single or double angle sections carrying axial loads.

3. DESIGN OF TENSION MEMBERS

Introduction – different forms of tension members – Behaviour of tension members – Different modes of failures – gross section yielding, net Section rupture and block shear failure – Maximum values of effective slenderness ratios as per code – Calculation of net effective sectional area of single angle with welded connection only – Calculation of the design strength due to yielding of gross section, rupture of critical section and block shear – problems on single angle with welded connection only – Design procedure of tension members – Problems on design of tension members single angle with welded connection only.

4. DESIGN OF COMPRESSION MEMBERS, COLUMNS AND COLUMN BASES

Introduction – different forms of compression members – Behaviour of compression members – classification of cross sections – class 1 (plastic), class2 (compact), class3 (semi compact) and class4 (slender) – Effective lengths to be used for different end conditions – table 11 of I.S:800 – Buckling class of cross section – imperfection factor and stress reduction factor for different buckling classes – column buckling curves – Maximum values of effective slenderness ratios as per code – design compressive stress for different column buckling classes – Calculation of design strength of compression members – problems – Design procedure of compression members –

problems on simple sections only (no built-up sections) – Design details – effective sectional area – codal provisions for angle struts – single angle and double angle – discontinuous and continuous struts –Codal provisions of single / double lacing and battening for built-up columns (no problems) – Design of slab base along with a cement concrete pedestal, design of welded connection of base plate and column – problems.

5. DESIGN OF STEEL BEAMS

Concept of limit state design of beams – shape factor and plastic properties of beams – Problems on shape factor – Behaviour of steel beams – design strength in bending (flexure) – Factors affecting lateral stability – influence of type of loading – web buckling and web crippling – Beams failure by flexural yielding – Laterally supported beam – holes in tension zone – shear lag effects – design bending strength – lateral torsional buckling of beams – (theoretical concept only – no problems) – Effective length of compression flanges - Concept of shear in beams – resistance to shear buckling – Shear buckling design methods – simple post critical method – tension field method – Design of laterally supported simple beams with solid webs – Component parts of plate girders with sketches – brief description of different types of stiffeners - Design of laterally supported simply supported beam considering all codal requirements.

6. DESIGN OF ROOF TRUSSES

Types of trusses – plane trusses, space trusses – Sketches of different roof trusses with their suitability for a given span – Cross sections of truss members – Loads on roof trusses as per I.S. 875 -2015 –Determination of live load given pitch of the truss.

7. PORTABLE CABINS / PREFAB MODULAR STRUCTURES

Introduction – Design considerations and Planning – Construction and Installation – Safety and Regulations – Specific Applications- Maintenance and Repair

REFERENCE BOOKS:

1. IS 800-2007 –Indian Standard; General construction in steel — code of practice
2. Design of Steel Structure; by N Subramanian, Oxford University Press, New Delhi.
3. Limit state design of steel structures by S K Duggal, Tata McGraw Hill Education, New Delhi
4. Fundamentals of structural steel design M L Gambhir, Tata McGraw Hill Education Private Limited, New Delhi
5. Steel Structures: Design and Practice by N Subramanian, Oxford Publishers, New Delhi
6. Design of steel structure by Limit State Method as per IS 800- 2007 by Bhavikatti S S, I.K. International Publishing House, New Delhi
7. Limit state design of Steel Structure by Ramchandra & Gehlot, Scientific Publishers, Pune.
8. Teaching Resource Material : http://www.steel-insdag.org
9. Hybrid Structure Construction & Portable Cabins-e MAGAZINE-March 2025-Constrofacilitator

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.8
Unit Test – II	From 4.1 to 7.5

WATER SUPPLY & SANITARY ENGINEERING

Course code	Course title	No. Of period / week	Total no. Of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE502T	WATER SUPPLY AND SANITARY ENGINEERING	06	90	30	70	4

TIME SCHEDULE

S. No.	Chapter/ Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	CO's Mapped
1	Water Supply Scheme & Sources and Conveyance of Water	14	14	2	1	CO1
2	Quality and Purification of Water	20	22	2	2	CO1
3	Introduction to Sanitary Engineering & Quantity of Sewage	6	11	1	1	CO2
4	Laying of Sewers & Sewer appurtenances	10	11	1	1	CO2
5	Characteristics of Sewage, treatment & disposal	20	25	3	2	CO2
6	Solid waste management and rural sanitation	20	17	3	1	CO3
	Total Periods	90	100	12	8	
7	Field visits	Three field visits are recommended for each CO i.e, 1) Water intakes, Water purification plant. 2) Sewerage systems, Sewage Treatment plants 3) Solid waste management facility, Bio-medical waste treatment facility.				

COURSE OBJECTIVES:

Upon completion of course the student shall be able to	
(i)	Familiarise with basic knowledge on Sustainable Development goals(SDG), Importance of water supply and sanitation, water supply scheme. Understand the sources, quality & quantity, collection, conveyance, testing and treatment techniques of water.
(ii)	Understand various operations involved in water treatment process

(iii)	Learn basic knowledge of the sanitary Engineering, Sewerage works, methods of sewage collection, basic concepts of design of sewers, their laying with appurtenances. Explain the methods of sewage treatment
(iv)	Types and Characteristics of solid waste. Methods of solid waste collection and disposal. Concept of bio-mining in landfills(Material Recovery, Land Recovery) and Sanitation in Rural areas for material and land recovery.

COURSE OUTCOMES:

CO1	CE502.1	Understand about the importance of water supply scheme, quality, quantity and standards of water. Describe various methods of water purification
CO2	CE502.2	Explain about various types of sewerage works and sewer laying procedure. Explain various methods of sewage treatment and sludge disposals.
CO3	CE502.3	Describe type, characteristics of solid waste. Explain various methods of collection and disposals of solid waste. Categorize various operations involved for effective use in solid waste management. Explain various concepts in rural sanitation.

LEARNING OUTCOMES:

1. WATER SUPPLY SCHEME, SOURCES AND CONVEYANCE OF WATER

1.1. Explain the importance of water supply scheme in relevant to Sustainable Development Goals(SDG) of UN ,(Goal 6).
1.2. States the need for protected water supply, objectives of protected water supply scheme.
1.3. Define Per capita demand .List the factors affecting per capita demand . Explain the variation in demand for water supply.
1.4. Estimate the quantity of water required by different towns in relevant to various methods of forecasting population.
1.5. State the common sources of water for a water supply scheme, different types ,merits and demerits of surface and sub surface water sources, salient features of surface sources and explain various types of intakes with sketches.
1.6. Define Aquifer, Aquiclude and Ground water table, Classify wells according to construction.
1.7. Explain with sketches: Infiltration galleries and Infiltration wells
1.8. Explain different methods of conveyance of water, merits and demerits of different types of pipes, different joints used for connecting pipes with sketches, method of Pipe laying and testing.

2. QUALITY AND PURIFICATION OF WATER

2.1. State different types of impurities, need for laboratory tests, explain the method of obtaining samples for testing, different tests for analysing quality of water with their significance.
2.2. Explain the importance of chemical and bacteriological analysis of water used for domestic purpose.
2.3. State the various water borne diseases in India, State the maximum acceptable limits of Turbidity, Hardness, Nitrates and Fluorides for the public drinking water. (WHO limits) as per WHO standards.
2.4. State the objectives of treatment of water, Sketch the layout of a water treatment plant indicating the different stages.
2.5. State the objectives and explain the process of Aeration, Plain sedimentation, Sedimentation with coagulation, Filtration and Disinfection.
2.6. Describe different types of sedimentation tanks.

2.7. Describe the construction and operation of slow sand filters, Rapid sand filters and pressure filters and compares them.
2.8. Define disinfection of water, Explain the need for disinfecting water, methods of disinfection of water and types of Chlorination.
2.9. List the substances responsible for causing colour, taste and odour, Explain the temporary hardness and permanent hardness, various methods of removal of hardness.
2.10. Describe reverse osmosis method, merits and demerits.

3. INTRODUCTION TO SANITARY ENGINEERING AND QUANTITY OF SEWAGE

3.1. State the objectives of sewage disposal works.
3.2. Define the terms: Sewage, Sewer and Sullage, Sewerage, Refuse and Garbage
3.3. List the objectives of sewerage works and explain various methods of sewage collection works and compare them.
3.4. Explain the different sewerage systems, compare them, discuss their suitability
3.5. State the main constituents of sewage. Define Dry weather flow, discuss the factors affecting, state the factors affecting the quantity of storm sewage and explain the variation in rate of sewage.
3.6. List the requirements of good surface drains, explain different types of surface drains with their merits and demerits.

4. LAYING OF SEWERS AND SEWER APPURTENANCES

4.1. State various shapes of sewers, explain them with sketch, discuss their merits and demerits.
4.2. Mention different materials used for sewers discuss their merits and demerits.
4.3. Explain the method of laying the sewers as per given alignment, and the necessity of providing sewer appurtenances on the sewer lines.
4.4. Explain the construction, function and location of the different sewer appurtenances.
4.5. Describe the testing of sewers.

5. CHARACTERISTICS OF SEWAGE, TREATMENT AND DISPOSAL

5.1. Define strength of sewage, describe the method of sampling sewage.
5.2. State the physical, chemical and biological characteristics of sewage.
5.3. Define C.O.D and B.O.D. State the significance of tests like i) Total Solids (ii) C.O.D. (iii) B.O.D. (iv) PH Value (v) Chlorides.
5.4. State the characteristics of industrial waste water, explain the principles of treatment of industrial waste water.
5.5. State the objectives of sewage treatment. Draw the conventional sewage treatment plant of a town and indicate the units.
5.6. State the function of screens, skimming tanks and grit chambers and explain their working.
5.7. Explain with sketch wherever necessary the treatment works: Sedimentation tank, Trickling filters, Activated sludge process, Sludge digesters
5.8. Compare activated sludge process and trickling filters. List out various methods of sludge disposal and briefly explain them.
5.9. Explain with sketch the treatment of sewage by septic tank and soak pit.
5.10. List and explain the various methods of sewage disposal.

6. SOLID WASTE MANAGEMENT AND RURAL SANITATION

6.1. Explain the types, characteristics of solid waste and source segregation of solid waste
6.2. Describe various methods of disposals of solid waste, merits and demerits
6.3. Concept of bio-mining in land fills and landfill management
6.4. State Vermi composting and explain the procedure of Vermi composting and mention its advantages.

6.5. Describe with sketches the construction of sanitary latrines in rural areas.
6.6. Describe bio-methanation method. Explain briefly about bio gas plant. State the advantages of biogas plant, factors on which the production of biogas depend.

CO – PO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2		2	2		2	2		2
CO2	3	3		3	3		3	3		3
CO3	1	1		1	1		1	1		1
Average	2	2		2	2		2	2		2

COURSE CONTENT

1. WATER SUPPLY SCHEME &SOURCES AND CONVEYANCE OF WATER

General importance of water supply-Sustainable development goals(SDG)-GOAL 6 –Development of Water supply–Need for protected Water supply-Flow chart of a typical water supply scheme– Total quantity of water for a town, per capita demand and factors affecting demand - Water requirements for domestic purposes, industrial use, firefighting, commercial and institutional needs, public use – Variation in demand peak demand – seasonal, daily and hourly variation– Forecasting population by arithmetical, geometrical and incremental increase methods-problems on above methods.

Surface sources Lakes, streams, rivers and impounded reservoirs – Underground sources-springs, wells, infiltration wells and galleries – Yield from wells by constant pumping and recuperation tests. (No problems required) - Comparison of surface and subsurface sources Types of intakes - Reservoir intake, River intake, Canal intake, Lake Intake - Conveyance of water-open channels, aqueduct pipes - Pipe Materials C.I Pipes, Steel Pipes, concrete pipes, A.C. Pipes, G.I. Pipes Plastic Pipes (PVC &HDPE), merits and demerits of each type - Pipe joints spigot and socket joint, flange joint, expansion joint for C.I. Pipe, joints for concrete and asbestos cement pipes - Pipe Laying and testing, Leak detection, prevention and rectification.

2. QUALITY AND PURIFICATION OF WATER.

Impurities of water-need for laboratory test – sampling-grab and composite sampling– Tests of water-Physical, chemical and bacteriological tests – P**H** value of water. – Standard quality for domestic use(WHO standards) and industrial purposes - Flow diagram of different treatment units. –Aeration-methods of aeration- Sedimentation plain sedimentation and sedimentation with coagulation - Filtration -Construction and operation of slow sand, rapid sand and pressure filters - Disinfection of water - necessity and methods of chlorination, prechlorination, break point chlorination - Colour, taste and odour control. Hardness – Types of Hardness Removal of hardness. Reverse osmosis method-merits and demerits. NOTE: No design of treatment units.

3.INTRODUCTION TO SANITARY ENGINEERING AND QUANTITY OF SEWAGE

Objective of providing sewerage works - Definition of terms : sullage, sewage, sewer and sewerage – classification of sewage - Systems of sewage disposal water carriage system –Types of sewerage systems and their suitability – separate, combined and partially separate systems –Quantity of discharge in sewers, dry weather flow, variability of flow surface drainage - requirements, shapes, laying and construction.

4.LAYING OF SEWERS AND SEWER APPURTENANCES

Different shapes of cross section for sewers – circular and non-circular – merits and demerits of each - Brief description and choice of types of sewers - stone ware, cast iron, cement concrete sewers and A.C Pipes - Laying of sewer - setting out, alignment of sewer, excavation, checking the gradient , preparation of bedding, handling, lowering, laying and jointing, testing and back filling - Brief description - location, function and construction of Manholes, Drop manholes, Street inlets, Catch basins.

5.CHARACTERISTICS OF SEWAGE, TREATMENT & DISPOSAL

Strength of sewage - sampling of sewage, characteristics of sewage - physical, chemical and biological Analysis of sewage – significance of the following tests for Total Solids, C.O.D, B.O.D, Ph Value, Chlorides - brief Characteristics of Industrial waste water–principles of treatment– Preliminary treatment; Brief description and functions of following units Screens, Skimming tanks and Grit chambers; Primary treatment - Brief description and functions of Plain sedimentation, Secondary treatment - Brief description of Trickling filters, Activated sludge process; Sludge digestion – Process and methods of sludge disposal - Miscellaneous treatments - septic tank.-Construction and uses of soak-pit. Sewage disposal dilution, disposal on to lands, ground water recharge, reuse etc.

6.SOLID WASTE MANAGEMENT AND RURAL SANITATION

Different types, Characteristics of solid waste-Different methods of collection of solid waste Source segregation of solid waste-Methods of disposals of solid waste – various operations involved in effective solid waste management- Concept of bio mining in landfill- and sanitary latrines, soak pits-Biogas production technology (bio methanation) brief description and operational details of biogas plants using animal waste, night soil and agricultural wastes.

REFERENCE BOOKS:

1.Water Supply & Sanitary Engineering – Including Environmental Engineering & Pollution Control Act's, G. S. Birdie, Dhanapati Rai publishing company
2.Elements of Environmental Engineering, K.N. Duggal, S. Chand Publications
3.Textbook of Water Supply and Sanitary Engineering, S.K. Hussain, CBS Publishers and distributors Pvt Ltd.
4.Environmental Engineering, N.N.Basak, Tata Mc Graw-Hill education
5. Water Supply Engineering, Santosh Kumar Garg, Khanna Publishers

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.6
Unit Test – II	From 4.1 to 6.6

TRANSPORTATION ENGINEERING

Course code	Course title	No. Of period/ week	Total no. Of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE503T	TRANSPORTATION ENGINEERING	05	75	30	70	3

TIME SCHEDULE

S. No.	Chapter/ Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	CO's Mapped
1	Introduction to Highways and Geotechnical Engineering.	14	14	2	1	CO1
2	Highway Surveys and Traffic Engineering	13	19	1	2	CO2
3	Highway Construction and Maintenance	15	25	3	2	CO3
4	Introduction to and Permanent way of Railways	13	14	2	1	CO4
5	Station yards and Maintenance of Railways	10	14	2	1	CO4
6	Basics of Bridge Engineering	10	14	2	1	CO5
	Total	75	100	12	8	

COURSE OBJECTIVES

Upon completion of course the student shall be able to	
(i)	Understand the functions of various components of roads and learn the fundamentals of Geotechnical Engineering
(ii)	Understand the importance of surveys, alignment and geometric features of Highways, bridges and Railways.
(iii)	Differentiate between types of highway pavements, their construction and maintenance
(iv)	Understand the concepts of permanent way, points and crossings, station yards in railways, basics terms used in bridge engineering and state different types of bridges.

COURSE OUTCOMES:

CO1	CE503.1	Explain the technical terms of highway cross-section and terms of related to highway engineering
CO2	CE503.2	Describe different surveys to be conducted for fixing the alignment of highway.
CO3	CE503.3	Discuss the (i) construction of roads (ii) equipment used for high way construction (iii) Maintenance of WBM Road

CO4	CE503.4	Describe the components of (i) Permanent way (ii) Station Yards (iii) Maintenance measures of a railway track
CO5	CE503.5	Explain the basics of bridge engineering.

LEARNING OUTCOMES

1.0 INTRODUCTION TO HIGHWAYS AND GEOTECHNICAL ENGINEERING

1.1. State the importance of transportation engineering.
1.2. State the importance of I.R.C & List the functions of I.R.C
1.3. Classify roads as per I.R.C
1.4. Define the terms: 1. Width of pavement, 2. Shoulder,3. Formation width, 4. Right of way, 5. Camber, 6. Gradient, 7. Super elevation, 8. Sight distance.
1.5. Explain the components of a road with a sketch.
1.6. State: 1. Ruling gradient, 2. Limiting gradient, 3. Exceptional gradients
1.7. State recommended values of gradients as per I.R.C
1.8. State the need for providing super elevation and write the formula for super elevation
1.9 State the need for curves in highways and state the different types of horizontal curves adopted in roads. State the different types of vertical curves adopted in road
1.10. List physical properties of soils & define the following properties of soils: 1. Plasticity, 2. Cohesion, 3. Consolidation, 4. Compaction, 5. Permeability, 6. Compressibility
1.11. State the different systems of classification of soils & explain the textural classification of soils and I S Classification of soils.
1.12. Define the following terms: Ultimate bearing capacity of soil, Safe bearing capacity, and Net bearing capacity.

2. HIGHWAY SURVEY AND TRAFFIC ENGINEERING

2.1. Define alignment of road.
2.2. State the factors influencing selection of alignment for a road in plain and hilly areas.
2.3. List the surveys required for fixing alignment.
2.4. Explain various engineering surveys conducted to fix the alignment of a road.
2.5. State the different data required for the preparation of highway project.
2.6. State the importance of traffic census/traffic surveys.
2.7. List various traffic surveys conducted.
2.8. Explain the following with sketches: Traffic islands, Interchanges.
2.9. State types of pavement markings with sketches and state their functions
2.10. State the purpose of traffic signs. State the functions of traffic signs with sketches.

3. HIGHWAY CONSTRUCTION AND MAINTENANCE

3.1. State the need for road drainage.
3.2. Explain the methods of providing surface and sub-surface drainage.
3.3. State the materials used in construction of bituminous, cement concrete and WBM roads
3.4. List the tests on Bitumen.
3.5. State the equipment/machinery used in construction of different roads.
3.6. Explain the methods of construction of different types of roads.
3.7. Explain the maintenance of WBM of roads.
3.8. State the need for joints in C.C roads.
3.9. Explain the different types of joints used in C.C roads with sketches.
3.10. List different types of software used in highway planning and designing

4. INTRODUCTION TO PERMANENT WAY OF RAILWAYS

4.1. State the advantages of Railways.
4.2. Define gauge and Classify gauges.
4.3. State the component parts of a permanent way
4.4. List the functions of each component part of a permanent way
4.5. State the requirements/characteristics of good rail, Rail joint, Sleeper and Ballast.
4.6. State the different types of Rails, Joints, Rail fittings, Sleepers, Ballast used in Indian Railways with sketches (wherever required).

5. STATION YARD AND MAINTENANCE OF RAILWAYS

5.1 Describe different types of turnouts with sketches.
5.2 Describe different types of crossings with sketches
5.3 Classify stations.
5.4 State different maintenance measures of a railway track.
5.5 State the duties of a permanent way inspector.
5.6 List different types of software used in railway planning and design.

6. BASICS OF BRIDGE ENGINEERING

6.1. Classify the bridges based on materials, position of bridge floor and form/type of super structure.
6.2. Define the terms: Waterway, Linear waterway, Afflux, Vertical clearance, Scour depth, and Free board.
6.3. State the factors influencing selection of site for a bridge.
6.4. State component parts of a bridge sub-structure with sketches
6.5. List the functions of a bridge sub-structure
6.6. Distinguish between deck and through bridge.
6.7. Draw different types of bridge super structures.
6.8. List different types of 1. Causeways and 2. Culverts.
6.9. State suitability of different types of culverts and causeways.
6.10. Sketch different types of causeways and culverts

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2						2	3	3
CO2	2	3						2	3	3
CO3	3	2		2	2			2	3	3
CO4	3	3		2	2			2	3	3
CO5	3	3						2	3	3
Average	2.6	2.6		2	2			2	3	3

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Field visits (viii) Tech fests (ix) Mini project works (x) Library visits etc.

COURSE CONTENT

1. **INTRODUCTION TO HIGHWAYS AND GEOTECHNICAL ENGINEERING**

Importance of transportation engineering- Importance of I.R.C - List the functions of I.R.C – Classification of roads as per I.R.C – Define (i) Width of pavement (ii) Shoulder (iii) Formation width (iv) Right of way (v) Camber (vi) Gradient (vii) Super elevation and (viii) Sight distance components of a road - types of gradients and their recommended values by I.R.C - need for providing super elevation and its formula – Necessity of curves in highways - types of horizontal curves and vertical curves adopted in roads – Physical properties of soil like plasticity,

cohesion, consolidation, compaction, Permeability and compressibility - Soil moisture content – Specific gravity and density - Types of soils – Residual soil – Transported soil – sand – silt – clay – peat – Till – loess – Bentonite – Soils in India - Different systems of classification of soils – Textural classification – I S classification of soils - Bearing Capacity – Definition – Importance in foundation design.

2. HIGHWAY SURVEY AND TRAFFIC ENGINEERING

Alignment of Road - Definition - factors influencing selection of alignment for a road in plain and hilly areas - List the surveys required for fixing alignment - Various engineering surveys conducted to fix the alignment of a road - Different data required for the preparation of highway project - Traffic census/traffic surveys - Importance – Types – Traffic islands and Interchanges - types of pavement markings and its functions - purpose of traffic signs and its functions

3. HIGHWAY CONSTRUCTION AND MAINTENANCE

Necessity of road drainage - Methods of providing surface and sub-surface drainage - materials used in construction of different types of roads - Tests on Bitumen - equipment/machinery used in construction of different roads - Methods of construction of different types of roads - maintenance of WBM of roads - Different types of joints used in C.C roads - necessity for joints in C.C roads-software used in planning and design of highways.

4. INTRODUCTION AND PERMANENT WAY OF RAILWAYS

Railways - advantages – Definition and classification of gauges – Functions of each component part of a permanent way and its requirements/characteristics - Different types of 1. Rails, 2. Joints, 3. Rail fittings, 4. Sleepers, 5. Ballast used in Indian Railways with sketches (wherever required).

5. STATION YARD AND MAINTENANCE OF RAILWAYS

Classification of stations - Types of turnouts and crossings with sketches maintenance measures of a railway track - Duties of a permanent way inspector-software used in planning and design of railways.

6. BASICS OF BRIDGE ENGINEERING

Classification of bridges based on materials, position of bridge floor and form/type of super structure - Factors influencing selection of site for a bridge - Data required for preparation of bridge project. Definitions - 1. Waterway 2. Linear waterway 3. Afflux 4. Vertical clearance 5. Scour depth, and 6. Free board - Formulae for economical span and afflux - component parts of a bridge sub-structure with sketches - Functions of a bridge sub-structure - Distinguish between deck and through bridge – sketches of different types of bridge super structures - List different types of 1. Causeways and 2. Culverts - suitability of different types of culverts - suitability of different types of causeways – Sketches of different types of causeways – Sketches of different types of culverts.

REFERENCE BOOKS:

1. Highway Engineering by S. C. Rangwala, Charotar Books Distributors
2. Railway Engineering by S. C. Rangwala, Charotar Publishing House Pvt. Ltd.
3. Bridge Engineering by S. C. Rangwala, Charotar Publishing House Pvt. Ltd.
4. Highway Engineering by Khanna and Justo-Nem Chand & Sons.
5. Transportation Engineering by L.R. Kadiyali, Khanna Publishing House.

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.5
Unit Test – II	From 3.6 to 6.10

CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP

Course code	Course title	No. Of periods /week	Total no. Of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE504E	CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP	03	45	30	70	2

TIME SCHEDULE

S. No.	Chapter/ Unit Title	No. of Periods	Weightage of marks	No. of Short Answer Questions	No. of Essay Questions	CO's Mapped
1.	Introduction	3	3	1	-	CO1
2.	Organizational Aspects	6	14	2	1	CO1
3.	Management Tools	8	19	1	2	CO2
4.	Contracts, Tenders and Arbitration	10	22	2	2	CO3
5.	Management of Resources in Construction	8	25	3	2	CO4
6.	Entrepreneurship	6	6	2	-	CO5
7.	Human Relations and Professional Ethics	4	11	1	1	CO5
	Total	45	100	12	8	

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Familiarize with the Preliminary Planning & Organizational aspects, constructional planning, contracts and tender systems.
(ii)	Gain adequate knowledge in managing different resources in construction field and human relations and professional ethics.

COURSE OUTCOMES

CO1	CE504.1	State the importance of project management and Organizational aspects.
CO2	CE504.2	Analyse the tools of Management for construction projects in planning.
CO3	CE504.3	Discuss different types of contracts, Tendering systems and Arbitration.
CO4	CE504.4	Analyse the principles of management of Resources like Men, Material and Machinery.

CO5	C-504A.5	Discuss the role of Entrepreneur for better outcome in construction industry by inculcating better Human Relations.

LEARNING OUTCOMES

1.0 INTRODUCTION

1.1. Define Management.
1.2. State the functions of Management.
1.3. State the need for scientific Management of projects.
1.4. Describe the fields level management.
1.5. Describe the sequencing of work

2.0 ORGANIZATIONAL ASPECTS

2.1. Explain the organizational structure of a Government Engineering Department
2.2. List the duties of different officers of an Engineering department.
2.3. Define Preliminary estimate, Detailed estimate, Administrative approval and Technical sanction.
2.4. State the limit of powers of sanction by various officers in an Engineering Department (Government).
2.5. Give the Organizational structure of a public sector construction company.
2.6. Compare the Headquarters versus Regional Office/ Organisational Structure.
2.7. List the duties of Chief Engineer in a construction company.
2.8. List the duties of a Resident Engineer.

3.0 MANAGEMENT TOOLS

3.1 Define CPM and PERT.
3.2 State the advantages of CPM and PERT.
3.3 Explain the use of bar chart and its limitations
3.4 Define Network, Activity, Event, Activity duration, Dummy activity, EST, EFT, LST, LFT, Total float, free float and Critical path.
3.5 Prepare Network diagram using basic rules of network formation.
3.6 Calculate Project duration using CPM network .
3.7 State the limitations of CPM.
3.8 Distinguish between CPM and PERT.

4.0 CONTRACT, TENDERS AND ARBITRATION

4.1 Define contract, State the contents of a contract document, and explain different contract systems available for construction works.
4.2 List the merits and limitations of each of the contract systems, List the general conditions of contract for a civil engineering construction project.
4.3 Define tender, Explain the need for calling of tenders, List the steps involved in fixing up agency through tender system.
4.4 Draft a tender notice for a work, Prepare tender documents.
4.5 Explain the need of earnest money and security deposits.
4.6 Prepare a comparative statement.
4.7 Explain the method of selecting a contractor from the tenders, List out the conditions of contract agreements.
4.8 Define E-procurement. Know about portals for e-procurement.
4.9 Define the terms Dispute and Arbitration, Explain the scope for disputes in a construction industry.
4.10 State the need for arbitration, List the qualifications of an arbitrator, List the advantages of arbitration.
4.11 Define insolvency. Consequences of insolvency in construction industry.

5.0 MANAGEMENT OF RESOURCES IN CONSTRUCTION

5.1 Explain the scope of materials management, Classify the common building materials based on the procurement, Explain different Stages of materials management.

5.2 Explain the points to be observed in the storage of perishable and non-perishable store materials, Explain the terms Indent, Invoice and Bin card, Explain the importance of verification of stores.

5.3 Explain the need for mechanization, Explain the need for optimum utilization of plant and equipment, Explain the financial impact of mechanization.

5.4 Explain about the preventive maintenance of plant and equipment.

5.5 Explain the importance of training of operators.

5.6 Explain the need for overhauling or replacement.

5.8 State the importance of finance as a resource.

5.9 Explain the different stages at which cost control can be achieved.

5.10 Explain the financial control at head office level and site level.

6.0 ENTREPRENEURSHIP

6.1 Define 1. Entrepreneur and 2. Entrepreneurship.

6.2 Outline the concepts of entrepreneurship.

6.3 State the role of entrepreneur in economic development.

6.4 List the characteristics of an entrepreneur.

6.5 Evaluate the risks and rewards of an entrepreneur.

6.6 State the role of financial institutions in entrepreneurial development.

6.7 State various policies of state and central governments aimed to encourage the entrepreneurs.

6.8 Explain the concept of Venture capitalism.

6.9 list the formalities to become a contractor

7.0 HUMAN RELATIONS AND PROFESSIONAL ETHICS

7.1 State role of Human relations and Performance in organization.

7.2 State the role of interpersonal relationship for effective work culture.

CO-PO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3				2	2		2	2	3
CO2	2	3	2	1	2	3		2	2	3
CO3	2				2	3		2	2	3
CO4	2				1	2		2	2	3
CO5	2				2	2		2	2	3
Average	2.2	3	2	1	1.8	2.4		2	2	3

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc.

COURSE CONTENT

1. INTRODUCTION

Definition and concept of management – need for scientific management of projects – need for attitudinal change – Scope and characteristics of construction Industry.

2. ORGANIZATIONAL ASPECTS

Govt. Organizations: Organizational structure of P.W.D. – duties of various officers – Preliminary estimates – detailed estimate – budget provision – administrative approval and technical sanction – powers of sanction-Public sector organizations: Organizational structure of a construction company – Head quarters versus Regional and Project Management–Duties of Chief Engineer – preparation of bids – duties of Resident Engineer.

3. MANAGEMENT TOOLS

Different Management Tools – Gantt Bar chart, modified Gantt bar chart – Limitations of bar charts – Introduction CPM and PERT – advantages of CPM and PERT – terms used in CPM – formation of network – Basic rules – Problems on determination of critical path – limitations of CPM – comparison of CPM and PERT.

4. CONTRACTS, TENDERS AND ARBITRATION

Contracts – Legality of contracts – contract document – types of contracts – piece work contracts – item rate contracts – Lump sum contracts – percentage contracts – negotiated rates – departmental execution of works – merits and limitations of each contract system – conditions of contract for civil engineering works-Tenders – Necessity of tenders – Sealed tenders – tender notice – tender documents – Earnest Money and Security Deposits – Opening of tenders – comparative statement – acceptance of tenders – work order – contract agreement – conditions of contract-e-procurement-Arbitration – Disputes – disputes in construction industry – arbitration – need for arbitration – arbitrator – qualifications of arbitrator – advantages of arbitration-Insolvency.

5. **MANAGEMENT OF RESOURCES IN CONSTRUCTION INDUSTRY**

Materials management – Scope – Classification of common building materials based on the procurement – procedural formalities for acquisition – stages of materials management- Plant and Equipment – Need for mechanization – Optimum utilization of plant and equipment – Financial impact of mechanization – Preventive maintenance –Overhauling and replacement – Cantering, shuttering and scaffolding requirements-Financial Management – Finance as Resource – Purpose of cost control – stages of cost control – pre contract stage and post contract stage – Financial control at head office level and site level.

6. ENTREPRENEURSHIP

Entrepreneur – concept, definition, role, expectation – characteristics of entrepreneur – risk and rewards of an entrepreneur – role of financial institution in entrepreneurial development-Government policies for entrepreneurs-concept of venture capitalism- list the formalities to become a contractor.

7. HUMAN RELATIONS AND PROFESSIONAL ETHICS

Human relations and performance in organization – Understand self and others for effective behaviour – Interpersonal relationship for effective work culture – Need for professional ethics.

REFERENCE BOOKS

1. Management in construction Industry, P.Dharwadker, Oxford& IBH Publishing Co. Pvt., Ltd.
2. Construction Management And Accounts, V.N.Vazirani & S.P. Chandola, Khanna Publishers.
3. Construction Planning and Management, U.K. Shrivastava,Galgotia Publications Pvt. Ltd., New Delhi.
4. Construction Management and Planning, B. Sengupta & H. Guna, Tata Mc. Graw Hill Publishing Company Ltd. .
5. Construction Management and Accounts, Harpal Singh, Tata Mc. Graw Hill Publishing Company Ltd.

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 4.4
Unit Test – II	From 4.5 to 7.2

GEOTECHNICAL ENGINEERING

Course code	Course title	No. of periods/ week	Total no. of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE505E	GEOTECHNICAL ENGINEERING	3	45	30	70	2

TIME SCHEDULE

S. No.	Major Topics	No. of Periods	Weightage of Marks	Short Type	Essay Type	COs mapped
1	Soil Composition and Phase relationships	12	25	3	2	C01
2	Classification of soils	05	14	2	1	C02
3	Permeability	12	25	3	2	C03
4	Consolidation of compressive soils	05	11	1	1	C04
5	Compaction of soils	11	25	3	2	C04
	TOTAL	45	100	12	8	

COURSE OBJECTIVES

Upon completion of course the student shall be able to	
(i)	To enable the student to find out the index properties of the soil and classify it
(ii)	To enable the student to determine permeability of soils
(iii)	To enable the student to differentiate between compaction and consolidation

COURSE OUTCOMES

CO1	CE505.1	State the soil composition and phase relationships
CO2	CE505.2	Knows the classification of soils
CO3	CE505.3	Explain the permeability of soils
CO4	CE505.4	Compare the consolidation and compaction of soils

LEARNING OUTCOMES

1. SOIL COMPOSITION AND PHASE RELATIONSHIPS

1.1 Explains the importance of soil mechanics
1.2 Lists the types of soils, formation and deposition
1.3 Explains the phase composition and soil as a 3-phase system
1.4 Defines the terms: “void ratio”, “porosity” “soil moisture content”, “plasticity” , “Atterberg Limits – Liquid limit, Plastic limit and Shrinkage Limit”, “plasticity index”, specific gravity of soil particles, “dry density”, “saturated density”, “submerged density”.
1.5 Expresses the relationships between volume of voids, moisture content, density of soil mass, dry density, saturated density, submerged density, specific gravity, void ratio, porosity, Degree of saturation, percentage of air voids, air content and density index
1.6 Work out simple problems using the relationships between various soil parameters.
1.7 Explains the test for soil moisture content by Oven drying method – tests for determination of Atterberg’s Limits – test for specific gravity by Pycnometer method

2.0 CLASSIFICATION OF SOILS

2.1 States the different systems of classification of soils
2.2 Explains the textural classification of soils with a neat sketch
2.3 I.S. classification of soils

3.0 PERMEABILITY

3.1 Explain Darcy's law and Coefficient of permeability
3.2 Explains the determination of Coefficient of permeability by Constant head method and Falling head method
3.3 Permeability of stratified soils
3.4 Quick sand

4.0 CONSOLIDATION OF COMPRESSIVE SOILS

4.1 Defines the principle of "Consolidation"
4.2 Explain in detail, the Terzaghi's model analogy of compression springs, showing the process of consolidation
4.3 Explain the field implications of consolidation

5.0 COMPACTION OF SOILS

5.1 Theory of compaction – compaction and its objectives – factors affecting compaction
5.2 Laboratory compaction tests – Proctor's compaction test –Modified Proctor compaction test
5.3 Field measurement of compaction by core cutter method and sand replacement method – California Bearing Ratio – definition and its importance in the design of pavements

CO-PO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2		1				2	3	2
CO2	3			2				2	3	2
CO3	3			3				2	3	2
CO4	3			3				2	3	2
Average	3	2		2.25				2	3	2

NOTE: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits .etc.

COURSE CONTENT

1. SOIL COMPOSITION AND PHASE RELATIONSHIP:

Importance of soil mechanics; Types of soils, formation and deposition; Phase composition and soil as a 3-phase system; "soil moisture content", "plasticity". "Atterberg"s Limits – Liquid limit, Plastic limit and Shrinkage Limit", "plasticity index", specific gravity of soil particles, "dry density", "saturated density", "submerged density", "void ratio", and "porosity"; Relationships between volume of voids, moisture content, density of soil mass, dry density, saturated density, submerged density, specific gravity, void ratio, porosity, Degree of saturation, percentage of air voids, air content and density index (Work out simple problems using the relationships between various soil parameters); Test for soil moisture content by Oven drying method – tests for determination of Atterberg's Limits – test for specific gravity by Pycnometer method

2. CLASSIFICATION OF SOILS:

Classification of soils – different systems of classification of soil – textural classification of soils – I.S. Classification of soils

3. PERMEABILITY:

Darcy's law and Coefficient of permeability; Determination of Coefficient of permeability by Constant head method and Falling head method; Permeability of stratified soils; Quicksand

4. CONSOLIDATION OF COMPRESSIVE SOILS:

Consolidation – definition – Terzaghi's model analogy of compression/springs showing the process of consolidation – field implications

5. COMPACTION OF SOILS:

Theory of Compaction – objectives of compaction – factors affecting compaction; Laboratory compaction tests – Proctor's compaction test & Modified Proctor compaction test; Field measurement of compaction by Core cutter method and Sand replacement method – California Bearing Ratio – definition and its importance in the design of pavements

REFERENCE BOOKS

1. Soil mechanics and foundation engineering, Dr.B.C. Punmia
2. Modern Geo technical Engineering, Alam Singh
3. Soil Mechanics (SI Version), T. William Lambe and Robert V.Whitman
4. Geo technical Engineering, Dr. C. Venkataramaiah.
5. Basic and Applied Soil Mechanics, Gopal Ranjan & A.S.R.Rao

TABLE SPECIFYING THE SCOPE OF SYLLABUS TO BE COVERED FOR UNIT TEST-I & UNIT TEST-II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.2
Unit Test – II	From 3.3 to 5.3

ADVANCED CIVIL ENGINEERING TECHNOLOGIES

Course code	Course title	No. Of period / week	Total no. Of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE506A	ADVANCED CIVIL ENGINEERING TECHNOLOGIES	02	30	-	-	-

TIME SCHEDULE

S.No.	Chapter/Unit Title	No. of Periods	COs Mapped
1	Prestressed concrete	7	CO1
2	Advanced methods in Earth retaining structures	6	CO2
3	Pre-fabricated Building Technology	5	CO3
4	Introduction to Pre Engineered Buildings	5	CO4
5	IoT & Smart-Home/Civil Applications	7	CO5
	Total	30	

COURSE OBJECTIVES

Upon completion of the course, the student shall be able to
(i) Know the Prestressed Concrete, Advanced methods in Earth Retaining Structures
(ii) Understands Prefabricated building technology and Pre Engineered Buildings and IOT Applications

COURSE OUTCOMES

CO1	CE506.1	Explain about the Prestressed concrete systems, materials and methods.
CO2	CE506.2	Explain the Advanced methods in Earth retaining structures
CO3	CE506.3	Describe the Prefabricated building technology
CO4	CE506.4	State Pre Engineered components.
CO5	CE506.5	Apply IOT Techniques in Civil Engineering.

LEARNING OUTCOMES

1.0 **PRESTRESSED CONCRETE**

1.1 Understand fundamental principles of prestressed concrete, systems and types of Prestressing, merits and demerits

1.2 State the materials used in Prestressed Concrete

1.3 List the losses of Prestress.

1.4 Explain the methods of 1. Pre stressing, 2. Pre tensioning system and 3. Post tensioning systems.

2.0 ADVANCED METHODS IN EARTH RETAINING STRUCTURES

2.1 Understand the concepts of advanced earth retaining structures

2.2 list the advantages of advanced earth retaining structures

2.3 List and explain the methods of advanced earth retaining structures – reinforced anchored earth wall – geogrids – geomats

3.0 PRE-FABRICATED BUILDING TECHNOLOGY

3.1 State alternatives for cast in-situ structures
3.2 Understand pre fabrication technology
3.3 State Importance for standardisation and modularisation
3.4 State advantages of the pre-fabricated structures
3.5 State Materials used in pre-fabricated elements and explain their suitability for various climatic conditions
3.6 Explain types of pre-fabricated systems – large panel systems - frame systems – slab /column systems with walls – mixed systems

4.0 INTRODUCTION TO PRE ENGINEERED BUILDINGS (PEB)

4.1 Explain history of PEB
4.2 List the advantages and applications of PEB
4.3 Materials used for manufacturing of PEB
4.4 EXPLAIN THE DIFFERENT PEB COMPONENTS

3.0 IOT & SMART-HOME/CIVIL APPLICATIONS

3.1 Define the Internet of Things (IoT) in simple terms and explain its importance in daily life.
3.2 List the basic components of an IoT system: sensors, gateway, cloud, and dashboard.
3.3 Compare common communication types (Wi-Fi, Bluetooth, and LoRaWAN) in terms of range and energy use.
3.4 Illustrate how sensor data travels through an IoT system to a mobile app using a simple example.
3.5 Describe how IoT enables real-time condition monitoring of civil structures (e.g., bridges, roads).
3.6 Define what a "smart home" means and give simple examples of connected devices.
3.7 Demonstrate how to operate smart bulbs or switches using a smartphone app.
3.8 Explain how a smart thermostat can learn and follow a user's schedule for automatic control.
3.9 Explain how smart locks, cameras, and door/window sensors improve home safety.
3.10 Describe how smart leak detectors and energy/water meters help manage utilities efficiently.
3.11 Sketch a simple block diagram of a complete smart-home IoT setup.
3.12 List basic privacy and security measures for protecting IoT-based systems.

CO-PO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	1	-	2	2	-	3	3	1	3
CO2	3	2	1	2	1	-	-	3	1	3
CO3	3	1	2	2	1	-	-	3	1	3
CO4	3	2	1	2	1	-	-	3	1	3
CO5	3	3	-	-	3	-	3	3	1	3
Average	2.6	1.8	1.33	2	1.6	-	3	3	1	3

COURSE CONTENT

1. PRESTRESSED CONCRETE

Introduction – Basic principles – Systems of prestressing – Types of prestressing - Advantages and Disadvantages - Requirements of steel and concrete for prestressed concrete- Losses of Prestress - Tensioning devices – Method of Prestressing – Pre tensioning system – Post tensioning systems – Freyssinet, Magnel - Blaton, Gifford Udal and LeeMcal

2.ADVANCED METHODS IN EARTH RETAINING STRUCTURES

Concept of advanced earth retaining structures- Advantages of advanced earth retaining structures- Methods of advanced earth retaining structures –Reinforced anchored earth walls - Geogrids-Geomats.

3. PRE FABRICATED BUILDING TECHNOLOGY

Alternatives for cast in-situ structures- pre fabrication technology- Importance for standardisation and modularisation - pre fabricated structures – explain their utility - advantages of the pre-fabricated structures - Materials used in pre fabricate elements and explain their suitability for various climatic conditions - types of pre-fabricated systems – large panel systems - frame systems – slab /column systems with walls – mixed systems

4. INTRODUCTION TO PRE ENGINEERED BUILDINGS

Introduction – History – Advantages of PEB – Applications of PEB – Materials used for manufacturing of PEB – Different PEB components

5. IOT & SMART-HOME/CIVIL APPLICATIONS

Definition of IoT and system components – Connectivity options (Wi-Fi, Bluetooth, LoRaWAN) – Sensor→gateway→cloud→dashboard data flow – Real-time monitoring of bridges, roads and utilities – Smart-home demos (lighting, climate, security, leak detection) – AR overlays for utility mapping

REFERENCE BOOKS

1. N. Kishna Raju, Prestressed Concrete, Mc Graw Hill, New Delhi
2. Braja M Das, Fundamentals of Geotechnical Engineering
3. CBRI Building Materials and Components, NPTEL Lecture 31
4. Prof shiva Kumar Babu, Reinforced Soil Retaining Walls, Designs and construction.
5. Dr. R. Sarvanan, Prefabricated Structures, Laxmi Publications
6. K.S.Vivek & P.Vaishavi – Pre Engineered Steel Buildings, Lambert Academic Publishing
7. The Internet of Things by Raj Kamal (Tata McGraw-Hill)

FIELD PRACTICES

Course code	Course title	No. of Periods/ week	Total no. of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE507L	FIELD PRACTICES	07	105	40	60	2

TIME SCHEDULE

S.No.	Chapter/Unit title Name	No. Of periods/week	CO's Mapped
1.	Site Preparation: Clearing, levelling, and marking given plot boundaries.	04	CO1
2.	Setting out works: Marking for the earth work for a column at the junction of two walls, centre line marking for simple buildings. Marking High flood level.	12	CO1
3.	Foundation Works: Excavation, refilling trenches and Termite treatment	04	CO2
4.	Concrete works: Proportioning and mixing concrete, shuttering, Levelling of shuttering, centering and placement of reinforcement	08	CO2
5.	Masonry Works: Brick work in English bond, Preparation of cement mortar with specified mix, Supervisory skills of Plastering of a wall. Provision of lintel over the openings, Placement of bands in 115 mm brick wall. Ceiling finish in different methods.	15	CO3
6.	Flooring and finishing: Marking of flooring levels. Supervisory skills for construction with Cement mortar, Ceramic tile and marble flooring and for fixing of floor trap, gully trap and their connections to drain.	08	CO3
7.	Structural Works: Placement of reinforcement in an Isolated Column Footing, Sun shade (with specific attention of location), Stairs spanning longitudinal case (with specific attention at the junction of waist and landing slabs). Placement of reinforcement for slab (with specific attention of chairs). Placement of reinforcement for a Beam column junction (with specific attention to Earth quake resistance design).	18	CO4
8.	Plumbing and Sanitary Works: Calculation of slopes for Laying water supply line, Sewerage line with details of joints.	10	CO5

9.	Safety Practices on Site: PPE, Safety in scaffolding, Fire safety, First aid.	7	CO5
10.	Onsite records and reports: Daily activity logbook, Photographic documentation, work progress reports.	3	CO5
11.	Field visits: Residential building under construction, RMC plant, Highway and Bridge construction site.	16	CO5
	Total Periods	105	

COURSE OBJECTIVES

Upon completion of the syllabus, the student shall be able to	
(i)	Learn the marking for site boundary, earthwork, footings, basement and walls/columns of simple buildings.
(ii)	Familiarise with the process of Plastering, Flooring, Ceiling, Concreting, and fixing of traps
(iii)	Gain knowledge on the placement of reinforcement for different components of a building, Plumbing, Safety and Work progress report, Field visits.

COURSE OUTCOMES

CO1	CE507.1	Clearing the site, Mark for earthwork of Column at junction of two walls, Mark centre line for simple buildings.
CO2	CE507.2	Excavation of trenches, Termite proofing, Preparation of Concrete, Centering, Shuttering details for concreting.
CO3	CE507.2	Arrange bricks in English bond to plumb. Prepare Cement mortar mix by volumetric batching, Supervise plastering of walls, Flooring with Cement mortar, Tiles and Marble, Ceiling finishes.
CO4	CE507.3	Placement of reinforcement in an Isolated Column Footing and reinforcement in various components of building.:
CO5	CE507.4	Plumbing, Safety in site, Work progress reports, Field visits.

LEARNING OUTCOMES

1.0 PREPARATION OF THE SITE

1.1 Clearing, levelling, marking boundaries of the plot in the site with reference to a model registered site document.

2.0 SETTING OUT WORKS

2.1 Marking for the earth work of a Column & for the Earth work of the junction of two walls.
2.2 Marking for the earth work for a simple two roomed building.
2.3 Marking for the centre line of a one room in a residential building with reference to the given point using Total Station.
2.4 Marking high flood level of the site

3.0 FOUNDATION WORKS

3.1 Excavation methods in different soils and precautions.
3.2 Termite treatment in foundations and basement.
3.3 Refilling methods of foundation trenches.

4.0 CONCRETE WORKS

4.1 Proportion and mixing of Concrete by hand and machine mixing.
4.2 Learning different Shuttering and Centering methods.
4.3 Accuracy and precautions in placement of reinforcement in formwork, tolerable limits of eccentricity for particular structural element as per code.

5.0 MASONRY WORKS

5.1 Construction of 230mm and 115mm thick brick wall in English Bond at the corner of a wall; check for horizontality and verticality.
5.2 Preparation of cement mortar with specified mix proportion by manual mixing and volumetric proportioning.
5.3 Supervisory skills of Plastering of a wall.
5.4 Supervisory skills for finishing Ceiling with cement mortar.
5.5 Supervisory skills for fixing POP ceiling.

6.0 FLOORING AND FINISHING

6.1 Supervisory skills for construction of Cement Concrete Flooring; Laying base concrete and finishing the surface.
6.2 Fixing of floor trap, Gully trap in the floor and their connections to drain**.**

7. STRUCTURAL WORKS:

7.1 Placement of reinforcement for an Isolated Column Footing and positioning of shuttering to the column reinforcement.
7.2 Placement of reinforcement for sun shade (with specific attention of location)
7.3 Placement of reinforcement for stairs spanning longitudinal case (with specific attention at the junction of waist and landing slabs)
7.4 Placement of reinforcement for slab (with specific attention of chairs) and placement of reinforcement
7.5 Placement of reinforcement for a beam column junction (with specific attention to Earth Quake resistance design)

8.0 PLUMBING PRACTICE:

8.1 Method of laying water supply lines, with PVC pipes jointing them with different elements using solvents.
8.2 Laying PVC Sewerage lines connecting drain with gully/intercepting trap
8.3 Connection sewer line to septic tank and soak pit.

9.0 SAFETY PRACTICES

9.1 PPE (Personal protection equipment) in construction sites.
9.2 Checking safety in Centering and scaffolding common failures and remedies.
9.3 Learn the Fire safety at construction sites, rescue methods after accident.
9.4 Know the First aid practice.

10.0 ON-SITE DOCUMENTATION

10.1 Method of maintaining onsite records and daily activity logbook.
10.2 Preparation of Photographic documentation.
10.3 Submission of work progress reports.

11.0 FIELD VISITS

11.1 Field visit to a residential building under construction.
11.2 Visit to RMC (Ready Mix Cement concrete) Plant.
11.3 Visit to Highway construction sites.
11.4 Visit to Bridge construction site.

CO-PO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	1	1	1	1			2	1	2
CO2	1	1	1	3	3			2	1	3
CO3	3	1	1	2	2			3	1	3
CO4	3	3	3	2	2			3	1	3
CO5	2	1	1	1	1			3	1	2
Average	2.2	1.4	1.4	1.8	1.8			2.6	1	2.6

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc.

KEY COMPETENCIES TO BE ACHIEVED BY THE STUDENT

S.No	Experiment title	Key competency
1	Marking the boundary of site after site clearance; according to details in registered site document	Should be able to identify the surrounding sites and marking boundary of site as per dimensions in registered site document.
2	Marking for the earth work of a column Marking for the earth work for the junction of two walls	Mark the size of pillar with reference to the centre lines. Mark the centre line of main walls from the markings on marking pedestals
3	Marking the centre line of a one roomed building	Mark the centre line of cross wall perpendicular to main wall
4	Marking for the earth work of a simple two roomed building	Check the accuracy by measuring length of two diagonals and their equality.
5	Marking for the centre line of a one room in a residential building with reference to the given point using Total Station	Transfer the first corner point on to the ground.
6	Excavation of trench and termite proof and refilling	Know the trench excavation methods and termite proofing the trench and basement. Know the methods of refilling with local or alternate material.
7	Proportioning and mixing concrete; later placing concrete after fixing reinforcement in form work.	Practice mixing concrete with given proportions with suitable water content and also know the precautions in machine mixing. Know the care and accuracy in placement of reinforcement with proper cover blocks

		Know the precautions in filling form work with concrete.
8	Supervisory skills for construction of Cement Concrete Flooring. Supervisory skills of fixing of floor trap,	The cement slurry shall be properly processed and finished smooth. Fix the joint using proper filler and adhesive material such that the joint is water tight.
9	Construction of 230mm thick brick wall in English Bond at the corner of a Wall and check for horizontality and verticality.	Arrange the quoin header in line with the two perpendicular threads
10	Preparation of cement mortar with specified mix proportion by manual mixing and volumetric proportioning. Supervisory skills of Plastering of a wall.	Dry mix both sand and cement thoroughly to a uniform colour. Complete the ceiling plaster before commencement of wall plaster
11	Flooring with Cement mortar, tiles and marble maintaining proper slope with reference to levels of corners.	Know the methods of laying cement mortar flooring, method of laying ceramic tile, Finishing methods of marble flooring with proper slope. Know the method of fixing floor trap.
12	Finishing ceiling with Cement mortar and fixing Plaster of Paris ceiling.	Know the methods of Finishing ceiling with Cement mortar and fixing Plaster of Paris ceiling.
13	Placement of reinforcement in an Isolated Column Footing with proper cover. Positioning of shuttering to the column reinforcement	Mark centre of the outer reinforcing rods of footing in either direction. Place the shuttering box around the column and fix the fastenings
14	Placement of reinforcement for sun shade (with specific attention of location)	Place the grill for sun shade such that the main reinforcement is in the top zone leaving the cover
15	Placement of reinforcement for stairs spanning longitudinal case (with specific attention at the junction of waist and landing slabs).	Exercise care in the placement of reinforcement of at the junction of waist and loading slab.
16	Placement of reinforcement for slab (with specific attention of chairs). Placement of reinforcement for a Beam column junction (with specific attention to Earthquake resistance design).	Locate reinforcing bars and mesh so that there is enough room between the bars to place and compact the concrete. Decide detailed location of opening/hole and supply adequate details for reinforcements around the openings.

17	Method of laying water supply line	Know different materials used in laying PVC water supply line. Practice connecting joints
18	Method of laying sewer line, connecting gully trap to drain.	Precautions in laying sewer line, connecting intercepting trap/gully trap with street main.
19	Learn the safety practices in work site, PPE, safety in scaffolding, fire accident, first aid.	Knowledge in safety practices in site, Personal protection equipment, Prevention and rescue methods during fire accident, first aid methods and materials
20	Preparation of On-Site documentation	Know maintaining the daily records, log books, Photographic documentation, and work progress report. Prepare model documents for the above topics.
21	Field visits	Observation and identifying key points learned in this course at Residential building under construction Ready mixed concrete plant Highway or road/railway construction site Bridge construction site.

COURSE CONTENT

1. Marking the boundary of site according to details in registered site document
2. Marking for the earth work of a column. Marking for the earth work for the junction of two walls, marking high flood level in site.
3. Marking the centre line of a one roomed building.
4. Marking for the earth work of a simple two roomed building.
5. Marking for the centre line of a one room in a residential building with reference to the given point using Total Station.
6. Know the excavation methods of foundation trench and termite proofing, refilling the trench.
7. Practice mixing concrete with given proportions, placing reinforcement, precautions infilling concrete in formwork.
8. Supervisory skills for construction of Cement Concrete Flooring. Supervisory skills of fixing of floor trap, gully trap and their connections to drain.
9. Construction of 230mm and 115mm thick brick wall in English Bond at the corner of a Wall and check for horizontality and verticality.
10. Preparation of cement mortar with specified mix proportion by manual mixing and volumetric proportioning. Supervisory skills of Plastering of a wall.
11. Knowledge in Floor finish with cement mortar/tiles/marble. Practice marking levels at corners using water tube level. Finishing Joints in the ceramic tiles.
12. Knowledge in finishing ceiling with Cement mortar and fixing Plaster of Paris ceiling.

13. Placement of reinforcement in an Isolated Column Footing with proper cover. Positioning of shuttering to the column reinforcement.
14. Placement of reinforcement for sun shade (with specific attention of location).
15. Placement of reinforcement for stairs spanning longitudinal case (with specific attention at the junction of waist and landing slabs).
16. Placement of reinforcement for slab (with specific attention of chairs). Placement of reinforcement for a Beam column junction (with specific attention to Earthquake resistance design).
17. Laying water supply line, jointing PVC and CPVC pipes with solvents.
18. Laying sewer line and connecting street main with intercepting/gully trap.
19. Learn the safety practices in construction sites wearing personal protection equipment, safety in Centering and scaffolding, precautions to prevent fire accident and rescue methods at post-accident phase, First aid methods.
20. Preparation of model documents for Daily records, Log books, Photographic documentation, and Work progress report.
21. Observation and identifying key points learned in this course by visiting residential project under construction, Road/Rail project, and at Bridge construction site.

REFERENCE BOOKS:

1. CPWD Specifications, Govt of India Vol I&II, 2009
2. Practical Civil engineering hand book, Kale and Shaw
3. Building Construction, S.P.Bindra & S.P.Arora, Dhanpat Rai publications
4. National Building Code, BIS publication
5. Plumber Practical, Manish Sarma, Naeelkanth Publishers
6. Construction and Project management, KG Krishna Murthy & SV Ravindra, CBS Publishers
7. Construction Safety, RK Mishra, AITBS Publishers
8. Manual of Fire Safety, N Sesha Prakash, CBC Publishers

Table specifying the scope of the Syllabus to be covered for Unit Tests

Unit Tests	Learning Outcomes to Be Covered
Unit Test - 1	**1.1 TO 6.2**
Unit Tests - 2	**7.1 TO 11.4**

COMPUTER APPLICATIONS IN CIVIL ENGINEERING

Course code	Course title	No. Of periods / week	Total no. Of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE508L	COMPUTER APPLICATIONS IN CIVIL ENGINEERING	06	90	40	60	2

TIME SCHEDULE

S. No.	Major Topic	No. of Periods	COs Mapped
1.	MS EXCEL APPLICATIONS IN BUILDING ESTIMATES	21	CO1
2.	ANALYSIS OF RCC STRUCTURES USING SOFTWARE	21	CO2
3.	CONSTRUCTION PROJECT MANAGEMENT USING SOFTWARE	18	CO3
4.	BUILDING INFORMATION MODELING(BIM)	21	CO4
5.	APPLICATIONS OF AI IN CIVIL ENGINEERING	9	CO5
	TOTAL	90	

COURSE OBJECTIVES

Upon completion of the Course, the student shall be able to	
(i)	Prepare the estimates for quantities of building components using MS Excel.
(ii)	Analyse RCC structures using softwares.
(iii)	Understand Project Management in construction using software
(iv)	Practice software on Building Information Model (BIM)
(v)	Understand Applications of AI tools in Civil Engineering

COURSE OUTCOMES

CO1	CE508.1	Estimate the different quantities of building components using MS Excel.
CO2	CE508.2	Analyse RCC Structures using software
CO3	CE508.3	Understand the use of project management softwares in construction industry
CO4	CE508.3	Prepare basic elements & 3D model of building using REVIT ARCHITECTURE on Building Information Model (BIM)
CO5	CE508.4	Understand Applications of AI tools in Civil Engineering

LEARNING OUTCOMES

1 MS EXCEL APPLICATIONS IN BUILDING ESTIMATES

1.1 Prepare the detailed estimates for various buildings from the given drawings
1.2 Specifications , Site conditions and Report using MS-word for: Compound wall and Steps
1.3 Single Room with Verandah (Load bearing structure)
1.4 Single storied Residential building with one bed room (1 BHK) (Load bearing structure)
1.5 Single storied Residential building with two bed rooms (2 BHK) (Load bearing structure)
1.6 Two storied residential building (Framed structure)

2. ANALYSIS OF RCC STRUCTURES USING SOFTWARE

2.1 Carry out the analysis and design of simple RCC structures using any one of the available packages like STAADPRO, ETABS, CADS 3D or any other suitable packages.

3. CONSTRUCTION PROJECT MANAGEMENT USING SOFTWARE

3.1 Develop the CPM / PERT Network for the proposed simple building project using anyone of the available packages or any other suitable packages.

4. BUILDING INFORMATION MODELING (BIM)

4.1 Grid and Level Creation:
4.2 Linking Structural Element to REVIT Architecture: Beam, Column, Slab linked to architectural Elements
4.3 Basic Architectural Modelling:
4.3.1.Types of Elements
4.3.2.Create Doors/windows/ Walls
4.3.3. placing Furniture/ Kitchen components/ toilets
4.3.4. Walkthrough views

5. APPLICATIONS OF AI IN CIVIL ENGINEERING

5.1 Material Quantity Calculations
5.2 Introducing Various AI Tools like ChatGpt, MS Copilot, Gemini, Grok, civils.ai, togal.ai.

CO-PO MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	3	2				2	2	3
CO2	2	3	2	3				2	3	3
CO3	3	2	2	3		2	2	2	2	3
CO4	3	2	2	2				2	3	3
CO5	3	2	2	2			2	2	3	3
Average	2.6	2.4	2.2	2.4		2	2	2	2.6	3

Note : The gaps in CO-PO mapping will be met by one or more appropriate activities from the following (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v)

Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc

COURSE CONTENT

1. MS EXCEL APPLICATIONS IN BUILDING ESTIMATES

Prepare the detailed estimates for various buildings from the given drawings, specifications and site conditions: a.) Compound wall and Steps b) Single Room with Verandah (Load bearing structure) c) Single storied Residential building with one bed room (1 BHK) (Load bearing structure) d) Single storied Residential building with two bed rooms (2 BHK) (Load bearing structure) e) Two storied residential building (Framed structure) f) Reporting using MS-Word.

2. ANALYSIS OF RCC STRUCTURES USING SOFTWARE

Carry out the analysis and design of simple RCC structures using any one of the packages like STAADPRO, ETAB, CADS 3D or any other suitable packages.

a) Model Generation – Navigating the STAAD.Pro Graphical User Interface, Creating Structure Geometry, Editing Structure Geometry, Viewing Structure Geometry.

b) Property Assignment – Creating groups to quickly select groups of elements, assigning materials, sections and beta angles to structural members, Assigning specifications to nodes and members, Assigning supports to nodes

c) Model Loading and Analysis – Defining primary load cases in STAAD.Pro and load the structure, generating load combinations, defining load envelopes and reference loads, Analyzing a model

3. CONSTRUCTION PROJECT MANAGEMENT USING SOFTWARE

Develop the CPM / PERT Network for the proposed simple building project using anyone of the available packages mentioned below or any other suitable packages.

Ex: a) Various Menus available in MS-Project or Gantt project, identify various activities for a given project, Input data required for the given project, prepare schedules using MS-Project for resources like men, material, machinery, money.

b) Calculate duration of project and Critical Path, Generate various reports for the supervision of the project.

4. REVIT ARCHITECTURE IN BUILDING INFORMATION MODEL (BIM)

a. Grid and Level Creation:
   1.Primary User Interface Elements
   2. Setting Units: Create Grids and levels
   3. Properties

b. Linking Structural Element to REVIT Architecture: Beam, Column, Slab linked to architectural elements

c. Basic Architectural Modelling:
   1.Types of Elements
   2.Create Doors/windows/ Walls
   3. placing Furniture/ Kitchen components/ toilets
   4. Walkthrough views

5. APPLICATIONS OF AI IN CIVIL ENGINEERING

a. Introducing Various AI Tools like ChatGpt, MS Copilot, Google Gemini, Grok, civils.ai, togal.ai

b. Calculations of Quantities

c. Developing Plan, sectional views , Elevations and Landscaping

Commercial Software	Similar Open source	Download Link
Microsoft Project	GANTT PROJECT	http://www.gantt project.biz/

SUGGESTED E-LEARNING REFERENCES:

1.http://nptel.ac.in/
2. http://www.ganttproject.biz/
3. https://gemini.google.com/
4. https://copilot.microsoft.com/
5. https://civils.ai/
6. https://chatgpt.com/

Table specifying the scope of the Syllabus to be covered for Unit Tests

Unit Tests	Learning Outcomes to Be Covered
Unit Test - 1	**1.1 TO 2.1**
Unit Tests - 2	**3.1 TO 5.2**

PROJECT WORK

Course code	Course title	No. Of periods/ week	Total no. Of periods	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE509P	PROJECT WORK	04	60	40	60	1

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Provide with the opportunity to synthesize knowledge from various areas of learning and critically and creatively apply it to real life situations.
(ii)	Enable to acquire skills like collaboration, communication and independent learning to prepare them for lifelong learning and the challenges ahead.

COURSE OUTCOMES

CO1	Acquires collaborative skills through working in a team to achieve common goals.
CO2	Reviews and evaluates the available literature on the chosen problem and formulates the methodology to solve the identified problem.
CO3	Acquires the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
CO4	Acquires the skills to communicate effectively and to present ideas clearly and coherently to specific audience in both the written and oral forms.
CO5	Learns on own, reflects on their learning and takes appropriate actions to improve it and prepares and presents project report

LEARNING OUTCOMES

1. PROJECT WORK

1.1 Identifies different works to be carried out in the Project.
1.2 Collects data relevant to the project.
1.3 Carries out Site Surveys.
1.4 Selects the most efficient method from the available choices based on preliminary investigation.
1.5 Designs the required elements of the project as per standard practices.
1.6 Prepares working drawings for the project.
1.7 Estimates the cost of project, men, materials and equipment required.
1.8 Prepares schedule of time and sequence of operations.
1.9 Prepares project report.
1.10 Prepares C.P.M. Chart.
1.11 Collects the requirements to start a Small Enterprise/Industry under Self Employment Scheme.
1.12. Collects the necessary information to procure necessary finance, site and equipment.
1.13 Prepares the chart or model for each project.

CO-PO MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3				1	1	1	2	3	2
CO2	3	3		2		1		2	3	2
CO3	3	3	3	1	1			2	3	2
CO4	2	2				1	1	2	3	2
CO5	2	2				1	1	2	3	2
Average	2.6	2.5	3	1.5	1	1	1	2	3	2

Note : The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i)Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits ..etc

COURSE CONTENT

Project work is intended to provide training in the solution of field engineering problems involving Surveying, Planning, drawing plans, designing, estimating and marking out of a building/highway/irrigation/public health project. Project work will also include the preparation of the feasibility report for any one type of enterprise under self – employment schemes.

Students shall be divided into groups of five each and shall be assigned a problem that calls for application of the knowledge he/she acquired in the course and also which involves some extra study of reference materials.

SOME OF THE PROJECTS ARE LISTED BELOW FOR THE BENEFIT OF STUDENTS:

1. Study and detailed estimate of different components of modern residential building
2. Preparation of detailed estimate for low cost house two room set residential building
3. Design of rain water harvesting for a given building
4. Case study of repair and maintenance for a given building
5. Construction of concrete road using latest techniques
6. Design of soak pit with septic tank for 100 users
7. Design of concrete mix by using fly ash
8. Preparation of different civil engineering models e.g beam, one way slab, two way slab, column etc.,
9. Design of Car parking in your Polytechnic
10. Case study of floods and the affect of floods on irrigation structures eg: Budameru flood -Velagaleru Regulator

Every student should prepare a project report and submit the same for assessment. Every student puts his share to the work in all the operations of the project. The end examination in Project work shall consist of power point presentation and Viva-voce test to be assessed by a panel of examiners comprising of an External examiner, the Head of Section, and member of staff who guided the project as Internal examiner.

FORMATIVE AND SUMMATIVE ASSESSMENT

The Formative Assessment consisting of 40% of the total marks shall be distributed as follows:

Assessment	To be conducted at	Marks (Evaluated for)
Review-1	After the completion of 4 weeks from the start of the semester	10
Review-2	After the completion of 10 weeks from the start of the semester	15
Review-3	After the completion of 14 weeks from the start of the semester	15

The Summative Assessment consisting of 60% of the total marks shall be distributed as follows:

Assessment	To be conducted	Conducted by	Based on	Max Marks
Summative	After completion of the Project work	1.The mentor faculty concerned, 2.HoD concerned 3.An external examiner	1.Demonstration of skill relevant to the Project	30
			2. Project Report	20
			3. Viva Voce	10
			TOTAL	60

VI SEM

DIPLOMA IN CIVIL ENGINEERING

SCHEME OF INSTRUCTION AND MODEL BLUEPRINT FOR EVALUATION

VI SEMESTER

INDUSTRIAL TRAINING

Course Code	Course Title	Duration	Marks for Formative Assessment	Marks for Summative Assessment	Credits
26CE601I	Industrial Training	One Semester	240	60	20

TIME SCHEDULE

S. No	Code	TOPICS	Duration
1	26CE601I	• Practical training in Industry • Training Report Preparation Report Preparation: Title Page, Certificate, Acknowledgements, Abstract, Contents (Introduction of Industry/Organization, Organization structure, Duties of different officers in the organization, List of works undertaken by organization, Procedures adopted, M-book recording at various stages of construction, Procurement of Material, Labour & Equipment, Skills Acquired, Conclusions, Charts, Diagrams, Plans etc., pertaining to organization, Literature.	One Semester

COURSE OBJECTIVES

Upon completion of the course the student shall be able to	
(i)	Expose to real time working environment
(ii)	Enhance knowledge and skills already learnt in the institution
(iii)	Acquire new skills of measuring, supervising and recording civil engineering works.
(iv)	Develop qualities like team & work culture, integrity, responsibility and self-confidence.

COURSE OUTCOMES

CO1	CE601.1	Apply theory to practical work situations
CO2	CE601.2	Cultivate sense of responsibility and good work habits
CO3	CE601.3	Exhibit the strength, teamwork spirit and self-confidence
CO4	CE601.4	Write report in technical projects

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3

CO1	2				2		1	3		2
CO2						3		3		2
CO3						3		3		2
CO4						3		3		2
AVG	2				2	3	1	3		2

3: High, 2: Moderate, 1: Low

Note: The gaps in CO-PO mapping will be met by one or more appropriate activities from the following: (i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest lectures (v) Group discussions (vi) Quiz (vii) Industrial visits (viii) Tech fests (ix) Mini project works (x) Library visits etc

LEARNING OUTCOMES

The student shall be able to display the following skill set

2) Planning & scheduling of works, material & manpower.
3) Preparing the designs & drawings of structures and structural components with respect to loads, strengths etc.
4) Preparing& reading estimates for civil engineering works.
5) Drafting Skills (Like proposal for new works, repairs for existing works, justification for proposals, Inspection /investigation reports, request for manpower /equipment / Budget)
6) Developing Inter-personal relationship skills such as working as a team for a common cause.(Communication – Verbal, Nonverbal, and written)
7) Supervising civil engineering works.(With respect to quality, progress rate, material & processes)
8) Identifying raw materials/tools/equipment appropriate for the nature of work and appreciate their importance, their source, mode of Transport to site etc.,(NOT For Final evaluation)
9) Recognizing and Practicing safety Measures in the Construction Industry.
10) Preparing Reports pertaining to ongoing works

SCHEME OF FORMATIVE ASSESSMENT AND SUMMATIVE ASSESSMENT FOR INDUSTRIAL TRAINING

In case of Industrial Training, SOP will be circulated by SBTET, A.P from time to time. The Formative Assessment and Summative Assessment shall be done as illustrated in the following table:

S No	Course	Sub	Duration	Assessment No	Upon completion of	Conducted by	Based on	Max Marks
	Industrial Training	26CE601I	One Semester	Pre-Assessment	15 Days to 30 Days from the commencement of training	Mentor faculty member visits the industry one month after commencement of training and will submit a detailed report to the principal outlining the each candidate's details		

						and observed work culture		
				1.(For mative Assess ment)	Mid Semester Assessmen t (after three months - at industry	1.The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120
				2.(For mative Assess ment)	Last month of training (at industry)	1. The mentor faculty member concerned 2. Industry Training In charge	Learning outcomes as given in the scheme of assessment, for Industrial Training	120
				3.Sum mative Assess ment)	After completion of the training (at Institution)	1.The faculty member concerned, 2.HoD concerned 3.An external examiner from Industry	1.Demonstrat ion of any one of the skills listed in learning outcomes	30
							2.Training Report	20
							3. Viva Voce	10
				TOTAL				300

WEIGHTAGE OF MARKS FOR ASSESSMENT OF SKILLS

DURING FIRST AND SECOND ASSESSMENT OF INDUSTRAL TRAINING

Skill set No	Skill set Parameters	Max Marks Allotted For each skill set
1	Planning & Scheduling of works, material & manpower.	15
2	Reading Drawings & Preparing Designs of various structural components.	30
3	Given drawing, Preparing Estimates	25
4	Supervising Civil Engineering works with respect to Quality, Progress rate, Material, Processes	20
5	Developing interpersonal relation (Spoken & written communication)	15
6	Drafting skills	15
	Total	120

Note: During assessment, the performance of the students shall be assessed in those skills in which the student has been trained and be awarded the marks as per the Weightage assigned as above. In case the student has undergone training in few skill set only, then the total marks obtained shall be raised to 120 marks for the given

assessment i.e. either assessment 1 or 2. However the performance of the student shall be assessed at the most skill sets listed above but not less than three skill sets.

Illustration: If the student has undergone training in only 4 skill sets (namely S.No. 1,2,4,5) and marks awarded during assessment is 50 out of 80 marks, then the marks of 50 shall be enhanced to 120 proportionately as (50x120/80=75)

GUIDELINES FOR INDUSTRIAL TRAINING OF DIPLOMA IN CIVIL ENGINEERING PROGRAM:

1. Duration of the training: One Semester.
2. Eligibility: As per SBTET norms
3. Training Area: Students may be trained in planning, Designing, Estimating, Drafting, Scheduling and executing of Civil Engineering works.
4. The candidate shall put a minimum of 90% attendance during the Industrial training.
5. If the student fails to secure 90% attendance during industrial training, the student shall reappear for one semester industrial training.
6. Formative assessment at industry shall be carried out by the Mentor from the industry, where the student is undergoing training and the in faculty in-charge (Guide) from the concerned section in the institution.
7. The Industrial training shall carry a Weightage of 300 marks and pass mark is 50% in assessments at industry (first and second assessment) and final summative assessment at institution put together i.e. 150 marks out of 300 marks.
8. If the student fails to secure 50% marks in final summative assessment at institution level, the student should reappear for final summative assessment in the subsequent board examination.
9. Final summative assessment at institution level is done by a committee including1. Head of the section (of concerned discipline ONLY), 2.External examiner from an industry and 3. Faculty member who assessed the student during Industrial Training as members.

ROLES AND RESPONSIBILITIES OF THE FACULTY MEMBERS WHO ARE ASSESSING THE STUDENT'S PERFORMANCE DURING INDUSTRIAL TRAINING:

1. The faculty member shall guide the students in all aspects regarding training.
2. Shall create awareness regarding safety measures to be followed in the industry during the training period and shall check it is followed scrupulously.
3. Shall check the logbook of the students during the time of their visit for the assessment.
4. Shall monitor progress at regular intervals and make appropriate suggestions for improvement
5. Shall visit the industry and make first and second assessments as per stipulated schedule.
6. Shall assess the skill set acquired by the students during their assessment.
7. Shall award the marks for each skill set as per the marks allotted for that skill set during final assessment at institution.

8. Shall voluntarily supplement students learning through appropriate materials like photographs, articles, videos etc.
9. Shall act as co-examiner along with external examiner.
10. Shall act as liaison between the student and mentor.
11. Shall maintain a diary indicating his observation with respect to the progress of students learning in all three domains (Cognitive, Psychomotor and Affective)

GUIDELINES TO THE TRAINING MENTOR IN THE INDUSTRY:

1) Shall train the students in all the skill set as far as possible.
2) Shall assess and award the marks in both the assessments along with the faculty member.
3) Shall check and approve the log books of the students.
4) Shall approve the attendance of each student at the end of the training period.
5) Shall report to the guide about student's progress, personality development or any mis behaviour as the case may be.
6) Every Teacher (including HoD if not holding any FAC) shall be assigned a batch of students of 10 to 15 for industrial training irrespective of student's allotted place for training.