Shivaji University

Vidya Nagar, Kolhapur, Maharashtra 416004

Department of Technology

As per NEP2020 guidelines

Second Year B.Tech. (Civil Engineering), Detailed Curriculum 2024-25 onwards

A. Definition of Credit

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hr. Practical (Lab) per week	1 Credit

B. Credits for award of Degrees

a) A total of **176 credits** are required for all the students to get entitled for **Under Graduate Degree in Engineering (Major) with a Multidisciplinary Minor (MDM).** This feature is the **fourth vertical (Level 6.0)** from the National Credit Framework. For such a candidate the degree offered would be: B.Tech. in Major Degree Title with Multidisciplinary Minor. The routine fees will be charged for award of the degree with multidisciplinary minor**.** There will be a pool of multidisciplinary minors for each major UG Program.

b) A student will be entitled to acquire this 'MDM featured' **Under Graduate Degree** with **Honors,** if the candidate earns an **additional 17 credits.** Out of these 17 credits, 15 credits will be against 5 different theory courses (3 credits each) pertaining to the Major Discipline while 2 credits will be against an advance laboratory practice in the respective discipline of studies. These theory credits could be acquired preferably through MOOCs the title of which will be well declared to the aspirants. This particular feature is the **fifth vertical (Level 6.0)** from the National Credit Framework. For such a candidate the degree offered would be: B.Tech. Honors in Major Degree and Multidisciplinary Minor. For this option of Honors, the interested candidates have to pay the separate fees as decided by the institute.

c) A student will be entitled to acquire this 'MDM featured' **Under Graduate Degree having an option of Honors with Research**. For the same, the candidate, in addition to those **17** credits allotted to the Honors, has to earn an **additional of 3 credits against an extra research project.** (As regards this extra project work, it is mandatory to be successful in publishing at least one research paper based on the research topic.) This feature is the **sixth vertical (Level 6.0)** from the National Credit Framework. For such a candidate the degree offered would be: B.Tech. Honors with Research in Major Degree and Multidisciplinary Minor. The interested candidates for this option will have to pay the separate fees as decided by the institute.

d) A student will be entitled to acquire this 'MDM featured' **Under Graduate Degree** with **additional Specialization Minor,** if the candidate earns an **additional 14 credits**

against one more minor from the specialization. These will be a separate pool of the specialization minors for choice. (The courses under minors could be through MOOCs also). This is the case of double minors and it is the **seventh vertical (Level 6.0)** from the National Credit Framework. For such a candidate the degree offered would be: B.Tech. in Major Degree with double minors. (Multidisciplinary Minor and Specialization minor.) For this option of additional specialization minor, the interested candidates will have to pay the separate fees as decided by the institute.

C. Component wise distribution of credits

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits (Provided)	Requirement as per Maharashtra Government Resolution	AICTE
Basic Science Course	BSC	8	8	3	--	--	--	--	--	**19**	14-18	24
Engineering Science Courses	ESC	12	12	--	--	--	--	--	--	**24**	16-12	20
Program Core Courses	PCC	--	--	14	15	15	7	4	--	**64**	44-56	58
Program Elective Course	PEC	--	--	--	--	3	6	6	--	**12**	20	26
Multidisciplinary Minor	MDM	--	--	--	3	3	3	3	2	**14**	14	18
Open Elective	OE	--	--	--	--	--	3	3	6	**6**	8	12
Vocational and Skill Enhancement Course	VSEC	--	--	--	1	1	3	--	--	**5**	8	
Ability Enhancement Course (AEC)	Humanities and Social Sciences, Management Courses (HSSM)	--	--	1	1	1	--	--	--	**3**	4	
Entrepreneurship/ Economics/ Management Courses		--	--	--	--	--	--	3	--	**3**	4	6
Indian Knowledge System		1	1	--	--	--	--	--	2	**4**	2	2
Value Education Course		--	--	2	2	--	--	1	1	**6**	4	
Research Methodology	Experiential Learning Courses	--	--	--	--	--	--	1	--	**1**	4	
Comm. Engg. Project(CEP)/ Field Project (FP)		--	--	--	--	--	--	--	--	**1**	2	
Project		--	--	--	--	--	1	2	--	**3**	4	16
Internship/ OJT		--	--	--	--	--	--	--	10	**10**	12	
Co-curriculum Courses	(CCC)	--	--	--	1	--	--	--	--	**1**	4	
Compulsory Audit Course (Non-credit)	MAC	--	--	--	--	--	--	--	--	--	--	
Total Credits (Major)		**21**	**21**	**20**	**23**	**23**	**23**	**23**	**22**	**176**	**160-176**	**164-182**

Expected range of credits as per AICTE & NEP2020 guidelines is 160-176)

Sr. No.	Category Suggested	Course Code	No. of Credits	Components %
1.	Humanities and Social Sciences including Management and Environment Courses	HSMEC	3	1.70
2.	Indian Knowledge System	IKS	4	2.27
3.	Ability Enhancement Course	AEC	3	1.70
4.	Value Education Courses	VEC	6	3.41
5.	Basic Science courses	BSC	19	10.80
6.	Engineering Science Courses including workshop, drawing, basics of electrical/mechanical/computer etc.	ESC	24	13.64
7.	Professional Core Courses	PCC	64	36.36
8.	Professional Elective Courses relevant to chosen specialization/branch	PEC	12	6.82
9.	Open subjects – Electives from other technical and /or emerging subjects	OEC	6	3.41
10.	Project, Seminar and Internship	PSI	14	7.95
11.	Project Based Learning	PBL	0	0.00
12.	Vocational and Skill Enhancement Courses	VSEC	5	2.84
13.	Multidisciplinary Minor	MDM	14	7.95
14.	Mandatory Audit Courses [Some other courses Decided at the Institute level but that do not get fit in the credits]	MAC (HSMEC)*	0	0.00
15.	Experiential Learning Courses: Research Methodology	ELC: RM	1	0.57
16.	Co-curriculum Courses	CC	1	0.57
	Total		**176**	**100**

* Please note that most of the courses under HSMEC have been covered under audit courses.

D. Course code and Definition

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
MDM	Multidisciplinary Minor
SPM	Specialization Minor
ISE	In Semester Examination
ESE	End Semester Examination
IE	Internal Evaluation

EE	External Evaluation
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMEC	Humanities and Social Sciences including Management, Environmental Courses
PCC	Professional Core Courses
PEC	Professional Elective Courses
OEC	Open Elective Courses
VSEC	Vocational and Skill Enhancement Courses
IKS	Indian Knowledge System
AEC	Ability Enhancement Course
VEC	Value Education Course
MAC	Mandatory Audit Courses
PSI	Project, Seminar, Internship
PBL	Project Based Learning
PBL, PBI	Project Based Learning Program Based Internship
MN, HN, HNR	Minor, Honors, Honors with Research
CC, DC	Certificate Course, Diploma Course
CHE, CE,CST	Chemical Engineering, Civil Engineering, Computer Science and Technology
ETC, FT, ME	Electronics and Telecommunication Engineering, Mechanical Engineering, Food Technology

Mandatory Induction Program at F.Y. B. Tech First Term Commencement
(3 Weeks Duration)

a) Physical activity
b) Creative Arts
c) Universal Human Values
d) Literary
e) Proficiency Modules
f) Lectures by Eminent People
g) Visits to local Areas
h) Familiarization to Dept./Branch & Innovations

Note: On the campus, besides the curriculum structure, as co-curricular activities, National Cadet Corps (India) i.e. NCC is available for the interested & selected students while National Service Scheme i.e. NSS unit is for all the volunteer students who will contribute as and when necessarily called for the services.

E. Academic Rules and Regulations for MDM featured Four-Year B. Tech. Degree

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Glossary

B. Tech.: Bachelor of Technology, an Under Graduate Degree awarded from the Shivaji University, Kolhapur

Director: Director, Department of Technology, Shivaji University, Kolhapur

Program: The specialization in B.Tech. (Particular Major Branch)

Program Head: The Head of the Specialized Branch of B.Tech. studies

DC: Department Committee

DEC: Departmental Examination Coordinator

Semester: The academic year will be divided into two regular semesters of approximately 20 weeks' duration each. Typically, the odd semester will be from the first week of July to last week of November while the even semester will be from the first week of January to the last week of May.

This will include the period of academic delivery (14 to 15 weeks), Internal Evaluation (CIE) i.e. In Semester Examination and Assignments, End Semester Examination (ESE) assessment and declaration of results.

R.B.T.: Rule B.Tech.

Course: Subject

Course Coordinator: Subject teacher

Course Credit: Weighted sum of the number of Lecture hours (L), Tutorial hours (T), and Practical hours (P) associated with the course.

Credits Earned: The sum of course credits for credit courses in which a student has passed.

Grade: Assessment of the student's performance in a course indicated by the letters, "AA", "AB", "BB", "BC", "CC", "CD", "DD", "FF", "XX", "ABSENT", "PP", "NP".

Grade Point: Number equivalent of the letter grades given by 10, 9, 8, 7, 6, 5, 4 corresponding to grades "AA", "AB", "BB", "BC", "CC", "CD", "DD" respectively. "FF" and "XX" carry zero grade points.

Instructor: Member of faculty who will be assigned to teach a specific course.

Semester Grade Points: The sum of the products of credits and Grade Points for each course registered by a student in a semester.

SGPA: Semester Grade Point Average

CGPA: Cumulative Grade Point Average

ATKT: Allowed to Keep Terms.

R.B.T. 1 Admission:

At the Department of Technology, Shivaji University, candidates are admitted to all the available specialized B.Tech. Programs according to norms and conditions prescribed as per AICTE, New Delhi and DTE, Mumbai, Maharashtra.

R.B.T. 2 Award of Degree:

Following rules prevail for the award of degree:

1. B.Tech. Degree will be awarded to the student, who has registered and earned all the credits of prescribed courses under the general departmental requirements.
2. In addition to the credit requirement prescribed above for the Degree award, each student will have to complete the requirements of Audit Course (AC) during the programme. All the students will receive certification as PP *(for Passed),* and NP *(for not passed)* in AC, in the mark sheet. While obtaining certification as PP is a mandatory requirement for the Degree award of a student, this will not be taken into account for computing the final Cumulative Grade Point Average.
3. A student has obtained CGPA ≥ 4.5.
4. A student has paid all the institute dues and satisfied all the requirements prescribed.

5. A student has no case of indiscipline pending against him/her.
6. University authorities will recommend the award of B. Tech. Degree to a student who is declared to be eligible and satisfies the said norms.

R.B.T. 3 Attendance Rule:

All students must attend every lecture, tutorial and practical class. However, to account for late registration, sickness or other such contingencies, the attendance requirement will be a minimum of 75% of the classes actually held. A student with less than 75% attendance in a course during the semester, in lectures, tutorials and laboratories taken together (as applicable), will be awarded an 'XX' grade in that course irrespective of his/her performance in the tests.

Attendance record will be maintained based upon roll calls (or any equivalent operation) in every scheduled lecture, tutorial and practical class. The course coordinator will maintain and consolidate attendance record for the course (lectures, tutorials and laboratories together, as applicable).

R.B.T. 4 Academic Progress Rules (ATKT Rules)

1. If a candidate fails in any number of courses (subject heads) of Semester I, will be allowed to proceed to Semester II.
2. A candidate, who earns 50% of total credits of Level 4.5 (FY B.Tech), will be allowed to keep terms in Level 5.0 (SY B.Tech).
3. If a candidate fails in any number of courses (subject heads) of Semester III, will be allowed to proceed to Semester IV.
4. A candidate, who earns 50% of total credits of Level 5.0 (SY B.Tech), will be allowed to keep terms in Level 5.5 (TY B.Tech).
5. No candidate will be allowed to proceed to Semester V (TY B.Tech), unless candidate has passed in all courses of Level 4.5 (FY B.Tech).
6. If a candidate fails in any number of courses (subject heads) of Semester V, will be allowed to proceed to Semester VI.
7. A candidate, who earns 50% of total credits of Level 5.5 (TY B.Tech), will be allowed to keep terms in Level 6.0 (Final Year B.Tech).
8. No candidate will be allowed to proceed to Semester VII (Final Year B.Tech), unless candidate has passed in all courses of Level 5.0 (SY B.Tech).

9. If a candidate fails in any number of courses (subject heads) of Semester VII, shall be allowed to proceed to Semester VIII.
10. In case, if the rules of any Apex body differ from these rules, then the rules of that apex body will be applicable. However under the National Education Policy, the rules extended by University from time to time regarding ATKT will be applicable.
11. While considering the passing heads, for a year (both the semesters), 45 % aggregate score is mandatory failing to which the same will be considered as one more passing head. Any such student needs to improve the score in either of the courses to maintain 45 % aggregate for the year through appearing in re-examination or repeated examination. In such cases, the award of grade for calculation of SGPA and CGPA will be as per the table no.3 from clause R.B.T 12 with the consideration of one grade penalty as mentioned under the clause R.B.T 15, f.
12. A student who has obtained 'FF' grade in ESE of a regular semester and has obtained 'FF' grade in 2 nd attempt of ESE will be eligible to choose one of the two options below to clear the backlog:
    i. Re-registration for the next regular semester course whenever that course is offered.
    ii. Application for Repeated Examination.
13. A student who has been detained in a regular semester and obtained 'XX' grade can Re-register for the next regular semester whenever it is offered.
14. The maximum duration for getting B. Tech. degree for students admitted in the first semester of U.G. program will be 16 semesters (eight academic years) while for latera lentry students admitted in the third semester will be 14 semesters (seven academic years) from their date of admission. The maximum duration of the program includes the period of withdrawal, absence and different kinds of leaves permissible to a student but excludes the period of rustication of a student from the department.
15. If a student is unable to gain all credits of first year in three years from the date of the admission, then the candidate will be declared as "Not Fit for Engineering" leading to discontinuation of candidate's registration with the department.
16. Depending upon the academic progress of a student, department may take a decision regarding continuation or discontinuation of candidate's registration with the institute.

R.B.T. 5 Academic Flexibility

1. Flexibility in deciding curriculum structure and contents of curriculum with reasonable frequency for changes in the same.
2. Continuous assessment of student's performance with newly adopted NEP 2020 Credit system based on Award of Grade.
3. Credits are quite simply a means of attaching relative values to courses different components. These are a currency of learning, and in general regarded as a measure of the time typically required to achieve a given curricular outcome.
4. All courses (year-wise) under each program/discipline are unitized

R.B.T. 6 Credit system:

Education at the Institute is organized around the semester-based credit system of study. The prominent features of the credit system are a process of continuous evaluation of a student's performance/progress and flexibility to allow a student to progress at an optimum pace suited to candidate's ability or convenience, subject to fulfilling minimum requirements for continuation.

A student's performance/progress is measured by the number of credits that the candidate has earned, i.e. completed satisfactorily. Based on the course credits and grades obtained by the student, grade point average is calculated. A minimum grade point average is required to be maintained for satisfactory progress and continuation in the program. Also a minimum number of earned credits and a minimum grade point average should be acquired in order to qualify for the degree. All programs are defined by the total credit requirement and a pattern of credit distribution over courses of different categories.

R.B.T. 7 Features of Credit System at Department of Technology, Shivaji University, Kolhapur:

Every course is allotted credits based on its academic importance/weightage.

1. All courses may not have same credits.
2. 21 credits / semester for First Year B.Tech. while 20 credits /semester for remaining 6 semesters. Thus there are 162 credits against the B.Tech. Major plus additional 14 credits against the chosen Multidisciplinary Minor. So the total credits of this Multidisciplinary Minor (MDM) Featured B.Tech. Degree are 176. The particular

Degree falls under the **fourth vertical** (Level 6.0) as per the National Credit Framework.

3. Absolute grading System with 7 passing Grades viz. AA, AB, BB, BC, CC, CD, DD and FF for failure.
4. Standardization of courses; with few exceptional cases, each course is of 6 units.
5. In Semester Examination (ISE) and End Semester Examination (ESE), both having (30:70) weightage in the student's performance in course work/laboratory work and other activities. A student's performance in a subject will be judged by taking into account the results of In Semester Examination and End Semester Examination together. Students must score 40% marks in ESE irrespective of the ISE marks.

   (Note: The ISE will be conducted as In Semester Exam and assignments throughout the semester on dates announced in advance by the department and its results to be made known to the students from time to time. However, the dates for the ESE will be fixed at the University level.)
6. Continuous internal evaluation consists of 'In Semester Examination' of 20 marks and assignment of 10 marks handled by Department of Technology and setting of question papers should be done by course coordinator. Assignments may be of varied nature for each course based on the need of the course coordinator.
7. End Semester Examination (ESE) to be conducted by the Department of Technology however setting of question papers will be as per University Rules. The ESE will include a written examination for theory courses and practical/design/drawing examination with built-in oral part for laboratory/ design/drawing courses.

   7.1 End Semester Examination (ESE) of the courses offered for the MOOCs will be conducted by MOOC offering Institute. The credits earned by the students will be communicated to the University and to be converted as per the weightage of the said course in the structure. Student may get failure in the said MOOC or the examination may get delayed by the MOOC offering institute, in either cases, ESE of the said course will be conducted as per the University rules.
8. In case the candidate is absent on the scheduled ISE, request for separate In Semester Examination for the students representing in co-curricular, extracurricular activities or on medical grounds will only be considered. On receipt of application from the student, the DC will take decision for the conduct of the In Semester Examination.
9. Care will be taken to ensure that the total numbers of days for academic work are ≥180 per year.

10. Academic schedule prescribed will be strictly adhered and applicable to all the UG Programs.

R.B.T. 8 Course credits assignment:

Each course, except a few special courses, has a certain number of credits assigned to it depending upon its lecture, tutorial and laboratory contact hours in a week. This weightage is also indicative of the academic expectation that includes in-class contact and self-study outside of class hours.

Lectures and Tutorials: One lecture or tutorial hour per week per semester is assigned one credit.

Practical/Laboratory: One laboratory hour per week per semester is assigned half credit.

Sample Example: Course: Design of Steel Structures : 05 credits (3-1-2)

The credits indicated for this course are computed as follows:

3 hours/week lectures = 3 credits

1 hours/week tutorial = 1 credit

2 hours/week practical = 2 × 0.5 = 1 credit

Also, (3-1-2) **5** credit course = (**3** hr. Lectures + **1** hr. Tutorial + **2** hr. Practical) per week

= **6** contact hours per week = **5** credits

R.B.T. 9 Detailed Evaluation Scheme:

1. Out of total 100% theory weightage, 30% weightage is allotted for In Semester Examination (ISE). Appearing for ISE is must and student must submit the assignments to become eligible for End Semester Examination (ESE) of respective course.
   ISE (30% weightage) includes:
   a. In Semester Examination of 20 Marks of one Hour
   b. Assignments of 10 Marks during entire semester
2. For the End Semester Examination (ESE), 70 marks question paper will be set in which student must secure 40% (28 Marks out of 70) as university examination pass head and candidate must be appeared for ISE to become eligible for ESE of respective course.

3. Final theory marks (out of 100) will be the addition of ISE (30 Marks) and ESE (70Marks).
4. Final laboratory letter grade will be awarded (100%) will be the addition of IE (50%) and EE (50%) as applicable to the course.
5. End Semester Examination (ESE) for laboratory consists of internal evaluation (IE) and External Evaluation (EE). Nature of the evaluation as viva-voce or practical will be as applicable to the course which will be well mentioned in the course description.
6. There will be no EE for laboratory courses of the First Year. The entire assessment of a student will be based on IE 100% weightage and a minimum performance of 40% in IE will be required to obtain the passing grade. IE of laboratory work will be based on turn-by-turn supervision of the student's work and the quality of the candidate's work as prescribed through laboratory journals and the candidate's performance in oral or Practical/Oral examinations uniformly distributed throughout the semester. Student must submit and secure 40% marks in the IE of the concerned course. Non submission of the term work and the IE score below 40% marks will lead to term not grant (TNG). The TNG cases must be promptly communicated by the course teacher to the examination cell of the Department of Technology. The Departmental Examination Coordinator (DEC) will communicate the same to the office of the Director, Board of Examinations and Evaluation,, Shivaji University, Kolhapur for further actions.
7. The assessment of laboratory courses from the 3rd semester onwards will be carried out in two parts.
    i. ISE of laboratory will be based on turn-by-turn supervision of the student's work and the quality of candidate's work as prescribed through laboratory journals and the performance in oral or Practical/Oral examinations uniformly distributed throughout the semester. Student must submit and secure 40% marks in the IE of the concerned course. Non submission of IE will lead to term not grant (TNG).
    ii. ESE of laboratory will be based on performing an experiment followed by an oral examination or a written examination.
    iii. The relative weightage for IE and EE for assessment of laboratory courses will be 50% and 50% respectively from second year onwards and a minimum performance of 40% in both IE and EE separately will be required to obtain the passing grade.
    iv. EE for laboratory course will normally be held one week before the ESE for theory courses and will be conducted by a panel of examiners consisting of

external and internal examiner. This activity will be coordinated by Department Examination Coordinator (DEC) in consultation with Coordinator of the respective Program.

8. A student failed in EE of a laboratory course in a regular semester will be eligible to appear for examination conducted along with ESE of laboratory courses of the subsequent semester. Such examination will be fairly comprehensive (generally of 3 hours similar to EE i.e. External Examinations) to properly judge candidate's practical skill and theoretical knowledge for that laboratory course. The candidate will suffer a grade penalty as per Table 3.
9. Assessment of Seminar, Mini-project, Major Project, internship etc.:
    i. The Seminar/Project report must be submitted by the prescribed date usually two weeks before the end of academic session of the semester.
    ii. It is desirable that the topics for seminar/project be assigned by the end of previous semester.
    iii. The seminar report and the presentation of seminar will be evaluated by panel of three departmental faculty members (decided by Branch Coordinator).
    iv. The mini-project will be evaluated jointly by a panel of three Internal Examiners.
    v. The report on field training will be evaluated by a panel of three Internal Examiners.
    vi. The assessment of B. Tech major project work will be carried out in two phases as follows:

    For IE, there will be

    a) Departmental Committee (To approve synopsis submission based on seminar)
    b) Project work assessment by Guide

    (Departmental Committee constitution will be as follow:

    (1) Director- Chairman
    (2) Branch Coordinator from respective branch – member
    (3) Senior faculty from respective branch – member
    (4) Guide/Course Coordinator- member

    EE consists of progress seminar and presentation to be evaluated by panel of internal and external examiners. The process will be as below:

a) Project work assessment by Guide
b) Report submission based on seminar which will be evaluated by Departmental Committee
c) EE (Viva-voce and presentations): Evaluation by panel of external and internal examiners.

vii. The evaluation of industrial internship: Students will undergo industrial internship for one semester (8^{th} Semester). Students have to prepare a report related to the work carried out during this internship. This may include study of the new science/technology, applications of the technology/development of the technology and its implementation /designing/obtaining practical or numerical solution etc. By the Program, there will random and surprise visits to the place of internship so as to record the attendance and performance of the interns. The evaluation will be as per the university examination similar to the project evaluation.

10. The duration of End Semester Examination will be 2.5 hrs. However there might be few courses having duration of End Semester Examination as 3 hrs.
11. In respect of IE and Laboratory work, a target date will be fixed for the completion of each sheet, job, Project, experiment or assignment and the same either complete or incomplete will be collected on the target date and assessed immediately at the respective departments by the concerned teachers and % marks (or grades) will be submitted to the Co-ordinator. The Co-ordinator of the Department of Technology will communicate this % of marks (or grades) to the University.
12. In respect of IE of the audit (Non Credit) courses, the respective course in charge will organize and plan activities for the conduct of the evaluation. Preferably, the teacher will announce 5 assignments each one carrying 10 marks. So based on the assignments submitted by the candidate, there will be evaluation out of 50 marks. The passing is for 20 marks. The passing is mandatory for every student. However, the course in charge will communicate to the examination section whether the student has passed the audit course or not. As mentioned earlier, in case of audit courses, the result will appear over the mark sheet and certificate as either PP for passed and NP for not passed.

R.B.T. 10 Earning credits:

At the end of every course, a letter grade is awarded in each course for which a student had registered. On obtaining a pass grade (≥40% minimum grade DD), the student

accumulates the course credits as earned credits. A student's performance is measured by the number of credits that the candidate has earned and by the weighted grade point average.

The credit system enables continuous evaluation of a student's performance, and allows the students to progress at an optimum pace suited to individual ability and convenience, subject to fulfilling minimum requirement for continuation.

As regards earning credits against certificate or Diploma award (exit after the first year and the second respectively) also through Honors, Honors with Research, Specialization Minors, all these are the optional for the interested ones. The earning of credits for certificate and diploma is mandatory to take place immediately within 45 days from the last day of respective even End Semester Examination. In case of the credits against the Honors, Honors with Research, Specialization Minor, interested candidates need to plan for the same from SY B.Tech. to Final Year B.Tech. completion. As per the list of interested students to opt for these features, the Department of Technology will plan the activities regarding conduct/mentoring of the course/s by such students. Further from time to time, the Department will communicate the details of such students to the University Examination section. The students will have their respective End Semester Examination in continuation to the End Semester Examination of the Majors.

The details regarding credits assigned against all these features are elaborated in R.B.T. 19.

R.B.T. 11 CGPA Improvement Policy for award of degree:

A student getting CGPA $\leq$ 4.50 with grade 'DD' in any course or grade 'FF' in any course will have the possibility to repeat one or more 'DD' graded courses along with the failed courses, /are being offered in a semester.

An opportunity will be given to a student who has earned all the credits required by the respective program with CGPA greater than or equal to 4.00 but less than 4.50, to improve his/her grade by allowing him/her to appear for SEE of maximum two theory courses of seventh and eighth semester.

R.B.T. 12 Evaluation System:

1. **Semester Grade Point Average (SGPA)**

$$= \frac{\sum(\text{Course credits in passed courses} \times \text{Earned Credits})}{\sum(\text{Course credits in registered courses})}$$

2. **Cumulative Grade Point Average (CGPA)**

$$= \frac{\sum(\text{Course credits in passed courses} \times \text{Earned Credits}) \text{of all Semesters}}{\sum(\text{Course credits in registered courses})}$$

   i. Cumulative Grade Point Average (CGPA) will be calculated cumulatively for Sem. I to Sem. VIII for regular students.

   ii. Cumulative Grade Point Average (CGPA) will be calculated cumulatively for Sem. III to Sem. VIII for lateral entry students.

3. At the end of B. Tech Program, student will be placed in any one of the divisions as detailed below:

   Ist Division with distinction : CGPA $\geq$ 7.5 and above

   Ist Division : CGPA $\geq$ 6.0 and < 7.5

   IInd Division : CGPA $\geq$ 5.5 and < 6.0

New gradation suggested as follows.

Table 1

Grade Points	Equivalent Range
5.5	55%
6.0	60%
6.5	65%
7.0	70%
7.5	75%

Conversion of CGPA to percentage marks for CGPA **≥ 4.5** can be obtained using equation.

Percentage marks = (CGPA x 10)

An example of these calculations is given below (It's a sample calculation):

Typical academic performance calculations - I semester.

Table 2

Course no.	Course credits	Grade awarded	Earned credits	Grade points	Points secured
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6 (col4 *col5)
MALXXX	5	CC	5	6	30
CSLXXX	4	CD	4	5	20
PHLXXX	4	AA	4	10	40
PHPXXX	2	BB	2	8	16
MELXXX	4	FF	0	0	00
TTNXXX	2	AB	2	9	18
Total	21		17	38	124

1. Total Points earned for this semester = 124

   $$\textbf{Semester Grade Point Average (SGPA)} = \frac{124}{21} = 5.90$$

2. Cumulative Grade Point Average (CGPA) =

   Cumulative points earned in all passed courses = 124 (past semesters) + 124 (this semester) = 248

   Cumulative earned credits = 23 (past semesters) + 21 (this sem.) = 44

$$\textbf{Cumulative Grade Point Average (CGPA)} = \frac{\Sigma(124+124)}{\Sigma(23+21)} = 5.63$$

Table 3: System of Evaluation

Grade	Grade Points	Marks obtained (%)			Description of Performance
		Regular Semester	Re-examination	Repeated Examination	
AA	10	90-100	--	--	Outstanding
AB	09	80-89	90-100	--	Excellent
BB	08	70-79	80-89	90-100	Very Good
BC	07	60-69	70-79	80-89	Good
CC	06	50-59	60-69	70-79	Fair
CD	05	45-49	50-59	60-69	Average
DD	04	40-44	40-49	40-59	Poor
DD$	04	Below 40	Below 40	Below 40	Poor (Subject to Application of Ordinance 96)
FF	00	Below 40	Below 40	Below 40	Fail
XX	--	--	--	--	Detained
ABSENT	--	--	--	--	Absent
PP	--	--	--	--	Passed (Audit Course)
NP	--	--	--	--	Not Passed (Audit Course)

Note: An equivalent certificate of CGPA to percentage of marks will be provided to student on candidate's demand after remitting prescribed fees by Shivaji University.

R.B.T. 13 Entry of Students from previous credit to new Credit Pattern

A student of Department of Technology, Shivaji University, Kolhapur admitted before academic year 2023-24 and having backlogs such student will clear back log subjects as per the equivalence given by the respective program.

R.B.T. 14 Audit Courses:

Additional courses are included as audit courses in each semester. While the performance of the student in audit courses will be included in the Grade Card, these grades do not contribute to SGPA or CGPA of the concerned student. However, the passing in Audit Courses is mandatory for every student.

R.B.T. 15 Awards of Grades for Re-Examination:

a) A student who has obtained grade 'FF' in regular semester will be eligible to appear for re-examination conducted before the commencement of the next regular semester.
b) In such cases In Semester Examination performance of a student will not be wiped out.
c) A student will apply for re-examination before the last date of such application and will appear for re-examination.
d) 70% weightage similar to ESE will be given to re-examination.
e) A student who is eligible for re-examination but remains absent for re-examination will be given grade 'Absent'.
f) A student will be awarded a grade between 'AB' to 'DD', or 'FF' or 'XX' as given in Table 3 depending upon the cumulative marks obtained by him/her in IE and Re-examination of ESE. Here a student has to suffer a grade penalty by accepting one grade lower as compared with the regular grades.

R.B.T. 16 Showing Evaluated Semester End Examination Answer Papers, Re-evaluation, and applying for revaluation:

The evaluated answer book will be shown to the student immediately as per the timetable prepared by the exam cell of Department of Technology before the declaration of result. The grievances regarding the incorrect total and assessment of the not assed questions will be done by the respective faculty. A student having doubt regarding the grade declared in a course can apply for the photocopy of the answer book by remitting the prescribed fee as

specified; a student can also apply for rechecking of his/her SEE answer book as per Shivaji University rules. There is no provision for showing of evaluated answer book, photocopy, rechecking and revaluation of the re-examination.

R.B.T. 17 Change of Branch:

Students will be eligible to apply for Change of Branch after completing the first two semesters. The change of branch will be permitted strictly on merit basis subject to the rules and regulations prescribed by Directorate of Technical Education, Maharashtra State/Admission Regulatory authority, Maharashtra State time to time.

R.B.T. 18 Disciplines and Conduct:

i. Every student will be required to observe discipline and decorous behaviour both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the Department.
ii. Any act of indiscipline of a student reported to the Department will be referred as per Shivaji University norms.
iii. If a student while studying in the institute is found indulging in anti-national activities contrary to the provisions of acts and laws enforced by Government, the candidate will be liable to be expelled from the Department without any notice.
iv. If a student is involved in any kind of ragging, the student will be liable for strict action as per Maharashtra anti-ragging act 1999, which is in effect from 15th May 1999.
v. If any statement/information supplied by the student in connection with his/her admission is found to be false/ incorrect at any time, his/ her admission will be cancelled and the candidate will be expelled from the institute and fees paid will be forfeited.
vi. Student once admitted in the Department of Technology will follow instructions issued from time to time.
vii. If a student is found guilty of malpractice in examinations then the candidate will be punished as per the recommendations of the Shivaji University, Kolhapur.
viii. Every admitted student will be issued photo identification (ID) card which must be retained by the student while the candidate is registered at Department of Technology. The student must have valid ID card with him/her while in the Department of Technology.

ix. Any student who alters or intentionally mutilates an ID card or who uses the ID card of another student or allows his/her ID card to be used by another student will be subjected to disciplinary action.

x. The valid ID card must be presented for identification purpose as and when demanded by authorities. Any student refusing to provide an ID card will be subjected to disciplinary action.

R.B.T. 19 Details regarding B.Tech. Major, Multidisciplinary Minor, Honors, Honors with Research, Specialization Minor and Multiple entry, multiple exit features:
(Major means the respective 6 UG Programs available on the Campus at the Department of Technology)

I. **B.Tech. Major:** The B.Tech. Major requires earning the routine no of credits i.e. 162 (First Two semesters, 21 credits each plus remaining 6 semesters @ 20 Credits=120 credits.), thus the total credits against the Major will be 42+ 120 = 162. Along with that, there will be mandatory audit courses in each semester.

II. **B. Tech. Multidisciplinary Minor (MDM):** There will be at least one Multidisciplinary Minor Program for each UG Major. For that sake, extra 14 Credits are mandatory to be earned. The credit split up is as follows: 3 Courses each of 3 credits plus 3 credits against MDM based internship plus 2 credits against MDM based Mini Project.

III. With the aforesaid I & II, every enrolee under a particular UG Degree program, after the successful completion of the same will be the awardee of **B.Tech. in Major Degree Title with Multidisciplinary Minor** (Minor Title Mention). *As per the National Credit* Framework's mention of verticals, this particular Degree falls under the **fourth vertical (Level 6.0).** Routine fees as decided by the institute will be applicable to all the enrolled students.

As usual if these graduates want to pursue PG, it will be of 2 years duration for them.

IV. The credits distribution for the MDM featured B.Tech. Degree in a particular Major Program is as follows: 21+21+20+23+23+23+23+22=176. The SGPA and CGPA calculation will be as per this distribution.

V. **B. Tech. (Honors):** This is purely an option to all the students. There will be additional **17** credits out of which **15** credits will be earned through successful completion of 05 courses 3 Credits each **plus 2** credits will be against a course in advanced laboratory practice from the major. (These courses could be preferably through the MOOCs. If so, these MOOCs need to be other than MOOCs of Semester VIII). The courses to be

completed throughout four years starting from second year. The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***fifth vertical (Level 6.0).*** As per NEP 2020 guidelines, such successful candidates will be eligible to enter at the Second Year of PG in the respective specialization.

VI. **B. Tech. (Honors with Research):** This is also purely an option to all the students. There will be **17 credits** earned as in case of Honors **plus** there will be **3 more credits** earned against an additional Project Work with success in publishing at least one research paper based on the research topic. The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***sixth vertical (Level 6.0).*** As per NEP 2020 guidelines, such successful candidates will be eligible to pursue Ph.D. studies **provided the candidate's entire CGPA is 7.5 and above.**

VII. **B. Tech. Double Minor:** This is also purely an option to all the students. As mentioned in I & II, the candidate in addition to Multidisciplinary Minor (MDM) along with the Major Degree, may choose to opt for one more minor from the Pool of Specialization Minors (Environmental Engineering) and earns 14 extra credits against this minor. The successful candidates will be the awardees of B.Tech. in Major Degree with Double Minors. (Mention of the Multidisciplinary and Specialization Minors). The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***seventh vertical (Level 6.0)*****..**

VIII. **Multiple entry and multiple exit feature:**

i. **After First year,** any candidate desiring exit from first year with a claim to be an awardee of certificate course in respective specialization, the enrolee has to complete (in addition to the First Year Credits 42 in number), two, '2 credits theory courses' and a skill based 4 credits course (i.e. 1 Month Industrial Training). These additional 08 credits to be earned by such aspirants. The details of these courses to be defined by the respective specialization and designed and well narrated to the aspirants. The interested students have to pay separate fees for the same. As per the National Credit Framework's mention of verticals, this particular case falls under the first vertical (Level 4.5).

ii. **After Second Year,** any candidate desiring to exit from second year with a claim to be an awardee of Diploma in respective specialization, the enrolee must have completed the courses against the Certificate. Moreover, the enrolee has to complete (in addition to the First Year and Second Year Credits 85 in number), three, '2 credits theory courses'

and a skill based 4 credits course (i.e. 1 Month Industrial Training). These additional 10 credits to be earned by such aspirants. The details of these courses to be defined by the respective specialization and designed and well narrated to the aspirants. The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***second vertical (Level 5.0)***

iii. **After Third Year,** any candidate desiring to exit from third year will bean awardee of Bachelor's Degree in Vocation (B.Voc.)in respective specialization, provided the enrolee must have completed all the courses till T.Y B.Tech (Credits 131 in number). However, such a candidate needs to earn an additional 8 credits that include any two '2 credits theory courses' and a skill based 4 credits course (i.e. 1 Month Industrial Training). The choice of these two theory courses could be from the two courses which are listed against the exit after first year for certificate and three courses which are listed against the exit after S.Y.B.Tech with a claim for Diploma in respective specialization. *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***third vertical (Level 5.5)***.

iv. In case of multiple entry-multiple exit features, to undergo the one-month internship against the certificate and diploma, also in case of all other internships, the selection of skill imparting industry or organization will be preferably from the **AICTE approved SKPs (Skill knowledge Providers)** list.

IX. **About the courses through MOOCs:** In case of the non-availability of the MOOCs, the students will prepare for the course in a self-study mode under the mentorship of a teacher assigned by the respective Program Coordinator and the Director of the Department of Technology. The students also will have option to choose to appear for the End Semester Examination either by the MOOCs organizers or that by the Shivaji University.

N.B.: All the students will be mandatorily enrolled under the academic bank of credits. As regards, multiple entries, any student from same specialization who desires to join at second, third or Final Year has to have accumulation of those minimum numbers credits in the ABC account till the candidate's last year to that of the entry year.

Note: Also one more feature of this revision is that, besides the curriculum structure, as co-curricular activities, National Cadet Corps (India) i.e. NCC and National Service Scheme i.e. NSS units are available for the interested ones the selections of whom will be as per the respective norms.

Note: All other rules and regulations will be applicable as per Shivaji University, Kolhapur.

F. Engineering Graduate Attributes

1. Domain specific Engineering Knowledge
2. Problem Analysis Ability
3. Acquiring Skills that enable them to Design & Develop Solutions to the Problems
4. Capacity to investigate Complex Problems
5. Familiarity of using Modern Tools
6. Understanding Engineer's role and connectivity towards Society
7. Awareness about Environment & Sustainability
8. Practicing ethics and values
9. Ability to work as an Individual & in a Team also
10. Acquiring Communication skills
11. Becoming well verse with task of Project management & Finance aspects
12. Developing Lifelong Learning attitude

G. B. Tech. (Civil Engineering) Program: Vision, Mission, PEOs and POs.

Vision

To be a centre of excellence of quality education in Civil Engineering and Technology with global perspectives.

Mission

1. To enhance the quality of civil engineering education in the undergraduate program through excellent educational programs, creativity, research and enriched with soft skills.
2. To develop the eagerness of graduates for higher education, professional career and competitive examinations.
3. To promote excellence in teaching, research and development.
4. To produce competent technical manpower in the field of Civil Engineering to cater for the needs of industry and society, academic institutions and R and D institutions.

Program Educational Objectives (PEOs):

PEO1: Graduates of the program shall establish themselves in successful careers in civil engineering, construction engineering, or a related field.

PEO2: Graduates of the program shall collaborate effectively on multi-disciplinary teams to address the needs of society and the environment.

PEO3: Graduates of the program shall pursue lifelong learning, professional development, and registration as appropriate for their employers.

Program Outcomes (POs)

PO1: Apply basic knowledge of science, mathematics and engineering to solve complex Civil Engineering problems.

PO2: Analyze complex Civil Engineering problems to arrive at appropriate solutions using the fundamentals of science and engineering.

PO3: Design and develop safe and environmentally friendly systems and their components to meet specific needs.

PO4: Design and conduct experiments for complex Civil Engineering problems to come out with valid conclusions.

PO5: Select and apply appropriate techniques and state of the art tools for accomplishing complex Civil Engineering activities.

PO6: Assess societal, cultural and legal issues and consequent responsibilities pertaining to Civil Engineering practice.

PO7: Understand the impact of Civil Engineering projects on the environment and the need for sustainable development.

PO8: Practice professional ethics while discharging responsibilities.

PO9: Work in a team as a member or as a leader in diverse professional environments.

PO10: Comprehend and communicate effectively complex Civil Engineering activities through presentations and reports.

PO11: Understand financial aspects and apply management principles to Civil Engineering projects.

PO12: Engage in independent and lifelong learning in the context of rapid technological changes.

Program Specific Outcomes (PSOs)

PSO1: Able to perform economic analysis, quality checks, time/labour management and cost estimates related to design, construction, operations and maintenance of systems in the civil technical specialities

PSO2: Able to plan and prepare design and construction documents, such as specifications, contracts, change orders, engineering drawings, and construction schedules

H. Fee structure for Multiple Entry/Exit, Minor, Honors, Honors with Research

Sr. No.	Component	Total additional Credits	Fees to be charged* INR
1.	Exit After F.Y. B.Tech. claiming Certification in respective specialization	08	8000/-
2.	Exit After S.Y. B.Tech. claiming Diploma in respective specialization	10	10000/-
3.	Exit After TY B.Tech claiming Bachelor's Degree in Vocation (B.Voc.) in respective specialization.	08	8000/-
4.	B.Tech. Double minor (Only for Specialization Minor)	14	14000/-
5.	B.Tech. (Honors)	17	17000/-
6.	B.Tech. (Honor with Research)	20	20000/-

*For these optional features, the fees calculation is based on INR1000 per Credit. These fees featured B.Tech. against the additional optional features are applicable to the batch enrolled in the year 2023-24. All these fees will be in addition to the management approved total tuition fees per year for the MDM. Majors plus the admissible and payable other fees.

Shivaji University, Kolhapur
Department of Technology

Second Year B.Tech. (Civil Engineering), Semester- III, AY 2024-25

Teaching and Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Basic Science Course	BSC 211	Mathematics for Civil Engineers	03	-	-	03	03	30:70	00:00
2.	Programme Core Course	PCC 211	Strength of Materials	03	-	02	05	04	30:70	00:50
3.	Programme Core Course	PCC 212	Fluid Mechanics	03	-	02	05	04	30:70	50:50
4.	Programme Core Course	PCC 213	Surveying	03	-	02	05	04	30:70	00:50
5.	Programme Core Course	PCC 214	Building Construction	02	-	-	02	02	30:70	00:00
6.	Humanities, Social Sciences, Management: Value Education Course	HSSM (VEC 211)	Engineering Geology	02	-	-	02	02	00:00	50:00
7.	Humanities, Social Sciences, Management: Ability Enhancement Courses	HSSM (AEC 211)	Soft Skills Development	01	-	-	01	01	-	50:00
							-	**20**	**500**	**300**
8.	Humanities, Social Sciences, Management: Value Education Course	HSSM (VEC 212)	Environmental Studies	02	-	-	02	University Exam at Year End		
9.	Experiential Learning Courses: Common Engg. Projects/Field visits	ELC (CEP/FP 211)	Mini Project I and Industrial Visit	-	01	-	01	ISE at Course in charge end		
			Total Hours	19	01	06	**26**	-		

Course Categories	BSC	ESC	PCC	PEC	OE	VSEC	HSSM				ELC				CC	Total
							AEC	EEMC	IKS	VEC	RM	CEP/FP	PR	INT/OJT		
Credits	3	--	14	--	--	--	01	--	--	02	--	--	--	--	--	20
GR	--	--	8-10	--	04	--	--	02	--	02	--	02	--	--	--	20

Shivaji University, Kolhapur
Department of Technology

Second Year B.Tech. (Civil Engineering), Semester- IV, AY 2024-25

Teaching and Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Programme Core Course	PCC 221(L)	Concrete Technology	03	-	02	05	04	30:70	00:50
2.	Programme Core Course	PCC 222 (L) VSEC 221(P)	Building Planning and Computer-aided Civil Engineering Drawing	03	-	02	05	03(PCC) 01(VSEC)	30:70	50:50
3.	Programme Core Course	PCC 223	Structural Analysis	03	01	-	04	04	30:70	00:00
4.	Programme Core Course	PCC 224	Soil Mechanics	03	-	02	05	04	30:70	00:50
5.	Humanities and Social Sciences, Management: Value Education Course	HSSM (VEC 221)	Numerical Methods and Programming	02	-	-	02	02	30:70	00:00
6.	Humanities and Social Sciences, Management: Ability Enhancement Course	HSSM (AEC 221)	Technical Communication	01	-	-	01	01	00:00	50:00
7.	MDM Course	MDM 221	Multidisciplinary Minor Course I*	03	-	-	03	03	30:70	00:00
8.	Co-curriculum Courses	CC 221	Introduction to Performing Arts	01	-	-	01	01	-	50:00
								23	**500**	**300**
9.	Mandatory Audit Course	MAC 222	Aptitude Enhancement Course I	-	01	-	01	ISE at Course in charge end		
10.	Experiential Learning Courses: Common Engg. Projects/Field visits	ELC (CEPFP 221)	Mini Project II and Industrial Visit	-	01	-	01	ISE at Course in charge end		
11.	Humanities, Social Sciences, Management: Value Education Course	HSSM (VEC 221)	Environmental Studies	02	-	-	02	University Exam at Year End		
			Total Hours	21	03	06	**30**	-		

Course Categories	BSC	ESC	PCC	PEC	OE	VSEC	HSSM				ELC				CC	Total
							AEC	EEMC	IKS	VEC	RM	CEP/FP	PR	INT/OJT		
Credits	--	--	15	--	--	01	01	--	--	02	--	--	--	--	01	20
GR	--	--	8-10	--	02	02	02	02	--	02	--	--	--	--	--	20

Year, Program, semester	S.Y. B. Tech (Civil Engineering), Semester III, AY 2024-45 onwards					
Course Code	BSC 211					
Course Category	Engineering Science Course					
Course title	**Mathematics for Civil Engineers (Theory)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	03	-	-	03	03	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	30	70		-	-	100
Pre-requisites (if any)	Knowledge of Differential Calculus and Integral Calculus					
Course Rationale	This course offers a mathematical understanding for engineering applications. This course produce graduates with mathematical knowledge, computational skills and the ability to deploy these skills effectively in the solution of problems, principally in the area of engineering.					
Course Objectives	The course is aimed at - 1. To describe solution of LDE and its applications in civil engineering. 2. To introduce Fourier series. 3. To be familiarize with partial differential equations and its applications. 4. To analyze engineering problems based on probability and curve fitting. 5. To introduce vector calculus.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Solve Linear Differential Equations and apply them to realistic problems. 2. Understand Application of Fourier series. 3. Solve Partial Differential Equations for solving problems in civil engineering fields 4. Understand the applications of second order PDEs. 5. To solve engineering problems using Probability and curve fitting. 6. Apply knowledge of Vector Calculus to solve engineering problems.					

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3									
CO 2	3	3	3									
CO 3	3	3	3	2								
CO 4	3	3	3	2								
CO 5	3	3	3	3								
CO 6	3	3	3	2								

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Linear Differential Equations** Linear Differential Equations with constant coefficients, Homogenous Linear differential equations, higher order linear equations with constant coefficients; Euler-Cauchy equations; initial and boundary value problems Applications of Linear Differential Equations like deflection of beams, dynamics of structures, steady state fluid flow, beam-column, beams on elastic foundation, Linear and Bernoulli's differential equations.	8
II	**Fourier Series** Dirichlet's conditions, Full range Fourier series, Half range Fourier series, Application of Fourier series in Civil Engineering like harmonic analysis, vibration of dynamic system.	7
III	**Partial differential equations** First order partial differential equations, solutions of first order linear and non-linear PDEs- Four standard forms of partial differential equations of first order. Classification of PDE, Solution of Wave Equation, Applications of partial Differential Equations like stress-strain, fluid dynamics, shells Laplace equation by the method of separation of variables.	7
IV	**Probability and Curve Fitting** Sampling theorems; Conditional probability; Descriptive statistics – Mean, median, mode and standard deviation; Random Variables – Discrete and Continuous, Poisson and Normal Distribution; Linear regression. Applications of probability in statistical quality control, damage analysis.	7
V	**Matrix algebra:** Inverse, Determinant, Multiplication of higher order matrix Applications to find displacements, forces, etc. in frames and trusses, Determination of slope and deflection, sway analysis.	8
VI	**Vector Calculus** Functions of single variable; Limit, continuity and differentiability; Mean value theorems, local maxima and minima; Taylor series; Evaluation of definite and indefinite integrals, application of definite integral to obtain area and volume; Partial derivatives; Total derivative; Gradient, Divergence and Curl, Vector identities; Directional derivatives; Line, Surface and Volume integrals. Eigen values and Eigen vectors	8
Suggested list of Assignments: 1. To find solution of LDE with constant coefficients 2. Applications of LDE		

3. Examples on Fourier series
4. Examples on Partial Differential Equations
5. Applications of PDE
6. Examples on Probability
7. Examples on Curve Fitting
8. Vector differentiation
9. Vector Integration

General Instructions:

1. Each Student has to write at least 6 assignments on entire syllabus.
2. Students must be encouraged to solve engineering mathematics problems using different software's like MATLAB, Scilab etc.

	Text Books
1.	B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons.
3.	Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi
	Reference Books
1.	C. R. Wylie, "Advanced Engineering Mathematics", McGraw Hill Publication, New Delhi.
2.	B. S. Grewal, "Higher Engineering Mathematics", Khanna Publications, New Delhi.
3.	S. S. Sastry, "Engineering Mathematics (Volume-I)", Prentice Hall Publication, New Delhi.
4.	H. K. Dass, "Advanced Engineering Mathematics", S. Chand Publishing.
5.	N. P. Bali, Iyengar "A text book of Engineering Mathematics by", Laxmi Publications (P)Ltd., New Delhi.
6.	M. D. Greenberg, "Advanced Engineering Mathematics", Pearson Education.
7.	Merle C. Potter, "Advanced Engineering Mathematics", OXFORD University Press, 3rd Edition
	Useful web links
1.	https://nptel.ac.in/courses/111105121
2.	https://nptel.ac.in/courses/111105134
3.	https://nptel.ac.in/courses/111105035
4.	https://nptel.ac.in/courses/111105167
5.	https://nptel.ac.in/courses/111102133

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- III, AY 2024-25 onwards					
Course Code	PCC211					
Course Category	Programme Core Course					
Course title	**Strength of Materials (Theory)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	03	-	-	03	03	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	30	70		-	-	100
Pre-requisites(if any)	Engineering Mechanics					
Course Rationale	Strength of Materials is a fundamental subject needed primarily for the students of Civil and Mechanical sciences. As the engineering design of different components, structures etc. used in practice are done using different kinds of materials, it is essential to understand the basic behavior of such materials.					
Course Objectives	The objective of the present course is to make the students acquainted with the concept of load resultant, consequences and how different kinds of loadings can be withstood by different kinds of members with some specific materials.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Compute stresses and strains in the section under external loading. 2. Analyse the behaviour of the beam under axial and transverse loading. 3. Draw shear and bending stress distribution diagrams for the beam. 4. Compute the ultimate load on the column.					

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	2	3										1
CO 2	2	3										1
CO 3	2	3										1
CO 4	2	3										1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Stresses and strains** Engineering material properties. Types of stresses and strains, Hooks law, elastic constants and their relations, Poisson's ratio, concept of modular ratio. Temperature stresses, hoop and longitudinal stresses in thin cylinders. Stresses in composite sections. Stresses under external loading in 1-D, 2-D and 3-D members.	7
II	**SFD and BMD of Statically determinate beams** Shear force and bending moment diagrams, sign conventions, nature of diagrams under different types of loading. Examples to construct SFD and BMD in beams.	7
III	**Bending and shear stresses in beams** Bending theory, assumptions. Concept of pure bending, neural axis. Bending stress distribution. Numerical on beams of different cross sections.	7

	Shear stresses in the beam, shear stress distribution. Numerical on beams of different cross sections.	
IV	**Principal stresses and Principal strains** Normal and Shear stresses on any oblique plane, Concept of principal planes and principal stresses; Derivation of principal stresses, maximum shear stresses; Orientation of principal planes, analytical and graphical methods (Mohr's circle of stress 2-D)	7
V	**Strain energy** Concept of strain energy, strain energy due to various loadings like axial, transverse, shear and torsion. Stress resilience	7
VI	**Torsion of circular shaft** Torsion theory, assumptions. Concept of pure torsion. Circular shaft subjected to torsion, polar moment of inertia, power transmitted through the shaft.	5
Text Books		
1.	Punmia, Jain and and Ashok Kumar, "Mechanics of Materials", Vol. I and II - Laxmi Publications	
2.	S. Ramamrutham, R. Narayanan, "Strength of Materials", 18th edition, Dhanapat Rai Publications.	
3.	S.S. Bhavikatti, "Strength of Materials", 4th edition, New Age Publications.	
4.	R.K. Bansal., "Strength of Materials", 5th edition, Laxmi Publications.	
5.	S.S. Bhavikatti, "Structural Analysis", 4th edition, Vikas Publications house, New Delhi.	
Reference Books		
1.	F.L. Singer and Pytel, "Strength of Material", 4th edition, Harper and Row publication	
2.	J.B. Popov, "Introduction to Mechanics of Solids", Prentice – Hall publication.	
3.	Gere and Timoshenko, "Mechanics of Materials", 2nd edition, CBS publishers.	
4.	R.C. Hibbler, "Mechanics of Materials", 11th edition Pearson Education.	
5.	S. Timoshenko," Strength of Materials", 3rd edition, D. Van Nostrand company	
Useful web links		
1.	https://nptel.ac.in/courses/112107146	
2.	https://archive.nptel.ac.in/courses/105/105/105105108/	

Year, Program, Semester	Second Year B. Tech. (Civil Engineering), Semester- III, AY 2024-25 onwards					
Course Code	PCC211					
Course Category	Program Core Course					
Course title	**Strength of Materials (Practical)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Credits**	
	-	-	02	02	01	
Evaluation Scheme	**ISE**	**ESE**	**IE**	**EE**	**Total**	
	-	-	-	50	50	
Pre-requisites(if any)	Engineering Mechanics					
Course Rationale	Strength of Materials is a fundamental subject needed primarily for the students of Civil and Mechanical sciences. As the engineering design of different components, structures etc. used in practice are done using different kinds of materials, it is essential to understand the basic behavior of such materials.					
Course Objectives	The objective of the present course is to study material mechanical properties, observe failure pattern when subjected to axial loads, transverse loads and torsion by an experimental approach.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Compute stresses and strains in the section under external loading by experimental approach. 2. Identify the material mechanical properties from failure pattern.					

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	2	1										1
CO 2	2	1										1

Level of Mapping as: Low 1, Moderate 2, High 3

Expt. No.	Experiment Title/Objective	Hours
A)	**List of experiments (Any five)**	
1	Tension and compression test on mild steel and HYSD steel bars	02
2	Shear test on mild steel	02
3	Compression test on timber and bricks	02
4	Impact strength test on mild steel	02
5	Hardness test of various materials	02
6	Torsion test on mild steel	02
7	Tests on bamboo	02
B)	**Assignments**	
	Solve at least one assignment on every unit	

Relevant Codes	
1.	Specifications for HYSD bars. IS 1786 – 1985
2.	Specification for Mild Steel and Medium Tensile steel bars. IS 432 (P II) 1966
3.	Method for Tensile testing of steel wires. IS 5121 – 1972
4.	Hard drawn steel wire for concrete reinforcement. IS 1566 – 1982
5.	IS: 432; 226; 2062 – mild steel of grade I.
6.	Method for Tensile testing of Steel products IS 1608 – 1972
7.	Code of practice for bending & fixing of bars for concrete reinforcement IS 2502 - 1963
8.	IS: 432; 1877 – mild steel of grade II
9.	Method of sampling of clay building bricks IS 5454 - 1978
10.	Method of test for burnt-clay building bricks. IS 3495 (Parts I TO iv) 1976
11.	Common burnt clay building bricks. IS 1077 - 1992
12.	IS2408 (1963): Method of static tests of timber in structural sizing
Reference Books	
1.	S. Timoshenko," Strength of Materials", 3rd edition, D. Van Nostrand company

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- III, AY 2024-25 onwards					
Course Code	PCC212					
Course Category	Programme Core Course					
Course title	**Fluid Mechanics (Theory)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	03		-	03	03	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	30	70		-	-	100
Pre-requisites(if any)	Engineering Mechanics, Engineering Physics.					
Course Rationale	The course focuses on fluid mechanics and its properties, fluid statics, fluid kinematics, fluid dynamics, Flow through pipes with minor and major losses, Laminar flow, Turbulent flow and Open Channel Flow and Flow around Submerged Bodies is taught in this course.					
Course Objectives	1. To study processes and science of fluid and their properties. 2. To study pressure measuring devices and pressure diagram. 3. To apply basic principles in fluid flow problems. 4. To identify the losses in pipes.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Study the basic properties of fluids and their behaviour under application of various force systems. 2. Discuss the basic concepts and principles in fluid statics, fluid kinematics and fluid dynamics with their applications in fluid flow problems. 3. Recognize the principles of continuity, momentum and energy as applied to fluid in motion. 4. Apply the equations to analyse problems by making proper assumptions and learn systematic engineering methods to solve practical fluid mechanics problems.					

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	3	2	2	2	2	2						1
CO 2	2	3	1						1			1
CO 3	2	3		1								1
CO 4	2	3			2					1		1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Basic Concepts Fluid Properties:** Viscosity, Newton law of viscosity, Vapour Pressure Cavitation, Surface Tension, Capillarity, Compressibility. **Fluid Statics** Fluid Pressure: Pascal's law, Pressure variation with temperature, density and altitude. Pressure measurement devices, Hydrostatic pressure and force.	7

	Buoyancy, Metacentre, Stability of Submerged and floating bodies.	
II	**Fluid Kinematics** Classification of fluid flow: Continuity equations in Cartesian coordinates, Path line, Streak line, Stream line, and Stream tube, Stream function, Velocity potential function and their relationship, Flow net.	5
III	**Fluid Dynamics** Surface and body forces, Euler's Equations of motion, Bernoulli's equation, Energy Principle, Venturemeter, Orifice-meter and Pitot tube, Momentum principle.	7
IV	**Flow through pipes** Loss of head through pipes, Darcy-Wiesbatch equation, Major and Minor losses, Total energy equation, Hydraulic gradient line, Pipes in series, Equivalent pipes, Pipes in parallel, Siphon, Power transmission through pipes, Water hammer.	7
V	**Laminar flow:** Reynolds's Experiment, Laminar flow through: circular pipes and parallel plates, Hagen– Poiseuille equation. **Turbulent flow:** Velocity distribution and Shear stresses in turbulent flow, Prandtl mixing length theory, Nikuradse's Experiment, Moody's Chart.	7
VI	**Flow in Open Channel** Introduction, Difference between Pipe Flow & Open Channel Flow. Types of Open Channels, Types of Flows in Open Channel, Geometric Elements, Measurement of Velocity.	6
Text Books		
1.	Modi/Seth, "Fluid Mechanics – Hydraulic and Hydraulic Mechanics", Standard Book House, Delhi	
2.	A.K. Jain, "Fluid Mechanics", Khanna Pub., Delhi.	
3.	K. L. Kumar, "Fluid Mechanics", Eurasia Publication House, Delhi	
4.	R.K. Bansal, Laxmi Publications -Fluid Mechanics and hydraulic machine.	
Reference Books		
1.	K. Subramanyam, "Flow in open channel", Tata McGraw-Hill Pub. Co., Delhi	
2.	Rangaraju, "Open Channel flow", Tata McGraw-Hill Pub. Co., Delhi	
3.	Streeter, "Fluid Mechanics", McGraw-Hill International Book Co., Auckland	
4.	V. T. Chaw, "Flow in open channel", McGraw-Hill International Book Co., Auckland	
5.	R.C. Hibbeler, "Fluid Mechanics", Pearson Publication.	
Useful web links		
1.	https://nptel.ac.in/courses/105103095	
2.	https://www.youtube.com/watch?v=tDr6kNgyaYM	
3.	https://archive.nptel.ac.in/content/storage2/courses/112105171/Ques_Ans_Lecture_28.pdf	
4.	https://nptel.ac.in/courses/105107059	

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- III, AY 2024-25 onwards					
Course Code	PCC 212					
Course Category	Programme Core Course					
Course title	**Fluid Mechanics (Practical)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	-		02	02	01	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	-	-		50	50	100
Pre-requisites (if any)	-					
Course Rationale	The course basically focuses on fluid mechanics and its properties, Pressure measuring devices, discharge measuring devices of Pipe flow and Open Channel Flow.					
Course Objectives	1. To clarify the Practical Applications of fluid mechanics, 2. To study various pressure measuring devices, discharge measuring devices. 3. To identify the Practical losses in pipes 4.To determine flow parameters in open channel flow					
Course Outcomes	Upon completion of this course, student should be able to – 1. Study the basic properties of fluids and their behaviour under application of various force systems. 2. Demonstrate an ability to verify stability of floating body and Bernoulli's Theorem. 3. Demonstrate an ability to measure discharge and losses in pipe flow 4. Demonstrate an ability to determine flow parameters in open channel flow					

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	2	3										1
CO 2	2	3				1						1
CO 3	2	3								1		1
CO 4		3			2							3

Level of Mapping as: Low 1, Moderate 2, High 3

Sr. No.	List of Experiment
1.	Verification of Bernoulli's Theorem.
2.	Determination of coefficient of discharge of Venturimeter.
3.	Determination of coefficient of discharge of Orifice meter.
4.	Study of factors affecting coefficient of friction for pipe flow (at least for two different materials and two different diameters)
5	Determination of loss of head due to i) Sudden expansion, ii) contraction iii) elbow iv) bend v) Globe Valve etc. (At least Two minor losses)

6.	Visualization of Laminar and Turbulent flow using Reynold's Apparatus and determination its sample value
7.	Study of V-Notch.
8.	Study of Rectangular Notch/Weir.
9.	Study of Trapezoidal Notch/Weir.
10.	Visit to Hydropower Plant. (Mandatory)
	Reference Books/Manual
1.	Modi/Seth, "Fluid Mechanics – Hydraulic and Hydraulic Mechanics", Standard Book House, Delhi
2.	A.K. Jain, "Fluid Mechanics", Khanna Pub., Delhi.
3.	K. L. Kumar, "Fluid Mechanics", Eurasia Publication House, Delhi
4.	R.K. Bansal, Laxmi Publications -Fluid Mechanics and hydraulic machine.

Year, Program, Semester	Second Year B. Tech. (Civil Engineering), Semester- III, AY 2024-25 onwards				
Course Code	PCC213				
Course Category	Programme Core Course				
Course title	**Surveying (Theory)**				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	03	-	-	03	03
Evaluation Scheme	ISE	ESE	IE	EE	Total
	30	70	-	-	100
Pre-requisites(if any)	Basic Civil Engineering				
Course Objectives	The course is aimed -- 1. To develop the ability of applying knowledge of mathematics, science, and Engineering to understand the measurement techniques and equipment used in land surveying. 2. To study the various conventional instruments used in surveying. 3. To learn advanced instruments to solve surveying problems.				
Course Outcomes	Upon completion of this course, student should be able to – 1. Use various levelling instruments for land survey. 2. Apply various surveying technique using conventional instruments for the Preparation of map. 3. Apply surveying technique using advanced instrument such as Total Station for Engineering Problem.				

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2		1	2									2
CO 2	3	2		1	2									2
CO 3	2	3		3	3									2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Surveying and Levelling** Distance and angle measurement, Errors and their adjustment; Maps - scale, coordinate system;, Construction and Permanent adjustments of Dumpy Level, Auto Level, Sensitivity of Bubble, Tube, Curvature and Refraction, Reciprocal Levelling, Errors in Levelling, Contouring, Characteristics of Contours, Methods of Plotting Contours, Uses of Contour Maps, Applications of levelling	7
II	**Theodolite** Theodolite, Types of Theodolite, Construction, Adjustments and uses, Methods of horizontal and vertical angle measurement, Use of Electronic Theodolite, Theodolite Traversing, Methods for Linear and Angular Measurement, Computation of Bearing, Latitudes and Departures, Consecutive and Independent Co-ordinate, Traverse Computations and adjustment, Omitted Measurement, Trigonometric Levelling	7
III	**Curves** Types of Curves, Elements of Horizontal and Vertical Curves, Horizontal curves: Elements, Setting out of simple circular curve, Tacheometry and its application,	7

	Work Stadia method, Subtense Bar system	
IV	**EDM Instrumentation** Basics of EDM, advances in technology, Working Principle and use of Total Station, Fundamental parameters for calculation, correction factors and constants; Setting up, levelling, initial general settings, back sighting, station codes, overview of system functions and applications; and data retrieval and processing	6
V	**GIS and GPS** Basics of Geographical Information Systems (GIS), Working Principle, Types and Methodology, Analysis using raster and vector data, Open Source Software Geographical Positioning System (GPS): Working Principle, Types and methodology, Different segments, space, control and user segments –satellite, Hand Held and Geodetic Receivers Introduction to GNSS	7
VI	**Modern Techniques of Surveying and Mapping** Modern techniques and procedures for Aerial, LIDAR, 3D Scanner, Data interpretation and analysis, Elements of visual interpretation, and digital image processing, Drone Surveying- Working Flow, Types of Drones, data collection, post processing for map projection, Introduction to Hydrographic Survey	5
Text Books		
1.	A.M. Chandra, “Plane Surveying”, New Age Publication, 2nd edition	
2.	A.M. Chandra, “Higher Surveying”, New Age Publication	
3.	T.P. Kanetkar and S.V. Kulkarni, “Surveying and Levelling”, Vol.1 & 2, Vidhyarthi Griha Prakashan, Pune	
Reference Books		
1.	K.R. Arora, “Surveying”, Vol. I ,II, III ,Standard Book House	
2.	C.D. Ghilani, “Elementary Surveying- An Introduction to Geomatics”, Pearson Publication	
3.	W. Schofield, “Engineering Surveying”, Taylor and Francis Group	
4.	B.C. Punmia, “Surveying”, Vol. I, II, III, Laxmi Publication.	
5.	P.J Gibson, Routledge, “Introduction to Remote Sensing - Principles and Concepts” Taylor & Francis, 2000.	
6.	P.J. Gibson and C.H. Power, Routledge “Introduction to Remote Sensing - Digital Image Processing and Applications” Taylor & Francis, 2000.	
7.	Jensen, J.R., “Remote Sensing of the Environment an Earth Resource Perspective”, Pearson Education, Delhi, 2003.	
Useful web links		
1	https://www.youtube.com/watch?v=TqbYlHIzYJs&list=PLwdnzlV3ogoXXrcA8w6rrYmXfq3uU4R7g	
2	https://nptel.ac.in/courses/105108077	
3	https://archive.nptel.ac.in/courses/105/107/105107218/	
4	https://nptel.ac.in/courses/105103193	

Year, Program, Semester	Second Year B. Tech. (Civil Engineering), Semester- III, AY 2024-25 onwards					
Course Code	PCC213					
Course Category	Programme Core Course					
Course title	**Surveying (Practical)**					
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Credits	
	-	-	**02**	02	**01**	
Evaluation Scheme	ISE	ESE	IE	EE	Total	
	-	-	-	50	50	
Pre-requisites(if any)	Basic Civil Engineering					
Course Objectives	1. To understand the use of basic surveying tools for land surveying. 2. To understand use of Theodolite survey. 3. To study advanced surveying instruments required for correct measurement. 4. To develop the skills required for team work.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Use basic surveying tools such as Dumpy Level, Auto Level, Plane Table and Theodolite for Land Surveying. 2. Able to use Theodolite for preparation of plan, locating details, setting curve. 3. Use advanced instruments such as Electronic Theodolite, Total station for correct measurements and for preparation of contour map. 4. Increase the efficiency, speed of the work, the ability to focus different minds on the same problem and provide mutual support through team work.					

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2		1	2				1	1				2
CO 2	3	2		1	2				1	1				2
CO 3	2	3		3	3				1	1				2
CO4	1	1		1	1				3	2				2

Level of Mapping as: Low 1, Moderate 2, High 3

Experiment No.	Experiment Title/Objective	Hours
1.	Use of Dumpy Level and Auto level	02
2.	Plane Table Survey- Radiation Method and Intersection Method.	02
3.	Computation of horizontal distances and elevations by Tacheometry.	02
4.	Setting of a Simple Circular Curve using Theodolite.	02
5.	Study and use of Electronic Theodolite and measurement of horizontal angle and vertical angle	02
6.	Study and use of Total Station	02
7.	Total Station application- area, volume, remote elevation Missing Line Measurement, Resection	02

8.	Set out points using Total Station	02
9.	Drone Surveying	02
10.	DGPS Surveying	02
	Projects	
1.	Project -Preparation of Contour Map for small area using Total Station	04
2.	Project -Electronic Theodolite Traversing	04
Reference Books and web links		
1.	K.R. Arora, "Surveying", Vol. I ,II, III ,Standard Book House	
2.	C.D. Ghilani, "Elementary Surveying- An Introduction to Geomatics", Pearson Publication	
3.	W. Schofield, "Engineering Surveying", Taylor and Francis Group	
4.	B.C. Punmia, "Surveying", Vol.I, II, III, Laxmi Publication.	

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- III, AY 2024-25 onwards					
Course Code	PCC 214					
Course Category	**Program core course**					
Course title	**Building Construction (Theory)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	02	-	-	02	02	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	30	70		-	-	100
Pre-requisites(if any)	Fundamentals of Civil Engineering					
Course Rationale	The course basically focuses on fundamentals and Engineering properties of building materials. Different building components their significance and functions are explained in the course.					
Course Objectives	1. To study Building construction material and statutory provisions 2. To categorize different building components					
Course Outcomes	Upon completion of this course, student should be able to – 1. Describe building construction components and material 2. Illustrate the Details of masonry work, properties of building material. 3. Explain design consideration of various building components					

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2		2											
CO 2	2		2		1		1							
CO 3	2		2		2		1							

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Functional requirements of building** *Basic requirements of a building as a whole*: strength and stability, Dimensional stability, comfort and convenience, damp prevention, water-proofing techniques, heat insulation, day lighting and ventilation. Sound insulation and anti-termite treatment. *Building components and their basic requirements* : Foundations, plinth, walls and RCC components in building, floors, doors and windows, sills, lintels and weather sheds, roofs, steps and stairs, utility fixtures. *Formwork for basic RCC elements*: Ideal Requirements and types. Method of fixing. *Foundations*: Stepped, isolated, combined, strip, raft, strap or cantilever, piles. Suitability of each type	5
II	**Materials of Construction** *Stones*: Requirements of good building stones, Dressing of stones, uses of building stones. *Bricks*: Manufacturing process, Types and Engineering Properties. *Aggregates*: Fine Aggregates and coarse aggregates	7

	Timber: Natural wood, Artificial wood and their use in Civil Engineering. *Steel*: Manufacturing of steel with reference to carbon content, Standard sections, steel as reinforcement. High Yield Strength Steel and high tensile steel, uses of steel in Building Construction. *Cement*: types of cement and their properties. Applications of different types of cement *Tiles*: Introduction to Vitrified, Natural Stone, Paving Blocks etc	
III	**Masonry construction** *Stone masonry* : Uncoursed Random Rubble, Uncoursed Rubble, Coursed Random Rubble and Ashlar Masonry *Brickwork and Brick Bonds* : English, Flemish, Principles Observed During construction	3
IV	**Composite masonry** Various types of partition walls, Solid concrete blocks, hollow concrete blocks and light weight blocks (Siporex), soil stabilized blocks, Fly Ash Blocks. Environment benefits	4
V	**Arches and Lintels** *Arches*: Arches, their types, methods of construction. *Lintel*: Necessity, Materials: wood, steel, R.C.C. **Doors and Windows** *Doors*: types of door, fixtures and fastening. *Windows*: types of windows, fixtures and fastening. **Stairs** Technical terms, requirements of a good stair, types, Design of stairs (Dog Legged and Open Well)	5
VI	**Roofs and Roof coverings** Terms used. Roof and their selection, pitched roofs and their types, Timber Trusses (King Post and Queen Post), Steel Trusses types, roof coverings and their selection. **Floorings** Flooring (Natural and Artificial Material), Concrete Flooring (Tremix Flooring)	4
Text Books		
1.	S.P. Arora, S.P. Bindra, “A Text Book of Building Construction”, Dhanpat Rai Publications	
2.	Arora N.L. and Gupta B.R, “Building Construction” ,Satya Prakashan	
3.	R.K. Rajput, “Engineering Materials” – (S. Chand)	
4.	B. C. Punmia, “Building Construction”, Laxmi Publications.	
Reference Books		
1.	M. M. Goyal, “ Handbook of Building Construction” (Amrindra Consultancy (P)ltd.	
2.	UDCPR , Urban Development Department , Government of Maharashtra.	
3.	V.B. Sikka, “A Course in Civil Engineering Drawing” , S.K .Kataria and Sons .	
Useful web links		
1.	https://archive.nptel.ac.in/courses/105/106/105106206/	
2.	https://archive.nptel.ac.in/courses/105/102/105102088/	
3.	https://archive.nptel.ac.in/courses/105/106/105106053/	

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- III, AY 2024-25 onwards					
Course Code	VEC 211					
Course Category	**Humanities and Social Sciences, Management: Value Education Course**					
Course title	**Engineering Geology (Theory)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	02	-	-	-	02	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	-	-		50	-	50
Pre-requisites(if any)	Fundamentals of Civil Engineering					
Course Rationale	Engineering Geology is a fundamental course in translating different information related to geo-ground for sound, safe, stable, naturally compact, environmentally sustainable and economic development of various facilities for safe, and environmentally sustainable progress of civilization and existing ecosystem.					
Course Objectives	1. To understand the different types of mineral, rocks and geological structures with emphasis on civil engineering aspects. 2. To identify the phenomenon of earthquake and landslides along with their civil engineering mitigation. 3. To study the suitability of site for construction of dams, reservoirs, bridges and tunnels etc.					
Course Outcomes	Upon successful completion of this course the student will be able to: 1. Describe the phenomenon of' weathering, erosion, earthquake and landslides along with their civil engineering significance. 2. Describe the different types of geological structures with impatience on civil engineering aspects. 3. Summarize the different types of minerals and rocks with their civil engineering significance. 4. Apply the knowledge of geology to know the suitability of site for construction of dams, reservoirs, and tunnels etc.					

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2										
CO 2	3	2										
CO 3	3	2										
CO 4	3	2										

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**General Geology & Petrology** Introduction: Definition, Scope and Subdivisions, applications of Geology in Civil Engineering. Internal structure of earth, Weathering - Types and civil engineering significance. Geological work of river: features of erosion, deposition and transportation, Civil Engineering Significance, Mineralogy: Classification of minerals. Petrology: Igneous rocks: Origin, Structures, Classification - Concordant and discordant intrusions, Sedimentary rocks: Formation, Structures, Civil Engineering significance. Grain size classification of sedimentary rocks. Metamorphic rocks: Agents and Types of Metamorphism.	06
II	**Structural Geology** Structural Geology: Strike and Dip, Unconformity-Types. Fold and Fault: Parameters, Classification, Causes. Joint: Types, Civil Engineering considerations.	03
III	Earthquake: Terminology, Causes, Seismic waves, Landslides: Types, Causes, Prevention of Landslides. Building stones: Engineering properties of rocks Requirement of good building stones.	02
IV	**Preliminary Geological investigations** Preliminary Geological Investigations, Steps in Geological investigations for project site. Exploratory drilling:- Observation, Preservation of core and core logging, Core recovery, RQD. Compilation and interpretation of information obtained from these, Correlation of surface data with results of subsurface exploration. Limitations of drilling.	03
V	**Geology of tunnel and Bridges** Difficulties during tunneling, influence of geological conditions on tunneling. Geological consideration while choosing tunnel alignment. Tunnel in folded strata, sedimentary rocks and Deccan traps	02
VI	**Geology of Dams and Reservoirs** Ideal Geological conditions for Dams and Reservoirs: Influence of geological conditions on Location, Alignment, Design and Type of a dam, Suitable and Unsuitable geological conditions for locating a dam site, Dams on carbonate rocks	03
Course Assessment Method		
For the internal assessment of the course, with a total evaluation is of 50 marks. Combination of different evaluation methods can be utilized to ensure comprehensive assessment of the students' performance at course coordinator end.		
Text Books		
1.	Prabin Singh, “Engineering and General Geology”, S. K. Katariya and sons, Delhi	
2.	R. B. Gupte, “A Text Book of Engineering Geology”, Vidyarthi Griha Prakashan,	

	Pune
3.	P. K. Mukerjee, “A Text Book of Geology”, The World Press Pvt. Ltd., Calcutta
Reference Books	
1.	Holmes, “Principles of Physical Geology”, ELBS Chapman & Hall, London.
2.	S. Sathya Narayanswami, “Engineering Geology”, Dhanpat Rai & Co.(P)Ltd, Delhi.
3.	P. Krynine & W. R. Judd, “Principles of Engineering Geology and Geotechnics”, CBS Publishers &Distributors, New Delhi.
4.	Dr. D. V. Reddy, “Engineering Geology for Civil Engineering”, Oxfard & IBH Publishing Co. Pvt.Ltd., New Delhi.
Useful web links	
1.	https://nptel.ac.in/courses/105105106
2.	https://onlinecourses.nptel.ac.in/noc23_ce107/preview
3.	https://archive.nptel.ac.in/courses/105/104/105104147/

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- III, AY 2024-25 onwards					
Course Code	AEC211					
Course Category	**Humanities, Social Sciences, Management: Ability Enhancement Courses**					
Course title	**Soft Skill Development**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	01	-	-	01	01	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	-	-		50	-	50
Pre-requisites(if any)	Fundamentals of Civil Engineering					
Course Rationale	In today's competitive professional landscape, technical skills alone are insufficient. Soft skills such as communication, teamwork, problem-solving, and adaptability are essential for engineering graduates to thrive in their careers. This course aims to equip students with the necessary soft skills to complement their technical expertise and enhance their employability and success in the workplace.					
Course Objectives	The teacher will 1. Help to enhance communication, teamwork, problem-solving skills. 2. Help to foster adaptability and resilience in engineering contexts.					
Course Outcomes	At the end of the course, the students will be- 1. Proficient in oral and written communication. 2. Effective as regards teamwork and collaboration skills. 3. Able to apply critical thinking to industrial problems. 4. Able to demonstrate adaptability and resilience in profession.					

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	-	-	-	-	-	-	-	-	3	3	-	-
CO 2	-	-	-	-	-	-	-	-	3	-	-	-
CO 3	-	3	-	-	-	-	-	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	-	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Written communication • Email Writing • Technical Report	3
II	Oral Communication • Presentation Skills	2
III	Soft Skills • Importance of Soft Skills • Overview of Various Soft Skills	2

IV	Team Spirit & Leadership Ability • Understanding team dynamics and roles • Building trust and rapport within team	2
V	Assessment • Discussion on incorporating soft skills development into daily practice • Case Studies or Role-Play	5

Course Assessment Method	
For the internal assessment of the course, with a total evaluation is of 50 marks. Combination of different evaluation methods can be utilized to ensure comprehensive assessment of the students' performance. Following Evaluation Components are suggested:	
1.	**Quizzes/Tests (10 marks)** Periodic quizzes or tests to evaluate students' understanding of key concepts and their ability to apply them.
2.	**Activity 1 (10 marks)** Group activity focusing application of creative thinking and teamwork; designed to assess both individual and group performance
3.	**Activity 2 (20 marks)** Group activity focusing application of creative thinking and teamwork; designed to assess both individual and group performance
4.	**Classroom Participation and Engagement (10 marks)** Demonstrating engagement with course material and Active participation in class discussions, group activities and question-answer sessions.

Reference Books	
1.	Sharma R. & Krishna Mohan (2017), Business Correspondence and Report Writing, McGraw Hill Education
2.	P. D. Chaturvedi & Mukesh Chaturvedi (2013), Business Communication: Skills, Concepts & Applications, Pearson Publications, New Delhi, 3rd Edition, Seventh Impression
3.	K. K. Sinha (2006), Business Communication, 2nd Edition (Reprint), Galgotia Publishing, New Delhi
4.	Khera, S. (1998). "You Can Win: A Step by Step Tool for Top Achievers." New Delhi: Macmillan Publishers India.
5.	Covey, S. R. (2004). "The 7 Habits of Highly Effective People." New York: Free Press.
6.	Carnegie, D. (2009). "How to Win Friends and Influence People." New York: Pocket Books.
7.	Bradberry, T., & Greaves, J. (2009). "Emotional Intelligence 2.0." San Diego, CA: Talent Smart.
8.	Dweck, C. S. (2006). "Mindset: The New Psychology of Success." New York: Ballantine Books.

Year, Program, semester	Second Year B.Tech. (Civil Engineering), Semester- III AY 2024-25 onwards					
Course Code	VEC 212					
Course Category	**Humanities, Social Sciences, Management: Value Education Course**					
Course title	**Environmental Studies (Theory)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	02	-	-	02	University Exam at year end	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	10	40		-	-	50
Pre-requisites(if any)	NA					
Course Rationale	The Course is all about learning the way we should live and how we can develop sustainable strategies to protect the environment. It helps individuals to develop an understanding of living and physical environment and how to resolve challenging environmental issues affecting nature.					
Course Objectives	The course teacher will 1. Introduce students to the fundamental concepts and principles of environmental science. 2. Describe the components of various ecosystems and their interrelationships. 3. Classify different types of natural resources and assess their availability and distribution. 4. Define biodiversity and its significance to ecosystem functioning and human well-being.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Define key terms and concepts related to environmental science. 2. Analyse ecosystem services and their importance to human well-being. 3. Identify various types of natural resources and their significance. 4. Describe the levels and patterns of biodiversity and their importance.					

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	3	2	-	-	-	-	3	3	-	-	-	-
CO 2	-	3	3	-	-	-	3	3	3	2	-	-
CO 3	-	2	3	-	-	-	3	3	3	3	-	-
CO 4	-	2	-	-	-	-	3	3	3	3	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Nature of Environmental Science:** Definition, scope and importance. Multidisciplinary nature of environmental studies Need for public awareness. Introduction to sustainable development: Sustainable Development Goals (SDGs) - targets and indicators, challenges and strategies for SDGs.	4
II	**Ecosystem:** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession. Food chains, food webs and ecological pyramids, Introduction, types, characteristics features, structure and function of the Following ecosystem: -Forest ecosystem,	6

	b)Grassland ecosystem, c)Desert ecosystem, d)Aquatic ecosystems(ponds, streams, lakes, rivers, oceans, estuaries) Degradation of ecosystems and its impacts.	
III	**Natural Resources and Associated Problems:** Overview of natural resources: Definition of resource; Classification of natural resources-biotic and abiotic, renewable and non-renewable. a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Water scarcity and stress; Conflicts over water. c) Soil and Mineral resources: Soil as resource and its degradation , Usage and exploitation, Environmental effects of extracting and using mineral resources., Wasteland reclamation, d) Energy resources: Growing energy needs, renewable and non- renewable energy resources, use of alternate energy sources. Solar energy , Biomass energy, Nuclear energy, e) Role of Indian traditions and culture in conservation of the environment	8
IV	**Biodiversity and its conservation:** Introduction- Definition: genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, India as a mega- diversity nation. Western Ghats as a biodiversity region. Hot-spots of biodiversity, Threats to biodiversity habitat loss, poaching of wildlife, man- wildlife , Conflicts, Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation Ramsar sites; Biosphere reserves; Protected Areas; Ecologically Sensitive Areas; Coastal Regulation Zone	7
V	Nature Visits / Field Work /Field Tour/ Industrial visits / Activities related to Campus environmental management	5

Text Books

1.	Agarwal, K. C., 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.
2.	Bharucha Erach, The Biodiversity of India, Map in Publishing Pvt. Ltd., Ahmadabad, 380013, India.
3.	Brunner R. C., 1989, Hazardous Waste Incineration, McGraw Hill Inc,

Reference Books

1.	Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T., 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,
2.	Gleick, H., 1993, Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press.
3.	Hawkins R. e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R).
4.	Heywood, V. H. & Watson, R. T., 1995, Global Biodiversity Assessment, Cambridge Univ. Press
5.	Jadhav, H. & Bhosale, V. M., 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi.
6.	Mckinney, M. L. & Schocl. R. M., 1996, Environmental Science Systems & Solutions, Web enhanced edition.
7.	Odum, E. P., 1971, Fundamentals of Ecology, W. B. Saunders Co. USA.
8.	Rao M. N. & Datta, A. K. 1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd.
9.	Sharma B. K., 2001, Environmental Chemistry, Goel Publ. House, Meerut.
10.	Trivedi R. K. and P. K. Goel, Introduction to air pollution Techno-Science Publications (TB).

11.	Trivedi R. K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R).
12.	Wagner K. D., 1998, Environmental Management, W. B. Saunders Co. Philadelphia, USA.
Useful web links	
1.	https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
2.	http://nitttrc.edu.in/nptel/courses/video/109105203/L41.html

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- III, AY 2024-25 onwards					
Course Code	CEPFP 211					
Course Category	**Experiential Learning Courses: Common Engg. Projects/Field visits**					
Course title	**Mini Project I and Industrial Visit**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	-	01	-	01	-	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	ISE at Course in charge end	-		-	-	-
Pre-requisites(if any)	Basic Sciences, Engineering Sciences, Mathematics, Program Core Courses					
Course Rationale	The Mini Project-I is designed to help students to develop practical ability and knowledge about practical tools / techniques in order to solve real-life problems related to the Civil engineering problems. The students will identify and work towards solving problems related major attributes of Civil Engineering. Also, the course intends to improve communication skills of students through technical report writing and presentations.					
Course Objectives	The teacher will 1. To apply basic engineering fundamentals and attempt to find solutions to the problems. 2. To develop communication skills and improve teamwork amongst group members and inculcate the process of self-learning and research.					
Course Outcomes	At the end of the course, the students will be- 1. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach. 2. Reproduce, improve and refine technical aspects for engineering projects.					

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	2	2	2	2		1		3	1	
CO 2	3	2	2	2	2	2		1		3	1	

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content	**Hours**
The student works on a topic based on following list • Fluid Mechanics: flow measurements, minor and major losses in various types of pipes • Building Construction: Preparation of model for different components of construction such as foundation, footings, bridge and their components, doors, windows, arches, etc • Survey: topographic survey, land survey, survey using advanced instruments such as total station, DGPS. Also, student has to prepare a comprehensive mini project report after completing the work and industrial visit to the satisfaction. Any mini project related to Civil Engineering is acceptable.	One hour weekly

Course Assessment Method
Assessment is based on presentations showcasing the efforts of the mini project for formulating the problem, developing/designing the solutions, testing and validating the solution, with submission of project report.

Year, Program, Semester	S.Y. Civil Engineering, Semester IV					
Course Code	PCC 221					
Course Category	Professional Core Course					
Course title	**Concrete Technology (Theory)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	03	-	-	03	03	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	30	70		-	-	100
Pre-requisites (if any)	Fundamentals of Civil Engineering, Building Construction					
Course Rationale	The objective in Concrete Technology is to expose the students to develop a comprehensive understanding of Concrete Technology and its practical applications, enabling them to contribute effectively to the construction industry and related fields.					
Course Objectives	1. To familiarize the appropriate selection of concrete ingredients based on engineering concepts which are applied in field Construction Fields 2. To elaborate procedure to design a concrete mix which fulfils the required properties for fresh and hardened concrete 3. To illustrate application of fundamental knowledge in the fresh and hardened properties of concrete. 4. Encourage students to critically think for the utilization of waste materials as novel innovative materials for use in concrete and to get acquainted with recent developments in the field of Concrete Technology.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Select appropriate concrete ingredients based on engineering concepts which are applied in field Construction Fields 2. Design concrete mixes to meet specified performance requirements, considering factors such as strength, workability, durability, and environmental conditions. 3. Understand the properties of fresh and hardened concrete. 4. Able to critically think for the utilization of waste materials as novel innovative materials for use in concrete and to get acquainted with recent developments in the field of Concrete Technology.					

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	3	1	1	3	1						1	1
CO 2	1	3	3	3	3	2	2	2	1	2	2	1
CO 3	2		2	3	1	1	1	1				1
CO 4	2	1	2			1					1	1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Ingredients of Concrete:** **a) Concrete:** Definition, Advantages and Disadvantages **b) Cement:** Physical properties of cement such as fineness, consistency test, Initial and final setting time, soundness, compressive strength, specific gravity. Manufacturing Process, Hydration of cement, Civil compounds of cement. Grades of cement, Types of cement- Ordinary Portland, Portland pozzolana, Low heat, Rapid Hardening Portland Cement, Quick setting cement, Sulphur resisting cement, Super sulphated cement, High Alumina, Coloured, Oil well, Hydrophobic cement. **c) Aggregates:** Properties of coarse and fine aggregates and their influence on concrete, Physical properties such as sieve analysis and fineness modulus, specific gravity and water absorption, silt content, Bulking of sand, Bulk density, moisture content, Flakiness index, Elongation index. Mechanical properties such as Crushing, Impact and Abrasion value, Alkali–Aggregate reaction, Grading of Aggregate, M-sand. **d) Water:** Specifications of water as per IS: 456 – 2000. **e) Ready Mix Concrete:** Layout	7
II	**Admixtures:** Types of admixtures, Plasticizers and super-plasticizers and their effects on workability, Role of plasticizers, Air entraining agents, Retarders, their effects on proportion of concrete, Pozzolanic admixtures, Fly ash, fly ash on fresh concrete, Silica flume, Metakaolin, Ground Granulated Blast Furnace Slag.	7
III	**Concrete Mix Design:** Nominal Mix Concrete, Objectives of mix design, Factors governing mix design, Methods of expressing proportions, statistical quality control. Mix design , Indian Standard method as per IS:10262 and IS:456, ACI 211.1-91 method, , DOE method, acceptance criteria	7
IV	**Manufacturing of Fresh Concrete:** Methods of Batching of concrete, methods of mixing of concrete, methods of Transportation of concrete, Placing of concrete in formwork, methods of placing of concrete including pumping of concrete, compaction techniques for good quality concrete, curing of concrete, methods of curing of concrete. **Properties of Fresh Concrete:** Workability of concrete and methods of measuring workability, Factors affecting workability, Segregation and bleeding, Temperature effects on fresh concrete.	7
V	**Hardened Concrete:** Strength of concrete, w/c ratio, Gel-space ratio, Effect of maximum size of aggregate, Factors affecting strength of concrete, Characteristic strength - compressive, tensile and flexure strength, Relation between compressive and tensile strength. Modulus of elasticity, Relation between modulus of elasticity and strength, Creep and shrinkage of concrete. **Durability of concrete:** Minimum and Maximum cement content, Strength and durability relationship, Volume change in concrete, Impact of w/c ratio on durability, permeability, carbonation, Accelerated Carbonation test, Sorptivity, Exposure to different conditions as per IS 456, Sulphate attack, Alkali aggregate reaction, Chloride attack, Corrosion of steel (chloride induced), Rapid Chloride	7

	permeability test, Corrosion Control.	
VI	**Special concrete**: Light weight concrete, No fines concrete, High density concrete, Fibre reinforced concrete and different types, Polymer concrete, High performance concrete, Self-compacting concrete, Extreme weather concreting, Vacuum concrete, Shotcreting, Plum Concrete, biological concrete. **Non-destructive testing:** Schmidt's rebound hammer – Mechanical and digital, Ultrasonic pulse velocity method, techniques of measuring and factors affecting the measurement of pulse velocity, Corrosion meter, Cover meter, Laser Testing methods, Leak Testing, Impact echo test, Core test and relevant provisions of I.S. codes. Case study based on structural audit.	6
Text Books		
1.	M.S. Shetty, "Concrete Technology (Theory and Practice)", S. Chand and Company Ltd, New Delhi, Seventh Revised edition 2013, Reprint 2015,	
2.	M.L. Gambhir, "Concrete Technology: Theory and Practice", Tata McGraw-Hill publishing Company Ltd, New Delhi, 5th edition.	
3.	B.L. Gupta and A. Gupta, "Concrete Technology", Jain Book Agency, 4th edition.	
Reference Books		
1.	M. Neville, "Concrete Technology", Pearson Education, New Delhi, 2nd edition.	
2.	A.R. Santhakumar, "Concrete Technology", Oxford University Press, New Delhi, 2nd edition, 2018.	
Reference Codes		
1.	IS: 456-2000, "Plane and Reinforced Concrete-Code of Practice", Bureau of Indian Standard, New Dehli.	
2.	IS: 10262-2019, "Guidelines for Concrete Mix Proportioning", Bureau of Indian Standard, New Dehli.	
3.	IS: 383-2016, "Concrete Specification Coarse and Fine Aggregate for (Third Revision)", Bureau of Indian Standard, New Dehli.	
Useful web links		
1.	https://archive.nptel.ac.in/courses/105/102/105102012/	
2.	https://archive.nptel.ac.in/courses/105/104/105104030/	
3.	https://archive.nptel.ac.in/courses/105/106/105106176/	
4.	https://archive.nptel.ac.in/courses/105/106/105106187/	
5.	https://www.youtube.com/playlist?list=PLbMVogVj5nJT6RXK4VKPGOfWHp2ZH8xin	

Year, Program, semester	S.Y. Civil Engineering, Semester IV					
Course Code	PCC 221					
Course Category	Professional Core Course					
Course title	**Concrete Technology (Practical)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	-	-	02	02	01	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	-	-		-	50	50
Pre-requisites(if any)	Fundamentals of Civil Engineering, Building Construction					
Course Rationale	The course aims at imparting knowledge and skill to design the concrete mix required for structural elements subjected different site conditions. It also help to develop capability to supervise concreting operations involving proportioning, mixing, transporting, placing, compacting, finishing and curing of concrete. Hence this course has its stand-alone value also.					
Course Objectives	1. Familiarize procedures to determine the properties of concrete ingredients i.e. cement, fine and coarse aggregate by conducting different laboratory test. 2. Illustrate properties of fresh and hardened concrete and apply knowledge for use of concrete at relevant site. 3. Elaborate procedure to design a concrete mix from laboratory test data of ingredients of concrete, which fulfils the required properties for fresh and hardened concrete. 4. Demonstrate the non-destructive test procedures on concrete and apply knowledge for the quality assurance without destructing the structure					
Course Outcomes	Upon completion of this course, student should be able to – 1. Determine the properties of concrete ingredients i.e. cement, fine and coarse aggregate by conducting different laboratory test. 2. Determine the properties of fresh and hardened concrete. 3. To Design Concrete Mix Proportioning by Using Indian Standard Method 4. Understand the non-destructive test procedures on concrete.					

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	2	1	1	3	1	1	1	1	1	1	1	1
CO 2	1	1	1	3	1	1	1	1	1			1
CO 3	3	2	2	3	1	1	1	1	1	2	2	1
CO 4	2	2	1	3	1				1	2	1	1

Level of Mapping as: Low 1, Moderate 2, High 3

Experiment No.	**Experiment title (Any 8 set of experiments)**	**Hours**
1.	Testing of cement: Consistency, fineness, setting time, specific gravity, soundness and compressive strength.	4

2.	Testing of fine aggregate: Specific gravity, sieve analysis and zoning, bulking of fine aggregate, bulk density, silt content.	4
3.	Testing of coarse aggregate: Specific Gravity, sieve analysis, bulk density, flakiness index, elongation index, water absorption and moisture content, soundness of aggregate.	4
4.	Mix Design of concrete as per IS code method	2
5.	Workability Tests on Fresh Concrete: Slump cone test, Compaction factor test, Vee-bee Consistometer Test, flow table test	2
6.	Strength tests of Hardened concrete - compressive strength by cube and cylinder, flexural strength, split tensile strength.	2
7.	Effects of Admixture - Accelerator, Retarder, Plasticizer, Super Plasticizer.	2
8.	Non-destructive Testing - Rebound Hammer test, Ultrasonic Pulse Velocity test, Cover determination, corrosion detection, carbonation detection (Atleast any 2)	2
9.	Durability Test: Accelerated Carbonation Test, Oxygen permeability Test, Rapid permeability Test, Sorptivity test, Germann water permeability, Wenner 4 probe resistivity.	2
10.	Micro structural study of concrete through XRD, SEM	2
11.	Field visit to construction site / RMC plant to observe manufacturing of concrete.	2
Text Books		
1.	M.S. Shetty, “Concrete Technology”, S. Chand and Company Ltd, New Delhi.	
Reference Books		
1.	M. Neville, “Concrete Technology”, Pearson Education, New Delhi, 1981.	
2.	Orchard, “Concrete Technology”, Asia publication, New Delhi, 1986.	
3.	A.R. Santhakumar, “Concrete Technology”, Oxford University Press, New Delhi, 2018.	
Reference Codes		
1.	IS: 456-2000, “Plane and Reinforced Concrete-Code of Practice”, Bureau of Indian Standard, New Dehli.	
2.	IS: 10262-2019, “Guidelines for Concrete Mix Proportioning”, Bureau of Indian Standard, New Dehli	
3.	IS: 383-2016, “Concrete Specification Coarse and Fine Aggregate for (Third Revision)”, Bureau of Indian Standard, New Dehli.	
Useful web links		
1.	https://www.youtube.com/watch?v=oD0qIR6PnlQ&list=PLbMVogVj5nJT6RXK4VKPGOfWHp2ZH8xin&index=39	
2.	https://www.youtube.com/results?search_query=nctel+lab+test+of+concrete	

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- IV, AY 2024-25 onwards					
Course Code	PCC 222					
Course Category	**Program core course**					
Course title	**Building Planning and Computer Aided Civil Engineering Drawing (Theory)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	03	-	-	03	03	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	30	70		-	-	100
Pre-requisites(if any)	Fundamentals of Civil Engineering, Building Construction					
Course Rationale	The course basically focuses on planning and designing of residential building from commencement stage to final drawing. Building planning bye laws and regulations, their significance are included in this course. This course also focuses on Building services like plumbing, electrification, ventilation, air conditioning, thermal insulation, sound insulation					
Course Objectives	1. To study Building planning principles and statutory provisions 2. To apply National Building Code Provisions for Buildings					
Course Outcomes	Upon completion of this course, student should be able to – 1. Use planning principles and byelaws for building design. 2. Apply provisions of national building code for buildings. 3. Identify appropriate building services based on use of building 4. Summarize concept of green building and affordable housing					

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2			2	1	1			1	
CO2	2	2	2			3		1			1	
CO3	2	2	2			2	1	1			1	
CO4	3	2	2			2		1			1	

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Planning of Building** Site Selection criteria. Types of Residential buildings, Principles of Planning for residential building, Types of public buildings, Planning of various public building, Significance Sun diagram, Wind Diagram, Orientation, Factors affecting, criteria under Indian condition	10
II	**Building Planning Byelaws & regulations** National Building code of India - group 1 to 5 (introduction only). UDCPR Urban Development Department, Government of Maharashtra: Introduction to Administration, Development permission and commencement certificate. General building requirements etc. Requirements of part of building. Structural safety, Water supply, drainage, sanitary requirements etc**.** RERA, introduction to various government housing scheme, Maharashtra Real Estate Regulatory Authority.	7

III	**Planning** of residential buildings, row houses, apartments, commercial complex, etc. Planning of public building like school, engineering college, office, etc.	4
IV	**Plumbing system** Various Materials for system like PVC, GI, AC, CI, and HDPE. Various types of traps, Fittings, Chambers. Need of Septic Tank, Concept of Plumbing & Drainage plan, introduction to rainwater harvesting. Electrification: Concealed & Open Wiring, Requirements & Location of various points, Concept of Earthing. Fire resistance in building: Fire protection precautions, confining of fire, fire hazards, Characteristics of fire resisting building materials and their resistance to fire.	7
V	**Ventilation** Definition and necessity of Ventilation, functional requirement, various systems. Air conditioning: Purpose, Classification, Principles, Systems & Various Components of the same. Thermal Insulation: General concept, Principles, Materials, Methods. **Introduction to Acoustics:** - Absorption of sound, various materials, optimum reverberation time, conditions for good acoustics. Sound Insulation: Acceptable noise levels, Noise prevention at its source, Transmission of Noise: Noise control.	7
VI	**Green building** Need and importance of green building, definition and benefits, site sustainability, water use efficiency, energy efficiency. Green building materials, assessment and evaluation of green buildings in India, top ten green buildings in India recognized by LEED.	6
Text Books		
1.	Dr. N Kumarswamy, A. Kameshwara Rao, " Building planning and drawing"	
2.	Shah, Kale, Patki, " Building Drawing", Tata McGraw- Hill	
3.	Arora N.L. and Gupta B.R, "Building Construction" ,Satya Prakashan	
4.	S.P. Arora, S.P. Bindra, "A Text Book of Building Construction", Dhanpat Rai Publications.	
Reference Books		
1.	SP 7- National Building Code Group 1 to 5 - B.I.S. New Delhi	
2.	UDCPR , Urban Development Department , Government of Maharashtra.	
3.	V.B. Sikka, "A Course in Civil Engineering Drawing" , S.K. Kataria and Sons.	
Useful web links		
1.	https://onlinecourses.nptel.ac.in/noc22_ce101/preview	
2.	https://www.youtube.com/playlist?list=PLM-jfaoaU5iynmQrTHewdlnmszCY8Mcpv	

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- IV, AY 2024-25 onwards					
Course Code	VSEC 221					
Course Category	Vocational and Skill Enhancement Course					
Course title	**Building Planning and Computer Aided Civil Engineering Drawing (Practical)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	-	-	02	02	01	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	-	-		50	50	100
Pre-requisites(if any)	Basic Civil Engineering, Building Planning and Design, CAD					
Course Rationale	Students will draw working and municipal submission drawing of residential building as per National Building Code provisions.					
Course Objectives	1. To draw Working drawings for Building Components and construction 2. To draw Municipal Submission drawing for residential building					
Course Outcomes	Upon completion of this course, student should be able to – 1. Develop Working drawings for Building Components and construction 2. Develop Municipal Submission drawing for residential building					

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3					3						
CO2	3					3						

Level of Mapping as: Low 1, Moderate 2, High 3

Expt. No.	Experiment or Practical Title/Objective	Hours
	A) List of Practical (Any Six)	
I	Building Components: Doors, Windows, Stair case	06
II	Measurement Drawing Drawing based on actual measurements of existing residential building: Consisting of plan, elevation, section passing through staircase and sanitary block, Site plan. Area statement and brief specifications, doors and windows schedule, septic tank details, etc. Preparation of site visit report.	06
III	Planning and designing of residential building (G+1). Submission drawing for planned residential building using AutoCAD.	06
IV	Submission Drawing for sanction from authority using AutoCAD.	
V	Detail working drawing of foundation and centre line plan of residential/public/commercial building using AutoCAD.	02
VI	Drawing on electrification system of residential/public/commercial building using AutoCAD.	02
VII	Drawing on plumbing system of residential/public/commercial building using	02

	AutoCAD.	
VIII	Introduction to REVIT software	02
	Introduction to BIM software	02
B)	**Assignments**	
	Solve at least one assignment on each unit	
Text Books		
1.	S. P. Arora and S. P. Bindra, " A text book of Building Construction"	
2.	V.B. Sikka, " A Course in Civil Engineering Drawing" – (S.K. Kataria and Sons)	
3.	Shah, Kale, Patki, " Building Drawing" – (Tata McGraw- Hill)	
4.	Sandeep Mantri**, "**A to Z of Practical Building Construction and Its Management**"**- (Satya Prakashan, New Delhi)	
Reference Books		
1.	SP 7- National Building Code Group 1 to 10- B.I.S. New Delhi	
2.	Unified Development Control Promotion Regulation (UDCPR), 2020	
3.	I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings	
Useful web links		
1.	https://www.youtube.com/watch?v=mqZBfuItwII	
2.	https://www.youtube.com/watch?v=hO865EIE0p0	
3.	https://www.linkedin.com/learning/topics/autocad	

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- IV, AY 2024-25 onwards					
Course Code	PCC223					
Course Category	Programme Core Course					
Course title	**Structural Analysis (Theory)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	03	01	-	04	04	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	30	70		-	-	100
Pre-requisites(if any)	Engineering mechanics					
Course Rationale	Structural analysis is a fundamental subject needed primarily for the students of Civil engineering. It is essential to understand the structural behavior of various compounds under externals loads.					
Course Objectives	The objective of the present course is to make the students acquainted with the concept of load resultant, consequences and how different kinds of loadings can be withstood by different kinds of members with some specific materials.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Compute deflections in structural elements subjected to external loading. 2. Draw SFD and BMD of the structural elements subjected to external loading. 3. Analysis of structures under relevant software.					

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	2	3			2							1
CO 2	2	3			2							1
CO 3	2	3			2							1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Slope and deflection** a) Slope and deflection in determinate beams- Euler–Bernoulli beam theory, Macaulay's method, moment area method and conjugate beam method to find slope and deflection of statically determinate beams. b) Determination of slope and deflection of determinate beams	7
II	**Axial and Eccentric loaded columns** a) **Axially loaded Columns-** Long and short columns, equivalent length of column for different end conditions, safe load on long and short columns by Euler's and Rankine's formulas. b) **Eccentric loaded columns-** Concept of direct and bending stresses; Applications to eccentrically loaded short columns, Concept of kern of section for standard symmetrical sections. No tension condition	7
III	**Analysis of Indeterminate structures** a) Basic concepts of Structural Analysis – Types and Classification of structure based on Structural forms, Concept of indeterminacy and degrees of freedom - Static and Kinematic degree of indeterminacy. Methods of analysis of indeterminate structures. b) Method of Consistent deformation: Compatibility equitation's. Analysis of fixed	7

	beam and propped cantilever. Sinking of supports.	
IV	**Slope deflection method** General and modified slope deflection equitation's, Analyse of continuous beams and portal frames (With and without sway) **Moment Distribution method** Carry over theorem, distribution factor and relative stiffness. Analyse of continuous beams and portal frames (with and without sway)	9
V	**Influence Line Diagram for determinate structure**	5
VI	**Energy Methods** Energy Methods in Structural Analysis, Principle of Superposition, Strain Energy, Castigliano's Theorems, Deflection in truss and frame by Virtual Work Principles.	5
Text Books		
1.	Bhavikatti S.S, "Structural Analysis", 4th edition, Vikas Publications house, New Delhi.	
2.	S. Ramamrutham, "Theory of Structures", Dhanapat Rai Publishing company, 9th edition.	
3.	Vazirani and Ratwani, "Analysis of Structures (Vol. I and II)", Khanna Publication, Delhi	
4.	Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill Publication Company Ltd., 3rd edition.	
5.	S. Ramamrutham and N. Narayan, "Theory of Structures", Dhanapat Rai Publishing company, 4th edition.	
Reference Books		
1.	Hibbeler R.C., "Structural Analysis", 9th Edition, Pearson Education India	
2.	Devdas Menon "Structural Analysis", Narosa Publication, Reprint 2019.	
3.	Wang C. K., "Indeterminate Structural Analysis", Tata McGraw-Hill Publishing Company	
Useful web links		
1.	http://www.digimat.in/nptel/courses/video/105105166/L45.html	
2.	https://archive.nptel.ac.in/courses/105/105/105105109/	
3.	https://www.youtube.com/watch?v=8nGgpKz07yk	

<table>
<tr><td>Year, Program, semester</td><td colspan="6">Second Year B. Tech. (Civil Engineering), Semester- IV, AY 2024-25 onwards</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC 224</td></tr>
<tr><td>Course Category</td><td colspan="6">Programme Core Course</td></tr>
<tr><td>Course title</td><td colspan="6">Soil Mechanics (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td colspan="2">03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>-</td><td>-</td><td>100</td></tr>
<tr><td>Course Rationale</td><td colspan="6">This course delves into fundamental principles such as soil properties, classification, compaction, stress distribution, shear strength, and settlement analysis. Equipping students with this knowledge not only aids in comprehending the behavior of soil but also lays the groundwork for proficient design and construction of foundations, embankments, and retaining structures. By mastering soil mechanics, students gain essential skills for addressing real-world engineering challenges, ensuring the integrity and longevity of civil engineering projects.</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course Teacher will:
1. To comprehend the basic components and characteristics of soil, including mineral composition, grain size distribution, and soil structure.
2. To classify soils based on standardized classification systems and identify their engineering properties, aiding in site characterization and design considerations.
3. To understand the behavior of soil-water systems, including principles of soil moisture content, permeability, and seepage, crucial for hydraulic engineering and drainage design.
4. To learn methods of soil compaction and stabilization to improve soil properties for construction purposes, ensuring adequate bearing capacity and minimizing settlement.
5. To analyze the shear strength of soils under different loading conditions and apply appropriate failure criteria, essential for slope stability analysis and foundation design.
6. To calculate earth pressures exerted by soils and design retaining structures, such as retaining walls and sheet piles, considering soil-structure interaction and stability requirements.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Student will be able to:
1. Demonstrate properties of soil
2. Determine permeability, compaction and consolidation
3. Compute stress distribution, shear strength and earth pressure
4. Apply knowledge of geo-environmental and geosynthetics.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	0	2	2	0	0	0	0	0	0	0
CO 2	3	2	3	3	3	3	1	1	2	2	0	0
CO 3	3	2	2	2	3	2	0	0	2	2	1	1
CO 4	3	3	3	2	1	3	3	2	2	2	2	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Properties of Soil:** Introduction to Soil Mechanics, formation of soil & soil structure, three phase soil system, weight volume relationships, detail index properties of soil -methods of determination and its significance, particle size and shape, classification of soils, soil consistency, field identification of soils.	6
II	**Permeability and Seepage:** Capillary water. Darcy's law, Factors affecting permeability, Determination of permeability by constant head and falling head method as per IS - 2720, field test as per IS – 5529 (part I) – pumping in test and pumping out test. Permeability of layered soils, Seepage forces, General flow equation (Laplace equation). Flow net construction and applications, Concept of effective neutral & total stress in soil mass. Quick sand condition. Uplift pressure, exit gradient, failure due to piping.	7
III	**Compaction and Consolidation** Factors affecting compaction, Dry density and moisture content relationship, Zero air voids line, Effect of compaction on soil structure, Standard Proctor test and Modified Proctor test as per IS – 2720. Field compaction equipment and methods, Field control of compaction, Spring analogy, Terzaghi's theory of one-dimensional consolidation, Determination of coefficient of consolidation-square root of time fitting method and logarithm of time fitting method, Rate of settlement, normally consolidated and over consolidated soils, Determination of pre consolidation pressure.	8
IV	**Stress Distribution in Soil & Earth pressure** Boussinesq theory- point load, line load, strip load, pressure distribution diagram on a horizontal and vertical plane, pressure bulb, Westergaard's theory, equivalent point load method, Newmark chart, contact pressure, approximate stress distribution method, earth pressure at rest, active and passive condition. Rankines and Coulomb's theory of earth pressure.	6
V	**Shear Strength:** Coulomb's theory and failure envelope, Principle stress, stress analysis (Total stress approach and effective stress approach), representation of stresses on Mohr's circle for cohesive, cohesion less, saturated and partly saturated soil, Application of shear stress parameters in the field Unconsolidated undrained, consolidated undrained and consolidated drained, type of test -box shear test, triaxial compression test with pore pressure and volume change measurement, unconfined compression test, vane shear test.	6
VI	**Introduction to Geo-Environmental Engineering and Geo-synthetics:** Scope, Soil-water-contaminant interaction, Waste containment system, Methods of	6

	landfill and design of landfills, Advance soil characterization, Limitations of landfills and importance of decentralized solid waste management systems, Introduction to Geosynthetic techniques and Geotextile.	
Text Books		
1.	Alam Singh, "Text Book of Soil Mechanics in Theory and Practice", Asian Publishing House, Bombay, Edition 2008.	
2.	V. N. S. Murthy," Soil Mechanics and Foundation Engineering", U. B. S. Publishers and distributors New Delhi, Edition 2011.	
3.	P. Purushottam Raj," Geotechnical Engineering", Tata Mcgraw Hill Company Ltd. New Delhi, Edition 2012.	
Reference Books		
1.	B. C. Punmia," Soil Mechanics and Foundations", Laxmi Publications (P) Ltd. New Delhi, Edition 2015	
2.	Terzaghi and Peak,John, "Soil mechanics", Willey and Sons, New-York, Edition 1994.	
3.	K.R. Arora, "Soil Mechanics and Foundation Engineering" ,Standard Publishers Distributors, Delhi, Edition 2011	
4.	B. J. Kasamalkar, "Geotechnical Engineering" ,Pune Vidyarthi Griha Prakashan Pune, Edition 2010	
Useful web links		
1.	https://archive.nptel.ac.in/courses/105/105/105105168/	

Year, Program, Semester	Second Year B. Tech. (Civil Engineering), Semester- VI, AY 2024-25 onwards					
Course Code	PCC 224					
Course Category	Programme Core Course					
Course title	**Soil Mechanics (Practical)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Credits**	
	-	-	02	02	01	
Evaluation Scheme	**ISE**	**ESE**	**IE**	**EE**	**Total**	
	-	-	-	50	50	
Pre-requisites (if any)	-					
Course Rationale	The Soil Mechanics Laboratory course offers students practical, hands-on experience to complement theoretical knowledge gained in the classroom. By conducting experiments and analyzing soil properties, students develop essential skills in critical thinking, problem-solving, and data interpretation. This experiential learning approach enhances their understanding of soil behavior, preparing them for real-world applications in civil engineering projects.					
Course Objectives	The objective of the Soil Mechanics Laboratory course is to provide students with practical skills in testing and analysing soil properties. Through hands-on experiments, students learn to characterize soil behaviour, interpret test results, and apply their findings to civil engineering projects. This course aims to bridge theoretical knowledge with real-world applications, preparing students for challenges in geotechnical engineering and construction.					
Course Outcomes	Students will be able to: 1. Determine index properties of the soil. 2. Compute compression, shear stress distribution, shear strength and earth pressure. 3. Compute consolidation and demonstrate safe bearing capacity of soil.					

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	2	1	-	-	-	-	-	-	-	-	-	1
CO 2	2	1	-	-	-	-	-	-	-	-	-	1
CO 3	2	1	-	-	-	-	-	-	-	-	-	1

Level of Mapping as: Low 1, Moderate 2, High 3

Experiment No.	Experiment Title/Objective	Hours
C) List of experiments (Any Eight)		
1	Classification of soils-Fine grain and coarse grain soil	02
2	Standard Proctor test/ Modified Proctor test	02

3	Determination Specific gravity by pycnometer / density bottle	02
4	Determination of consistency limits and its use in soil classification	02
5	Field density test by core cutter, sand replacement method	02
6	Determination of co-efficient of permeability by constant head and by variable head method	02
7	Direct shear test Experiment	02
8	Unconfined compression test	02
9	Triaxial test	02
10	One dimensional consolidation test	02
11	Demonstration/Determination of Safe bearing capacity of soil /Alluvial soil pressure by plate load test/Standard penetration test.	02
Text Books		
1.	Text Book of Soil Mechanics in Theory and Practice, Alam Singh, Asian Publishing House, Bombay, Edition 2008.	
2.	Soil Mechanics and Foundation Engineering-V. N. S. Murthy., U. B. S. Publishers and distributors New Delhi, Edition 2011.	
3.	Geotechnical Engineering, P. Purushottam Raj, Tata Mcgraw Hill Company Ltd. New Delhi, Edition 2012.	
Reference Books		
1.	Soil Mechanics and Foundations, B. C. Punmia, Laxmi Publications (P) Ltd. New Delhi, Edition 2015.	
2.	Soil mechanics-Terzaghi and Peak, John Willey and Sons, New-York, Edition 1994	
3.	Soil Mechanics and Foundation Engineering, K.R. Arora, Standard Publishers Distributors, Delhi, Edition 2011.	
4.	Geotechnical Engineering, B. J. Kasamalkar, Pune Vidyarthi Griha Prakashan Pune, Edition 2010.	

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- IV, AY 2024-25 onwards					
Course Code	VEC 221					
Course Category	**Humanities and Social Sciences, Management: Value Education Course**					
Course title	**Numerical Methods and Programming (Theory)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	02	-	-	02	02	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	30	70		-	-	100
Pre-requisites(if any)	Engineering Mathematics I, Engineering Mathematics II and Mathematics for Civil Engineers					
Course Rationale	This course offers a numerical method understanding for engineering applications. This course produce graduates with mathematical knowledge, computational skills and the ability to deploy these skills effectively in the solution of problems, principally in the area of engineering					
Course Objectives	1. To introduce various numerical methods for solving algebraic and transcendental equations. 2. To introduce the numerical techniques of interpolation in various intervals. 3. To introduce numerical methods for evaluation of derivatives and definite integrals. 4. To understand numerical methods for solving partial differential equations. 5. To introduce concept of Curve Fitting and Regression.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Understand the difficulty of solving problems analytically and the need to use numerical approximations for their resolution. 2. Identify, classify and choose the most appropriate numerical method for solving a problem 3. To solve different problems using curve fitting and regression. 4. To understand need of numerical methods in Civil Engineering 5. Deploy skills effectively in the solution of problems in Civil Engineering					

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	1			1							
CO 2	3	2										
CO 3	3	2		2	2							
CO 4	3	2		2	2							
CO 5	3	2		2	2							

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Approximations and round off errors, Truncation errors and Taylor Series, Determination of roots of polynomials and transcendental equations by Bisection method, Newton-Raphson, Secant and Bairstow's method Solutions of linear simultaneous linear algebraic equations by Gauss Elimination and Gauss- Siedel iteration methods.	05
II	Backward, Forward and Central difference relations and their uses in Numerical differentiation and integration, Application of difference relations in the solution of partial differential equations.	04
III	Numerical differentiation: Methods based on interpolation, Numerical integration: Trapezoidal rule, Simpson's $1/3^{rd}$ rules, Simpson's $3/8^{th}$ rules. Numerical solution of ordinary differential equations by Euler, Modified Euler, Runge-Kutta and Predictor-Corrector method. Curve fitting- linear and nonlinear regression analysis.	04
IV	Introduction to computer programming in C and C++ languages. Arithmetic expressions, Simple programs. The emphasis should be more on programming techniques rather than the language itself. The C programming language is being chosen mainly because of the availability of the compilers, books and other reference materials. Example of some simple C program. Dissection of the program line by line. Concepts of variables, program statements and function calls from the library (printf for example)	04
V	C data types, int, char, float etc. C expressions, arithmetic operations, relational and logic operations. C assignment statements, extension of assignment to the operations. C primitive input output using getchar and putchar, exposure to the scant and printf functions. C statements, conditional execution using if, else. Optionally switch and break statements may be mentioned. Concepts of loops, example of loops in C using for, while and do-while. Optionally continue may be mentioned.	05
VI	One dimensional arrays and example of iterative programs using Arrays, 2-d arrays. Use in matrix computations. Concept of Sub-programming, functions. Example of functions. Argument passing mainly for the simple variables. Pointers, relationship between arrays and pointers. Argument passing using pointers. Array of pointers, Passing arrays as arguments. Strings and C string library. Structure and unions. Defining C structures, passing structures as arguments. Program examples. File I/O. Use of fopen, fscanf and fprintf routines.	04
Course Assessment Method		
1.	Suggested list of Assignments: 1. Solution of Algebraic and Transcendental equations. 2. Interpolation 3. Approximation 4. Numerical differentiation 5. Numerical integration 6. Solution of Wave equation, Heat Equation and Laplace Equation	
2.	General Instructions: 1. Students must be encouraged to solve numerical problems using different mathematical software's.	

	2. Each Student has to write at least 6 assignments on entire syllabus.
Text Books	
1.	P. Kandasamy, K. Thilagavathy, K. Gunavathi, “Numerical Methods”, S. Chand & Company.
2.	S.S. Sastry, “Introductory Methods of Numerical Analysis”, PHI.
3.	Dr. B. S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, Delhi.
Reference Books	
1.	M. K. Jain, S. R. K. Iyengar, R. K. Jain, “Numerical methods for scientific and Engineering Computation”, New Age International Limited Publishers.
2.	S.C. Chapra, R.P. Canale, “Numerical method for Engineers”, Tata McGraw Hill Publications.
3.	Dr. B.S. Grewal, “Numerical Methods”, Khanna Publications.
4.	S. C. Gupta, “Fundamental of Statistics”,
5.	Veerarajan T., “Engineering Mathematics”, Tata McGraw-Hill, New Delhi
6.	Shastry, S.S., "Numerical Methods", Prentice Hall Inc., India, 1998.
7.	Noble Ben, "Numerical Methods", New York International Publications, New York, 1964. • Stanton Ralph G., "Numerical Methods for Engineering", Englewood cliffs, N.J., Prentice Hall Inc., 1961.
8.	Buckingham R.A., "Numerical Methods", Sir Isaac Pitman Sons. Ltd., London, 1957. • Bakhvalov, N .S., "Numerical Methods", Mir. Pub., Moscow, 1977.
9.	Grewal, B.S., "Numerical Methods", Khanna Pub., New Delhi, 1998. • Sudhit Kaicker, "The Complete ANSI C", BPB Publications, New Delhi, 1996.
10.	Kernighan, B. W. and D .M. Ritchie, "The C Programming Language", Prentice Hall of India, 1998.
11.	Byron, S. Gottfreid, "Programming with C", Tata McGraw Hill, 2nd edition 1998
Useful web links	
1.	https://archive.nptel.ac.in/courses/111/107/111107105/
2.	https://archive.nptel.ac.in/courses/127/106/127106019/
3.	https://archive.nptel.ac.in/courses/122/106/122106033/

Year, Program, Semester	S.Y. Civil Engineering, Semester IV					
Course Code	HSSM (AEC 221)					
Course Category	Humanities and Social Sciences, Management: Ability Enhancement Course					
Course title	**Technical Communication (Theory)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	01	-	-	01	01	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	---	---		50	-	50
Pre-requisites(if any)						
Course Rationale	Effective technical communication and documentation are crucial aspects of any project, especially in fields like software development, engineering, and scientific research. By mastering these skills, students can become proficient communicators and documentation experts who contribute positively to their organizations and society as a whole.					
Course Objectives	1. To provide learning environment to practice listening, speaking, reading and writing skills. 2. To assist the students to carry on the tasks and activities through guided instructions and materials. 3. To effectively integrate English language learning with employability skills and training. 4. To provide hands-on experience through case-studies, mini-projects, group and individual presentations.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills. 2. Improve English language with employability skills and training. 3. Practice Effective Technical Communication 4. Prepare Documentation through case-studies, mini-projects, group and individual presentations.					

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	3	1	1	3	1						1	1
CO 2	1	3	3	3	3	2	2	2	1	2	2	1
CO 3	2		2	3	1	1	1	1				1
CO 4	2	1	2			1					1	1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Vocabulary Building** 1.1. The concept of Word Formation 1.2. Root words from foreign languages and their use in English 1.3. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. 1.4. Synonyms, antonyms, and standard abbreviations.	2

II	**Basic Writing Skills** 1.1. Sentence Structures 1.2. Use of phrases and clauses in sentences 1.3. Importance of proper punctuation 1.4. Creating coherence 1.5. Organizing principles of paragraphs in documents 1.6. Techniques for writing precisely	2
III	**Identifying Common Errors in Writing** 1.1. Subject-verb agreement 1.2. Noun-pronoun agreement 1.3. Misplaced modifiers 1.4. Articles 1.5. Prepositions 1.6. Redundancies 1.7. Clichés	2
IV	**Nature and Style of sensible Writing** 1.1. Describing 1.2. Defining 1.3. Classifying 1.4. Providing examples or evidence 1.5. Writing introduction and conclusion	2
V	**Writing Practices** 1.1. Comprehension 1.2. Precise Writing 1.3. Essay Writing	2
VI	**Oral Communication** (This Unit involves interactive practice sessions in Language Lab) 1.1. Listening Comprehension 1.2. Pronunciation, Intonation, Stress and Rhythm 1.3. Common Everyday Situations: Conversations and Dialogues 1.4. Communication at Workplace 1.5. Interviews 1.6. Formal Presentations	3
Text Books		
1.	AICTE's Prescribed Textbook: English (with Lab Manual), Khanna Book Publishing Co.	
2.	Kul Bhushan Kumar, "Effective Communication Skills", Khanna Book Publishing, 2022.	
Reference Books		
1.	Michael Swan, "Practical English Usage", OUP, 1995.	
2.	F.T. Wood Macmillan, "Remedial English Grammar", 2007.	
3.	William Zinsser, "On Writing Well", Harper Resource Book, 2001.	
4.	Liz Hamp, "Study Writing".	
Useful web links		
1.	https://nptel.ac.in/courses/109106116	
2.	https://nptel.ac.in/courses/109106094	

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- IV, AY 2024-25 onwards					
Course Code	CC 221					
Course Category	**Co-curriculum Courses**					
Course title	**Introduction to Performing Arts**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	01		-	01	01	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	-	-		50	-	50
Course Rationale	The course "Introduction to Performing Arts" seeks to broaden the horizons of engineering students by integrating the rich and diverse realm of performing arts into their curriculum. By exploring various performing arts forms, students will not only develop a deeper understanding of human expression but also enhance their creativity, communication skills, and cultural awareness. This interdisciplinary approach aligns with NEP 2020's vision of holistic education and fosters the development of well-rounded individuals equipped to thrive in a rapidly evolving world.					
Course Objectives	The course teacher will ensure 1. Introduce fundamental concepts, history, and theoretical frameworks of various performing arts forms. 2. Cultivate appreciation for cultural, social, and aesthetic dimensions of performing arts. 3. Develop critical thinking and analytical skills through performance analysis. 4. Enhance communication and presentation skills through practical exercises. 5. Foster creativity and imagination through exploration of diverse performing arts mediums.					
Course Outcomes	By the end of the course, students will be able to 1. Identify and analyse key elements and techniques across theatre, dance, music, and visual arts. 2. Demonstrate understanding of historical, cultural, and social contexts in performing arts. 3. Critically evaluate performances using appropriate terminology. 4. Apply performance principles to effectively communicate ideas and emotions. 5. Engage in creative expression through original performances.					

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	2		2		2					
CO 2						3	2					
CO 3							2		3	3		
CO 4						2		2	3	3		
CO 5											3	

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Foundations of Performing Arts • Introduction to Performing Arts: Definition, scope, and significance. • Historical overview: Evolution of performing arts across cultures and civilizations.	2
II	Theatrical Arts • Introduction to theater: Origins, elements, and dramatic conventions. • Major theatrical movements and styles: Realism, surrealism, absurdism, etc. • Analysis of selected plays and playwrights.	3
III	Dance Forms • Introduction to dance: Styles, techniques, and cultural contexts. • Exploration of classical, folk, and contemporary dance forms. • Practical exercises and choreography workshops.	3
IV	Musical Expressions • Introduction to music: Basic principles, genres, and traditions. • Appreciation of classical, folk, and popular music styles. • Analysis of musical compositions and performances.	2
V	Visual Performing Arts • Introduction to visual arts in performance: Set design, costume, and makeup. • Role of visual elements in enhancing the theatrical experience. • Case studies and practical demonstrations.	2
VI	Performance and Presentation • Practical application of performing arts principles: Group performances and presentations. • Rehearsal techniques, stage presence, and audience engagement. Reflection and feedback on individual and group performances.	2

Course Assessment Method	
For the internal assessment of the course, with a total evaluation is of 50 marks. Combination of different evaluation methods can be utilized to ensure comprehensive assessment of the students' performance. Following Evaluation Components are suggested:	
1.	Written Assignments: 20 Marks
2.	Practical Assessments: 20 Marks
3.	Class Participation and Engagement: 10 Marks

Reference Books	
1.	Bharata Muni, Natyashastra, An ancient Indian treatise on performing arts covering various aspects of classical dance, music, and drama, composed between 200 BCE and 200 CE, influencing the theory and practice of Indian performing arts for centuries.
2.	Girish Karnad. (2005). Collected Plays: Volume 1. Oxford University Press.
3.	Mohan Khokar. (2000). Traditions of Indian Classical Dance. Clarion Books.
4.	Sunil Kothari. (2001). Kathak, Indian Classical Dance Art. Abhinav Publications.
5.	Sangeet Natak Akademi. (2005). Indian Music: Tradition and Trends. Sangeet Natak Akademi.
6.	P. Sambamurthy. (2010). South Indian Music, Vol. 1. The Indian Music Publishing House.

7.	Kapila Vatsyayan. (2007). Indian Classical Dance: Tradition in Transition. Publications Division, Ministry of Information and Broadcasting, Government of India.
8.	Vijay Tendulkar. (2010). Collected Plays in Translation. Oxford University Press.
Useful Links	
1.	https://www.youtube.com/watch?v=W7bEzgZrN7s
2.	https://www.youtube.com/watch?v=DQbNpx_CfJY
3.	https://www.youtube.com/watch?v=eGiz50aVYWQ

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- IV, AY 2024-25 onwards					
Course Code	MAC 222					
Course Category	**Mandatory Audit Course**					
Course title	**Aptitude Enhancement Course-I**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	-	01	-	01	-	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	At Course In charge End	-		-	-	-
Course Rationale	This Aptitude Enhancement Course I aims to nurture holistic development among second-year B. Tech. Engineering students by focusing on enhancing their critical thinking, problem-solving skills, creativity, and emotional intelligence. Aligned with the NEP 2020 and Outcome-Based Education (OBE) philosophy, the course seeks to empower students with essential aptitudes required for success in both academic and professional domains.					
Course Objectives	The course teacher will ensure to- 1. Equip students with critical thinking skills through analytical exercises and problem-solving tasks. 2. Foster creativity and innovation by engaging students in structured workshops and practical projects. 3. Develop students' emotional intelligence through self-awareness activities and stress management techniques. 4. Enhance collaborative skills and effective communication through group discussions and team-based projects.					
Course Outcomes	By the end of the course, the students will be able to 1. Demonstrate proficiency in critical thinking by analysing complex problems and proposing effective solutions. 2. Exhibit creativity through the development of innovative projects and solutions. 3. Display heightened emotional intelligence by managing stress, communicating empathetically, and resolving conflicts constructively. 4. Showcase collaborative skills by actively participating in group activities, contributing to team goals, and communicating ideas effectively.					

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1		3		3						2		
CO 2		2			2	1						
CO 3						3	2	3				
CO 4									3	3	2	1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Inter-Personal & Inter-Organisational Communication (2 hour)	2
II	Creative & Critical Thinking	2
III	Group Dynamics & Decision-Making Techniques	2
IV	Emotional Intelligence & Stress Management Strategies	3
V	Assessment	5

Course Assessment Method	
For the internal assessment of the course, with a total evaluation is of 50 marks. Combination of different evaluation methods can be utilized to ensure comprehensive assessment of the students' performance. The assessment will focus real-world scenarios that require the application of critical thinking, problem-solving, creativity, emotional intelligence, and teamwork. Following Evaluation Components are suggested:	
1.	Activity 1- Group Presentation (20 marks)
2.	Activity 2- Group Discussion (20 marks)
3.	Classroom Participation and Engagement (10 marks) Active participation in class discussions, group activities and question-answer sessions.

Reference Books	
1.	Chakravarthi T. Kalyana and Chakravarthi T. Latha, Soft Skills for Managers (Biztantra Publications, 2014 (ISBN: 978-81-7722-568-6))
2.	Kumar Sanjay and Pushp Lata (2015), Communication Skills, 2nd Edition, Oxford University Press, (ISBN: 9780199457069)
3.	P. D. Chaturvedi and Mukesh Chaturvedi (2017), The Art and Science of Business Communication- Skills, Concepts, Cases and Applications, 4th Edition, Pearson India Education Services Pvt. Ltd., (ISBN 978-93-325-8728-1)
4.	Wright, L. (2001). Critical Thinking: An Introduction to Analytical Reading and Reasoning. Oxford University Press.
5.	Kallet, M. (2014). Think Smarter: Critical Thinking to Improve Problem-Solving and Decision-Making Skills. Wiley.
6.	Bradberry, T., & Greaves, J. (2009). Emotional Intelligence 2.0. TalentSmart.
7.	Dweck, C. S. (2007). Mindset: The New Psychology of Success. Ballantine Books.

Year, Program, semester	Second Year B. Tech. (Civil Engineering), Semester- IV, AY 2024-25 onwards					
Course Code	CEPFP 221					
Course Category	**Experiential Learning Courses: Common Engg. Projects/Field visits**					
Course title	**Mini Project II and Industrial Visit**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	-	01	-	01	-	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	ISE at Course in charge end	-		-	-	-
Pre-requisites(if any)	Basic Sciences, Engineering Sciences, Mathematics, Program Core Courses					
Course Rationale	The Mini Project-II is designed to help students to develop practical ability and knowledge about practical tools/ techniques in order to solve real-life problems related to the Civil engineering problems. The students will identify and work towards solving problems related major attributes of Civil Engineering. Also, the course intends to improve communication skills of students through technical report writing and presentations.					
Course Objectives	The teacher will 1. To apply basic engineering fundamentals and attempt to find solutions to the problems. 2. To develop communication skills and improve teamwork amongst group members and inculcate the process of self-learning and research.					
Course Outcomes	At the end of the course, the students will be- 1. Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach. 2. Reproduce, improve and refine technical aspects for engineering projects.					

Course Outcome and Program Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	2	2	2	2		1		3	1	
CO 2	3	2	2	2	2	2		1		3	1	

Level of Mapping as: Low 1, Moderate 2, High 3

	Course Content	**Hours**
I	The student works on a topic based on following list • Concrete technology: Green Concrete, Self-Compacting Concrete, High Performance Concrete, Reactive Powder Concrete, Geopolymer Concrete, use of waste material, etc • Working Drawing of Institutional Building, Public Buildings, Markets, Cinema hall, Mall, Office Building, Hospitals, etc • Soil Mechanics: brick from black cotton soil, plastic as soil stabilizer, study on soil cement block, experimental studies on coir fibre reinforced soil,	One hour per week

	effect of blast furnace slag on soil cement stabilization, improvement of bearing capacity of sandy soil by grouting, role of geosynthetics in improvement of soil strength, etc Also, student has to prepare a comprehensive mini project report after completing the work to the satisfaction. Any topic related to civil engineering is acceptable.	

Course Assessment Method
Assessment is based on presentations showcasing the efforts of the mini project group for formulating the problem, developing/designing the solutions, testing and validating the solution, with submission of project report.

Year, Program, semester	Second Year B.Tech. (Civil Engineering), Semester- IV AY 2024-25 onwards					
Course Code	VEC 221					
Course Category	Value Education Course					
Course title	**Environmental Studies (Theory)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	02	-	-	02	University exam at year end	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	10	40		-	-	50
Pre-requisites (if any)	NA					
Course Rationale	The Course is all about learning the way we should live and how we can develop sustainable strategies to protect the environment. It helps individuals to develop an understanding of living and physical environment and how to resolve challenging environmental issues affecting nature.					
Course Objectives	The course teacher will 1. Describe the various types and sources of environmental pollution. 2. Explore other global environmental issues, such as biodiversity loss, deforestation, and ocean acidification. 3. Explain key environmental laws and regulations at the national and international levels. 4. Explain the relationship between human society and the environment.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Classify different types of environmental pollutants and their sources. 2. Analyze the interconnections between climate change and other global environmental issues. 3. Understand the legal frameworks and regulations governing environmental protection and management. 4. Describe the socio-economic drivers of environmental degradation and inequality					

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	3	3					3	3				
CO 2		3	3	3			3	3	3	2		
CO 3		2	3	3			3	3	3	3		
CO 4		2					3	3	3	3		

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Environmental Pollution:** Definition: Causes, effects and control measures of: Air pollution, Water pollution: Causes, effects and control measures, Marine pollution, Soil pollution: Causes, effects and control measures, Noise pollution: Causes, effects and control measures, Thermal pollution: Causes, effects and control measures, Nuclear hazards and their effects. Solid waste Management: Causes, effects and control, measures of urban and Industrial wastes, Role of an individual in prevention of pollution.	7

II	**Understanding Climate Change and Other Global Environmental Issues:** -Structure of atmosphere; greenhouse gas emissions; Projections of global climate change, Importance of 1.5°C and 2.0°C limits to global warming; Carbon foot print,- Impacts of climate change: on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure; -Mitigation of climate change: Green House Gas (GHG) reduction, sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policies for mitigation, net zero targets for the future; Energy efficiency measures; Renewable energy sources for carbon reduction; Carbon capture and storage.	8
III	**Environmental Legislation:** Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g), Environmental Protection Act., Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.	6
IV	**Social Environment:** Environmental ethics, Environmental movements- Chipko Movement, Appiko Movement, Silent Valley Movement. Water conservation: rain water harvesting, watershed management, Disaster management: floods, earthquake, cyclone, tsunami and landslides.	4
V	Nature Visits / Field Work /Field Tour/ Industrial visits / Activities related to Campus environmental management	5

Text Books	
1.	Agarwal, K. C., 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.
2.	Bharucha Erach, The Biodiversity of India, Map in Publishing Pvt. Ltd., Ahmadabad, 380013, India.
3.	Brunner R. C., 1989, Hazardous Waste Incineration, McGraw Hill Inc,
Reference Books	
1.	Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T. ,2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,
2.	Gleick, H., 1993, Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press.
3.	Hawkins R. e., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R).
4.	Heywood, V. H. & Watson, R. T., 1995, Global Biodiversity Assessment, Cambridge Univ. Press
5.	Jadhav, H. & Bhosale, V. M., 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi.
6.	Mckinney, M. L. & Schocl. R. M., 1996, Environmental Science Systems & Solutions, Web enhanced edition.
7.	Odum, E. P., 1971, Fundamentals of Ecology, W. B. Saunders Co. USA.
8.	Rao M. N. & Datta, A. K. 1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd.
9.	Sharma B. K., 2001, Environmental Chemistry, Goel Publ. House, Meerut.
10.	Trivedi R. K. and P. K. Goel, Introduction to air pollution Techno-Science Publications (TB).
11.	Trivedi R. K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R).
12.	Wagner K. D., 1998, Environmental Management, W. B. Saunders Co. Philadelphia, USA.
Useful web links	
1.	https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
2.	http://nitttrc.edu.in/nptel/courses/video/109105203/L41.html

Equivalence for the curriculum revision at B.Tech. (Civil Engineering)

B.Tech. Civil Engineering Program, Department of Technology is due for revision in curriculum w.e.f. 2023-2024. Hence, the structure and the syllabus content of the F.Y. B.Tech. Civil Engineering is revised. The entire structure for Second Year to Final Year B. Tech. Civil Engineering is also designed under this revision. The detailed of course content will be designed and submitted as the First Year batch proceed year to year.

A special feature of this revision is, ***it is in line with New National Education Policy 2020 guidelines.*** The effort has been taken to incorporate most of the key features of NEP2020.

Following is a semester wise table that depicts equivalences for the previous version of curriculum with the new one.

SEM – III

Sr. No.	**Second Year B.Tech. Semester III Pre-revised syllabus**	**Second Year B.Tech. Semester III Revised syllabus**	**Remark**
1	Engineering Mathematics-III	Mathematics for Civil Engineers	Contents are revised, Title is changed.
2	Surveying (Theory and Lab-IV)	Surveying (Theory & Practical)	Contents are revised.
3	Strength of Materials (Theory and Lab-II)	Strength of Materials (Theory & Practical)	Contents are revised.
4	Building Construction (Theory)	Building Construction (Theory)	No equivalence. Old course is required to run.
5	Building Construction (Lab-III)	---	No equivalence. Old course is required to run.
6	Fluid Mechanics-I (Theory and Lab-I)	---	No equivalence. Old course is required to run.
7	Environmental Studies	Environmental Studies	No change as it is centrally offered by the University. Included as audit course.

9	Introduction to Performing Arts	Introduction to Performing Arts	Shifted to Semester IV. Made it as a Credit course with content revision.
10	-----	Fluid Mechanics	Newly introduced credit course.
11	-----	Building Construction	Newly introduced credit course.
12	-----	Soft Skills Development	Introduced as a credit course and shifted from Semester IV.
13	-----	Mini Project I and Industrial Visit	Newly introduced audit course.

SEM – IV

Sr. No.	Second Year B.Tech. Semester IV Pre-revised syllabus	Second Year B.Tech. Semester IV Revised syllabus	Remark
1	Theory of structures - I	---	No equivalence. Old course is required to run.
2	Concrete Technology (Theory and Laboratory-I)	Concrete Technology	Contents are revised.
3	Fluid Mechanics-II (Theory and Lab-III)	------	No equivalence. Old course is required to run.
4	Building Planning and Drawing (Theory)	Building Planning and Computer-aided Civil Engineering Drawing	Title and Content revised.
5	Building Planning and Drawing (Lab-IV)	------	No equivalence. Old course is required to run.
6	Engineering Geology (Theory and Lab-II)	------	No equivalence. Old course is required to run.
6	Soft Skills Development	------	Shifted to Sem III. Content is revised and made it as a Credit course.
7	Environmental Studies	Environmental Studies	No change as it is centrally offered by the University. Included as audit course.
8	------	Structural Analysis	Newly added credit course.
12	------	Soil Mechanics	Newly added credit course.
13	------	Numerical Methods	Newly added credit course.
14	------	Effective Technical Communication and	Newly added credit course.

		Documentation	
15	------	Introduction to Performing Arts	Introduced as a credit course and shifted from Semester III.
16	------	Aptitude Enhancement Course I	Newly added audit course.
17	-----	Multidisciplinary Minor Course I	As per NEP feature, MDM is introduced.
18	------	Mini Project II and Industrial Visit	Newly introduced audit course.

Shivaji University

VidyaNagar, Kolhapur, Maharashtra 416004

Department of Technology

As per NEP2020 guidelines

B.Tech. (Civil Engineering Minors (Multi-disciplinary) Curriculum Structure
2024-25 onwards

Multidisciplinary Minor
In
Plumbing Technology
For
B.Tech. (Civil Engineering)

Shivaji University, Kolhapur
Department of Technology

B.Tech. (Civil Engineering), Multidisciplinary Minor in Plumbing Technology

Teaching and Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1	Preferably on SWAYAM (NPTEL) or any other MOOCs (Minor Program Core) Or In a Face-to-Face mode	MDM-1.1	Plumbing Terminology and Hydraulics	03	-	-	03	03	30:70	00:00
2		MDM-1.2	Pumps and Hydro Pneumatic System	03	-	-	03	03	30:70	00:00
3		MDM-1.3	Plumbing Estimating and Costing	03	-	-	03	03	30:70	00:00
4.	Minor Program Based Internship	MDM 1.4	Plumbing Industry Internship*	One Month Internship				03	-	50:50
5.	Project Based Learning	MDM 1.5	Mini Project*	-	-	-	-	02	-	50:50
				-	-	-	-	**14**	**300**	**200**
			Total Hours	**09**	**00**	**00**	**09**	-	-	-

Note: MDM Program's Internship and Mini Project need to be planned during winter or summer vacation days after 4th semester while respective evaluations will be the part of 7th and 8th Semesters of the B.Tech Major structure.

Multidisciplinary Minor I: Plumbing Technology

Year, Program, Semester	Multidisciplinary Minor II, 4th Semester onwards						
Course Code	MDM 1.1						
Course Category	Specialization Minor Program Core						
Course title	**Plumbing Terminology and Hydraulics (Theory)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	3	-	-	-		3	
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	30	70		---	---	---	---	---
Pre-requisites (if any)	The prerequisite for this course is to possess the fundamental knowledge of Hydraulics plumbing drawings pressure calculation.						
Course Rationale	This course prepares students for successful careers in the plumbing industry and related fields. It ensures that they have the essential knowledge and skills to perform their roles effectively and safely, contributing to their overall professional development and the integrity of the plumbing trade.						
Course Objectives	1. To provide students necessary knowledge and skills in Terminology related to Plumbing systems. 2. To carry out design of various plumbing items 3. To understand procedure of Plumbing systems design and execution.						
Course Outcomes	Upon completion of this course, student should be able to – 1. Design of plumbing projects 2. Prepare layouts of various plumbing engineering works and calculate flow rates for various items of plumbing. 3. Prepare water distribution and sanitary works report for plumbing engineering works.						

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3										1	1
CO 2	1	3	3	3	3	2	2	2	1	2	2	1
CO 3	2		2	3	1	1	1	1				1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Introduction**: Introduction to Plumbing Terminology viz. Bleed, Brass, Branch Drain, Effluent, Fitting, Flow Rate, Gallons per Flush (GPF), Gray Water, KiloPascal (kPa), Maximum Containment Level (MCL), Non-Ferrous, Potable, Pressure Head, Riser, Sediment, Soil Pipe, Trap Seal, Trap Weir, Water Hammer, Aerator, Ball Check Valve, Closet Bend, Closet Flange, Flow Control Valve, Gasket, Interceptor, Main, Manifold, O-Ring, Scald Guard, Shutoff Valve, Tee, Trap, Valve Seat, Vent, Water Hammer Arrestor, Wye Fitting, ABS, Auger, Blowbag, CPVC, Dope, Polybutylene (PB), Polyethylene (PE), PEX, Plumber's Putty, Plunger, PVC, Snake, Teflon Tape, Absorption Field, Leach Line, Septic Tank.	7

II	**Pressure and related factors in Plumbing** : friction factor, pressure drop for flow of non-compressible and compressible fluids (Newtonian Fluids), pipe line sizing, economic velocity. Pipeline networks and their analysis for flow in branches, restriction orifice sizing. Non-Newtonian fluids – types with examples, pressure drop calculations for Non-Newtonian fluids.	7
III	**Basics of Water supply & Distribution**: Preliminary Information, Identify Possible source, Water Treatment, Water Storage tank, Water Supply System, Water Supply Requirements for Buildings, Probable simultaneous demand, Hydro Pneumatic system, Over Head Tank Distribution, The Distribution system in respect of Gravity system for a Multi storeyed Building, Distribution system in respect of Hydro-Pneumatic system for a Multi-storeyed Building.	7
IV	**Water Supply and Distribution Systems:** Hot and Cold water systems, Identification of Potable and Non-potable water systems, Unacceptable Connections, Atmospheric Vacuum Breaker (AVB), Hose Connection Backflow Preventer, Parallel water Distribution, Pressure Reducing Valves, Water and Sewer line separation, Water hammer and Air Chamber air cushion depletion.	6
V	**Plumbing Fixtures, Fittings, Appliances and Appurtenances :** Plumbing Fixtures, Maximum Flow rate, Water Closet and Urinal Integral Traps, Types of Water Closets, Squatting Pans (Asian/Indian WC), Squatting Pan Trap, Bidet, Urinals, Non-water Urinals, Wash Basin, Shower, Bath Tubs, Trough Urinals, Plumbing Fittings, Metered Faucets, Emergency Showers, Standard Heights, Modern Installations, Appliances, Cloth Washer and Dishwasher, Valves.	6
VI	**Sanitary Drainage :** One pipe - partially vented system, tem- One pipe fully vented system, Two pipe system, Single stack system, Single Stack With Sovent, Materials for drainage piping, Plastic DWV Fittings, Clay Pipe, Stainless steel pipe and fittings, Cast-iron pipe and fittings, Cast Iron Joining Methods, Drainage Fixture units (DFU), Emergency Use Floor Drain, Receptor (Floor Sink), Kitchen Sink, Fixture Connections, Cleanouts, Grade of Horizontal Drainage Piping, Gravity Flow To Sewer, Back Water Valve, Testing The piping of the plumbing drainage, Smoke Test, Water Test.	6

Text Books	
1.	"Water Supply And Sanitary Engineering", By Rangwala,- Charotar Publishing house, 30th Edition 2022.
2.	Prof. Subhash Patil- Jain Book Depot " Plumbing Engineering"
3.	A Guide To Good Plumbing Practices- India Plumbing Association.
4.	Plumbing Design & Practice, 2nd Edition-By : S.G. Deolalikar Publisher : McGraw-Hill Education.
Reference Books	
1.	Standard specifications volumes I and II (PWD Maharashtra) Govt. of Maharashtra
2.	CPWD Specifications
3.	CPWD Schedules of Rates
4.	PWD Hand Book and Red Book
5.	RETS (Railway Engineering Technical Society)-Plumbing and Pipe Line Work.
Reference Codes	
1.	India Plumbing Association 2017 Uniform Illustrated Plumbing Code
2.	National Building Code of India – Guidelines for regulating the building construction activities

Useful web links	
1.	https://www.youtube.com/watch?v=kQ871qgdsm4
2.	http://swayam.gov.in/

Year, Program, Semester	Multidisciplinary Minor II, 4th Semester onwards						
Course Code	MDM 1.2						
Course Category	Specialization Minor Program Core						
Course title	**Pumps and Hydro Pneumatic System (Theory)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**		
	3	-	-	-	3		
Evaluation Scheme	**ISE**	**ESE**	**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	30	70	---	---	---	---	---
Pre-requisites (if any)	The prerequisite for this course is to possess the fundamental knowledge of Hydraulics plumbing drawings pressure calculation.						
Course Rationale	This course prepares students for successful careers in the plumbing and water supply industries. It ensures that they possess the advanced knowledge and skills required to design, install, maintain, and troubleshoot these critical systems, fostering their professional development and contributing to the overall efficiency and sustainability of water distribution networks.						
Course Objectives	1. To provide students necessary knowledge and skills in selection of pump for different types of plumbing works. 2. To carry out selection of pumps for various plumbing items 3. To understand procedure of design of Hydro Pneumatic system.						
Course Outcomes	Upon completion of this course, student should be able to – 1. Selection of pumps based on requirement on site. 2. Prepare design for various plumbing engineering works by using Hydro Pneumatic system. 3. Prepare project report for pump requirement in plumbing engineering works.						

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	1	1	1	1						1	1
CO 2	1	3	3	1	1						2	1
CO 3	2		2	2	2	2	2	2	2	2	2	1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Various Types of Pumps for Water Supply along with their merit and demerit :** Submersible Pumps, ,Vertical Pumps, Grinder, Slicer and Vortex Pumps, Dry Well Pumps, End-Suction Centrifugal Pumps, Condensate Return Pumps, Diaphragm pumps, Hydraulic pumps, Reciprocating pumps, Positive displacement pump, Dynamic pumps, Booster pumps, Peristaltic pumps, Axial-flow pump.	7
II	**Various Types of Pumps for waste water dewatering and sewage along with their merit and demerit.**: centrifugal, progressive cavity, and positive displacement, Mobile Dewatering/Flood Control Unit, Vertical Inline Pump, Submersible Sewage Dewatering Pump, Non-clog Submersible Pump.	7

III	Pressure boosting and Hydro-pneumatic systems: Definition and operating principles. Necessity operation and benefits deriving from the use of pressure boosters. Simple Design of Hydro-pneumatic system.	7
IV	**Accessories and controls of Pumping Systems:** Pressure Relief Valve, Float switch, Foot Valve, Strainer, Pressure gauge, Nozzle, Pressure regulators, Anti-Siphon Injection Valve, In-Line Check Valve, Feed Indicator.	6
V	**Design of Pumps and calculating pump Capacities :** System Characteristics, Pump Curves, Factors Affecting Pump Performance, Effect of over sizing the pump, Energy loss in throttling, Effect of speed variation, Energy Conservation Opportunities in Pumping Systems,	6
VI	**Design of different types of pumping systems** required on basis of application for multistoried residential Building (G+7).	6
Text Books		
1.	Bureau of Energy Efficiency- Pumps And Pumping System	
2.	Prof. Subhash Patil- Jain Book Depot " Plumbing Engineering"	
3.	A Guide To Good Plumbing Practices- India Plumbing Association.	
4.	Pumps: Theory, Design and Applications- by Sahu G.K.-New Age International, Publishers.	
Reference Books		
1.	National Building Code of India – Guidelines for regulating the building construction activities	
2.	Bureau of Energy Efficiency- Energy performance Assessment Of water Pumps.	
3.	ASHRAE Handbook -- HVAC Systems and Equipment Chapter: Centrifugal Pumps.	
Reference Codes		
3.	National Building Code of India – Guidelines for regulating the building construction activities	
Useful web links		
1.	http://acl.digimat.in › nptel › courses › video	
2.	http://swayam.gov.in/	

Year, Program, Semester	Multidisciplinary Minor II, 4th Semester onwards							
Course Code	MDM 1.3							
Course Category	Specialization Minor Program Core							
Course title	**Plumbing Estimating and Costing (Theory)**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**		
	3	-	-	-		3		
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	30	70		---	---	---	---	---
Pre-requisites (if any)	The prerequisite for this course is to possess the fundamental knowledge of Plumbing material specifications, building/structural/Plumbing drawings.							
Course Rationale	This course prepares students for successful careers in the plumbing industry. It ensures they possess the advanced knowledge and skills required to accurately estimate project costs, prepare competitive bids, manage project budgets, and control costs, thereby contributing to the financial success and sustainability of plumbing projects and businesses.							
Course Objectives	1. To provide students necessary knowledge and skills in estimation of Plumbing works 2. To carry out rate analysis of various plumbing items 3. To understand procedure of tenders and contracts							
Course Outcomes	Upon completion of this course, student should be able to – 1. take out of quantities for various plumbing projects 2. prepare estimates for various plumbing engineering works and calculate rates for various items of construction 3. draft specifications and tender notice 4. prepare valuation report for plumbing engineering works							

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	1	1	3	1						1	1
CO 2	1	3	3	3	3	2	2	2	1	2	2	1
CO 3	2		2	3	1	1	1	1				1
CO 4	2	1	2			1	1	1	1	1	1	1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Introduction**: Purpose of quantity estimates, Types of estimates, Various items to be included in estimates, Modes of measurement and units of measurement as per codal provision IS1200,** 2017 Uniform Illustrated Plumbing Code – India and National Building Code (NBC). Administrative approval and Technical sanction to estimates, Introduction to DSR (District Schedule Rate) and CSR(Common Schedule of Rates) **Specifications**: Purpose, basic principles, general and detailed specifications for various items related to plumbing.	7
II	**Measurement of Quantities**: Measurement sheet and abstract sheet of water supply and sanitary items including fitting and fixtures used in Plumbing engineering.	7

	Analysis of rates, Factors affecting cost of an item work, materials, sundries, labour, tools and plant, overheads and profit. Task work- Definition and factors affecting task work. Analysis of rates of items related to plumbing. Prime cost, Provisional sum and provisional quantities	
III	**Detailed Estimation**: Water supply line, Rising main, distribution network, waste water line, septic tank, GSR- Ground storage Reservoir, ESR-Elevated storage Reservoir, Culverts, earthwork for canals. Roads including hill roads and other plumbing engineering works.	7
IV	**Tenders (Bids):** Meaning, Categories, Tender notice, Notification in press and media, e-procurement	6
V	**Contracts:** General idea, Types of contracts viz: lump-sum, item rate, percentage rate, cost plus	6
VI	**Advanced Plumbing and Sanitary gadgets and their costing –** Vacuum toilets, Jacuzzi, Rain Shower, compact savage treatment plants, water efficient faucets, copper piping.	6
Text Books		
1.	S. C. Rangwala, "Elements of Estimating and Costing", Charotar Publishing house, 4th edition, 2014.	
2.	B.N. Dutta, "Estimating and costing", Dhanpat Rai and sons, 28th edition, 2016.	
3.	P.L. Bhasin and S. Chand, "Quantity Surveying", 3rd Revised edition, 1987.	
4.	B.S. Patil "Civil Engineering Contracts and Estimates", Universities Press Private Ltd, 4th edition, 2015.	
5.	G.S. Birdie, "Estimating and Costing", Dhanpat Rai and Sons, 6th edition, 2005.	
6.	Prof. Subhash Patil- Jain Book Depot " Plumbing Engineering"	
Reference Books		
1.	Standard specifications volumes I and II (PWD Maharashtra) Govt. of Maharashtra	
2.	CPWD Specifications	
3.	CPWD Schedules of Rates	
4.	PWD Hand Book and Red Book	
5.	PWD Schedule of Rates – Latest	
Reference Codes		
1.	India Plumbing Association 2017 Uniform Illustrated Plumbing Code	
2.	National Building Code of India – Guidelines for regulating the building construction activities	
Useful web links		
1.	http://swayam.gov.in/	

Year, Program, Semester	Multidisciplinary Minor II, 4th Semester onwards						
Course Code	MDM 1.4						
Course Category	Program Based Internship						
Course title	**Plumbing Industry Internship**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**		
	One Month				03		
Evaluation Scheme	**ISE**	**ESE**	**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	00	00	50	-	50	-	100
Pre-requisites(if any)	Basics of unit processes and unit operations.						
Course Rationale	The Industrial Internship course caters specifically to B.Tech Civil Engineering students pursuing additional specialization through the B.Tech Minor program in areas such as Plumbing Engineering. This course offers practical exposure to industry settings aligned with their chosen sub-specialization, aiming to bridge the gap between theoretical knowledge and practical application. By engaging in a one-month internship, students gain firsthand experience, essential skills, and insights crucial for their future careers in specialized sectors of Civil engineering.						
Course Objectives	The course teacher will 1. Help expose students to the 'real' working environment. 2. Promote hands-on experience to the students' in their related field. 3. Develop synergetic collaboration between industry and the university in promoting a knowledgeable society. 4. Assist in providing the opportunity for students to test their interest in a particular career before permanent commitments are made. 5. Elaborate the dynamic and challenging nature of industrial environments.						
Course Outcomes	Upon completion of this course, student should be able to 1. Understand industrial processes and operations related to their minor sub-specializations. 2. Apply theoretical concepts to solve practical problems in the industry. 3. Communicate effectively with industry professionals, colleagues, and supervisors. 4. Collaborate efficiently in team environments to complete tasks and projects. 5. Adapt to the dynamic and challenging nature of industrial environments. 6. Reflect on internship experiences for personal and professional growth.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	2	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	2	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	-	-	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content	Hours
The course consists of a one-month internship in a relevant specialized industry. Students will be placed in companies or organizations that align with their chosen sub-specialization within the field of Civil engineering. During the internship, students will engage in various activities, including but not limited to: 1. Shadowing industry professionals to observe and learn about different processes and operations. 2. Assisting with ongoing projects or research initiatives within the organization. 3. Participating in hands-on tasks related to their minor sub-specialization, under the guidance of experienced mentors. 4. Attending training sessions, workshops, and seminars conducted by the industry to enhance their knowledge and skills. 5. Engaging in discussions and meetings with supervisors and colleagues to gain insights into industry practices, challenges, and innovations. 6. Documenting their internship experience through reports, presentations, or reflective journals. The period of one month for this internship will be during the winter or summer vacations, any such slots 4th Semester onwards.	4 weeks

Course Evaluation Method

This particular evaluation will be the part of the structure of 7th Semester.
The evaluation for the Industrial Internship course will be conducted as follows:

- **Internal Evaluation (50 marks):**
    - Assessment by course teachers based on students' performance during the internship, including attendance, participation, attitude, and contribution to assigned tasks.
    - Evaluation by industrial supervisors on students' professional conduct, technical skills, problem-solving abilities, and overall performance in the workplace.
- **External Evaluation (50 marks):**

Evaluation by an external examiner appointed by the institute, who will assess students' internship reports, presentations, or any other documentation submitted at the end of the internship period.

The external examiner will review the quality of students' reflections on their internship experience, their ability to apply theoretical knowledge to practical situations, and the depth of their understanding of industry practices and challenges.

The final grades for the Industrial Internship course will be determined based on the combined assessment from both internal and external evaluations.

Reference Books

1.	India Plumbing Association 2017 Uniform Illustrated Plumbing Code
2.	National Building Code of India – Guidelines for regulating the building construction activities

Year, Program, Semester	Multidisciplinary Minor II, 4th Semester onwards							
Course Code	MDM 1.5							
Course Category	Project Based Learning							
Course Title	**Mini Project**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**		
	-	-	-	-		02		
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	00	00		50	-	50	-	100
Pre-requisites(if any)	Basics of unit processes and unit operations.							
Course Rationale	This course aims to provide students with practical exposure and hands-on experience in real-world industrial settings, fostering a deeper understanding of theoretical concepts through application. By engaging in this mini project, students will develop essential skills such as problem-solving, teamwork, and communication, preparing them for future challenges in the professional arena in green aspects of Industry.							
Course Objectives	The course teacher will 1. Facilitate application of theoretical knowledge. 2. Guide the students about enhancement of practical skills. 3. Explain about development of industry-relevant competencies.							
Course Outcomes	Upon completion of this course, student should be able to 1. Demonstrate application of theoretical concepts with instructor guidance. 2. Collaborate effectively in instructor-led team-based projects. 3. Communicate findings and insights professionally under instructor supervision.							

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	-	-	2	-	-	-	2	-	-	-
CO 2	-	-	3	-	-	-	-	-	3	-	2	1
CO 3	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

Specialization Minor Program Based Mini Project is a dynamic course designed to bridge the gap between classroom learning and real-world application. All the students will engage themselves in a series of tasks and challenge that will enable them to apply theoretical concepts learned in previous courses to solve practical problems. The project work need to be carried out independently covering a range of topics relevant to their field of study, allowing them to explore different facets of the particular discipline and develop versatile skill sets pertaining to application of Green Technology.

This activity may be planned after 4th Semester and can be completed prior to 8th Semester of their Major studies.

Course Assessment Process

This particular evaluation will be the part of 8th Semester of the major structure.

The course evaluation for the internals will be at the course teacher end while there will also be the external evaluation of the Project work.

The teachers will follow the instructions as below:

Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including:

• Rubric-based assessment for the project work and its report.

• Peer evaluation for project.
• Instructor-led discussions or presentations to evaluate communication skills and critical thinking.
• Overall course grading based on a weighted average of individual assessments and participation.
The evaluation format should be transparent, fair, and aligned with the course objectives and outcomes. Regular feedback and communication with students will ensure that the evaluation process remains supportive of their learning journey.

Multidisciplinary Minor
In
Artificial Intelligence and Machine Learning
For
B.Tech. (Civil Engineering)

Shivaji University, Kolhapur
Department of Technology

Multidisciplinary Minor in Artificial Intelligence and Machine Learning

Teaching & Evaluation Scheme										
Sr. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Contact Hours**	**Credits**	**Evaluation scheme**	
									Theory	**Practical**
				L	**T**	**P**			**ISE:ESE**	**IE:EE**
1.	Preferably on SWAYAM (NPTEL) or any other MOOCs (Minor Program Core) Or In a Face-to-Face mode	MDM 2.1	Introduction to AI & Machine Learning	03	-	-	03	03	30:70	00:00
2.		MDM 2.2	Introduction to Data Analytics	03	-	-	03	03	30:70	00:00
3.		MDM 2.3	Deep Learning and Neural Network	03	-	-	03	03	30:70	00:00
4.	Program Based Internship	MDM 2.4	AI ML Related Internship	One Month			-	03	-	50:50
5.	Project Based Learning	MDM 2.5	Mini Project	-	-	-	-	02	-	50:50
				-	**-**	**-**	**-**	**14**	**300**	**200**
			Total Hours	**09**	**00**	**00**	**09**	**-**	**-**	**-**

Note: MDM Program's Internship and Mini Project need to be planned during winter or summer vacation days after 4th semester while respective evaluations will be the part of 7th and 8th Semesters of the B.Tech Major structure.

Multidisciplinary Minor II: Artificial Intelligence and Machine Learning

Year, Program, Semester	Multidisciplinary Minor II , 4th Semester Onwards							
Course Code	MDM-2.1							
Course Category	Minor Program Core							
Course title	**Introduction to AI & Machine Learning**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**		
	03	-	-	03		03		
Evaluation Scheme	ISE		ESE	IOE	IPE	EOE	EPE	Total
	30		70	-	-	-	-	100
Pre-requisites (if any)	Mathematical concepts such as statistics, calculus, probability, and linear algebra.							
Course Objectives	The Course is aimed to 1. To review and strengthen important mathematical concepts required for AI &ML. 2. Introduce the concept of learning patterns from data and develop a strong 3. Theoretical foundation for understanding state of the art Machine Learning algorithms.							
Course Outcomes	Upon completion of this course, student should be able to 1. Design and implement machine learning solutions to classification, regression and clustering problems. 2. Evaluate and interpret the results of the different ML techniques. 3. Design and implement various machine learning algorithms in a range of Real-world applications.							

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	3	-	-	-	-	-	-	-
CO2	2	-	2	-	3	-	-	-	-	-	-	-
CO 3	-	-	2	-	2	-	-	-	-	-	-	-

Level of Mappings: Low1, Moderate2, High3

Unit No.	Course Content	Hours
I	Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming, Mathematical foundations: Matrix Theory and Statistics for Machine Learning.	9
II	Idea of Machines learning from data, Classification of problem–Regression and Classification, Supervised and Unsupervised learning.	8
III	Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice.	8
IV	Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting.	8
V	Discussion on clustering algorithms and use-cases cantered around clustering and classification.	6
Text / Reference Books		
1.	Saroj Kaushik, Artificial Intelligence, Cengage Learning,1st Edition 2011	
2.	AninditaDasBhattacharjee,"PracticalWorkbookArtificialIntelligenceandSoftComputing for beginners, Shroff Publisher-Xteam Publisher.	
3.	Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.	
4.	Tom Mitchell, Machine Learning, McGraw Hill, 2017.	
5.	Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.	
6.	T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.	

Note: Though it's a theory course, there will be classes on computers for hands on practice. The activity content for the same is as follows.

- Implementation of logical rules in Python
- Using any data apply the concept of: Liner regression, Gradient decent, Logistic regression
- To add the missing value in any data set.
- Perform and plot under fitting and over fitting in a dataset.
- Implementation of clustering and classification algorithms.

Year, Program, Semester	Multidisciplinary Minor II , 4th Semester Onwards							
Course Code	MDM-2.2							
Course Category	Minor Program Core							
Course title	**Introduction to Data Analytics**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**			**Total Credits**	
	03	-	-	03			03	
Evaluation Scheme	ISE		ESE	IOE	IPE	EOE	EPE	Total
	30		70	-	-	-	-	100
Pre-requisites (if any)	Solid foundation in basic mathematics, including algebra, calculus, and probability.							
Course Objectives	The Course is aimed to 1. Provide the knowledge and expertise to become a proficient data scientist 2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science 3. Produce Python code to statistically analyses a dataset 4. Critically evaluate data visualizations based on their design and use for communicating stories from data.							
Course Outcomes	Upon completion of this course, student should be able to 1. Explain how data is collected, managed and stored for data science. 2. Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists. 3. Implement data collection and management scripts using MongoDB.							

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	3	-	-	-	-	-	-	-	-
CO2	-	-	-	-	3	-	-	-	-	-	-	-
CO3	-	-	2	2	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Python in Data Science.	7
II	Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA-Quantitative technique, EDA-Graphical Technique, Data Analytics Conclusion and Predictions.	7
III	Feature Generation and Feature Selection (Extracting Meaning from Data)-Motivating application: user (customer) retention-Feature Generation (brainstorming, role of domain expertise, and place for imagination)-Feature Selection algorithms.	9
IV	Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects-Exercise: create your own visualization of a complex dataset.	9
V	Applications of Data Science, Data Science and Ethical Issues-Discussions on privacy, security, ethics- A look back at Data Science- Next-generation data scientists.	7

Text / Reference Books	
1.	Joel Grus, Data Science from Scratch, Shroff Publisher Publisher / O' Reilly Publisher Media
2.	Annalyn Ng, Kenneth Soo, Numsense, Data Science for the Layman, Shroff Publisher
3.	Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly PublisherMedia.
4.	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets.v2.1, Cambridge University Press.
5.	Jake Vander Plas, Python Data Science Handbook, Shroff Publisher / O'Reilly Publisher Media
6.	Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher / O'Reilly Publisher Media.

Note: Though it's a theory course, there will be classes on computers for hands on practice. The activity content for the same is as follows.

- Python Environment setup and Essentials.
- Mathematical computing with Python (NumPy).
- Scientific Computing with Python (SciPy).
- Data Manipulation with Pandas.
- Prediction using Scikit-Learn
- Data Visualization in python using matplotlib

Year, Program, Semester	Multidisciplinary Minor II , 4th Semester Onwards							
Course Code	MDM-2.3							
Course Category	Minor Program Core							
Course title	**Deep Learning and Neural Network**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**		
	03	-	-	03		03		
Evaluation Scheme	ISE		ESE	IOE	IPE	EOE	EPE	Total
	30		70	-	-	-	-	100
Pre-requisites (if any)	Basic Mathematics, matrix arithmetic, probability.							
Course Objectives	The Course is aimed to 1. Strengthen important Mathematical concepts required for Deep learning and neural network. 2. Get a detailed insight of advanced algorithms of neural networks. 3. Introduce different deep learning network.							
Course Outcomes	Upon completion of this course, student should be able to 1. Design and implement Artificial Neural networks. 2. Decide when to use which type of NN. 3. Implement and analyze various deep learning architectures							

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	2	-	2	-	-	-	-	-	-	-
CO2	-	2	-	-	2	-	-	-	-	-	-	-
CO3	-	2	3	-	3	-	-	-	-	-	-	-

Level of Mapping as: Low1, Moderate2, High 3

Unit No.	Course Content	Hours
I	Information flow in a neural network, understanding basic structure and ANN	8
II	Training a Neural network, how to determine hidden layers, recurrent neural network	8
III	Convolutional neural networks, image classification and CNN.	8
IV	RNN and LSTMs. Applications of RNN in real world.	8
V	Creating and deploying networks using tensor flow and keras	7

Text / Reference Books	
1.	John Paul Mueller, Luca Massaron, Deep Learning for Dummies, John Wiley & Sons.
2.	Adam Gibson, Josh Patterson, Deep Learning, A Practitioner's Approach, Shroff Publisher/O'Reilly Publisher Media.
3.	Christopher M. Bishop, Neural Networks for Pattern Recognition, Oxford.
4.	Russell Reed, Robert J Marks II, Neural Smithing: Supervised Learning in Feed forward Artificial Neural Networks, Bradford Book Publishers

Note: Though it's a theory course, there will be classes on computers for hands on practice. The activity content for the same is as follows.

- Introduction to Kaggle and how it can be used to enhance visibility.
- Build general features to build a model for text analytics.
- Build and deploy your own deep neural network on a website using tens or flow.

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">Multidisciplinary Minor II, 4th Semester onwards</td></tr>
<tr><td>Course Code</td><td colspan="7">MDM 2.4</td></tr>
<tr><td>Course Category</td><td colspan="7">Program Based Internship</td></tr>
<tr><td>Course Title</td><td colspan="7">AI ML Related Internship</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td colspan="5">One Month</td><td colspan="2">03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">00</td><td>00</td><td>50</td><td>-</td><td>50</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="7">Basics of unit processes and unit operations.</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The course caters specifically to B.Tech. Civil Engineering students as the part of multidisciplinary Minor with respect to AI & ML applications in Chemical and allied Engineering. This course offers practical exposure to industry settings aligned with their chosen discipline, aiming to bridge the gap between theoretical knowledge and practical application. By engaging in a one-month internship, students gain firsthand experience, essential skills, and insights crucial for their future careers in additional sector of industry.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course teacher will
1. Help expose students to the 'real' working environment;
2. Promote hands-on experience to the students’ in their related field;
3. Develop synergetic collaboration between industry and the university in promoting a knowledgeable society;
4. Assist in providing the opportunity for students to test their interest in a particular career before permanent commitments are made.
5. Elaborate the dynamic and challenging nature of industrial environments.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to
1. Understand industrial processes and operations related to their minor sub-specializations.
2. Apply theoretical concepts to solve practical problems in the industry.
3. Communicate effectively with industry professionals, colleagues, and supervisors.
4. Collaborate efficiently in team environments to complete tasks and projects.
5. Adapt to the dynamic and challenging nature of industrial environments.
6. Reflect on internship experiences for personal and professional growth.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	2	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	2	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	-	-	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content	**Hours**
The course consists of a one-month internship with respect to applications of AI & ML. Students will be placed in companies or organizations that align with the particular requirement. During the internship, students will engage in various activities, including but not limited to: 1. Shadowing industry professionals to observe and learn about different processes and operations. 2. Assisting with ongoing projects or research initiatives within the organization. 3. Participating in hands-on tasks related to their minor sub-specialization, under the guidance of experienced mentors. 4. Attending training sessions, workshops, and seminars conducted by the industry to enhance their knowledge and skills. 5. Engaging in discussions and meetings with supervisors and colleagues to gain insights into industry practices, challenges, and innovations. 6. Documenting their internship experience through reports, presentations, or reflective journals. The period of one month for this internship will be during the winter or summer vacations, any such slots 4th Semester onwards.	4 weeks

Course Evaluation Method

This particular evaluation will be the part of the structure of 7th Semester.
The evaluation for the Industrial Internship course will be conducted as follows:

- **Internal Evaluation (50 marks):**
  - Assessment by course teachers based on students' performance during the internship, including attendance, participation, attitude, and contribution to assigned tasks.
  - Evaluation by industrial supervisors on students' professional conduct, technical skills, problem-solving abilities, and overall performance in the workplace.
- **External Evaluation (50 marks):**
  - Evaluation by an external examiner appointed by the institute, who will assess students' internship reports, presentations, or any other documentation submitted at the end of the internship period.
  - The external examiner will review the quality of students' reflections on their internship experience, their ability to apply theoretical knowledge to practical situations, and the depth of their understanding of industry practices and challenges.

The final grades for the Industrial Internship course will be determined based on the combined assessment from both internal and external evaluations.

Year, Program, Semester	Multidisciplinary Minor II, 4th Semester onwards							
Course Code	MDM 2.5							
Course Category	Project Based Learning							
Course Title	**Mini Project**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**		
	-	-	-	-		02		
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	00	00		50	-	50	-	100
Pre-requisites(if any)	Basics of unit processes and unit operations.							
Course Rationale	This course aims to provide students with practical exposure and hands-on experience in real-world industrial settings, fostering a deeper understanding of theoretical concepts through application. By engaging in this field project, students will develop essential skills such as problem-solving, teamwork, and communication, preparing them for future challenges in the professional arena for AI ML applications.							
Course Objectives	The course teacher will 1. Facilitate application of theoretical knowledge. 2. Guide the students about enhancement of practical skills. 3. Explain about development of industry-relevant competencies.							
Course Outcomes	Upon completion of this course, student should be able to 1. Demonstrate application of theoretical concepts with instructor guidance. 2. Collaborate effectively in instructor-led team-based projects. 3. Communicate findings and insights professionally under instructor supervision.							

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	-	-	2	-	-	-	2	-	-	-
CO 2	-	-	3	-	-	-	-	-	3	-	2	1
CO 3	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

Minor Program Based Mini Project is a dynamic course designed to bridge the gap between classroom learning and real-world application. All the students will engage themselves in a series of tasks and challenge that will enable them to apply theoretical concepts learned in previous courses to solve practical problems. The project work need to be carried out independently covering a range of topics relevant to their field of study, allowing them to explore different facets of the particular discipline and develop versatile skill sets with respect to application of AI & ML.

This activity may be planned after 4th Semester and can be completed prior to 8th Semester of their Major studies.

Course Assessment Process

This particular evaluation will be the part of 8th Semester of the major structure.

The course evaluation for the internals will be at the course teacher end while there will also be the external evaluation of the Project work.

The teachers will follow the instructions as below:

Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including:

• Rubric-based assessment for the project work and its report.

• Peer evaluation for project.
• Instructor-led discussions or presentations to evaluate communication skills and critical thinking.
• Overall course grading based on a weighted average of individual assessments and participation.

The evaluation format should be transparent, fair, and aligned with the course objectives and outcomes. Regular feedback and communication with students will ensure that the evaluation process remains supportive of their learning journey.

Shivaji University

Vidya Nagar, Kolhapur, Maharashtra 416004

Department of Technology

As per NEP2020 guidelines

Pool of Specialization Minors for
B. Tech. (Civil Engineering), Exit after Second Year (Diploma in Civil Engineering)
Detailed Curriculum, w.e.f. 2024-25

2024-25 onwards

Shivaji University, Kolhapur
Department of Technology

B. Tech. (Civil Engineering), Exit after Second Year (Diploma in Civil Engineering)

Teaching & Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	SWAYAM (NPTEL) Or Any other MOOCs Or Face to face mode Or Self-Study Mode (Program Core Courses)	DC- CHE1	Design of Reinforced Concrete Structures	03	-	-	03	03	30:70	00:00
2.		DC- CHE 2	Software Tools in Civil Engineering	02	-	-	02	02	30:70	00:00
3.		DC- CHE 3	Estimating, Costing and Valuation	03	-	-	03	03	30:70	00:00
4.	Program Based Internship	DC-PBI	In plant Training	One Month				04	00:00	50:50
				-	-	-	-	**12***	**300****	**100**
			Total Hours	**08**	-	-	**08**	-	-	-

Note: The Workload against the Diploma Course will be finalised at the Program Level considering the strength of the students seeking for the Diploma.

*****Obtaining these credits will be in addition to 85 regular credits up to SY B. Tech. Also in such cases, acquiring certificate after First Year is mandatory.

****** There is an option for End Semester Examination either on respective MOOC platform if any or through the University System.

Note: Program Specific Industry Internship to be completed by such students before commencement of T.Y. B. Tech.

Year, Program, Semester	Exit after Second Year of B. Tech. (Civil Engineering), Diploma Claim						
Course Code	DC- CE1						
Course Category	Course for Diploma in Civil Engineering						
Course title	Design of Reinforced Concrete Structures						
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits		
	03	-	-	03	03		
Evaluation Scheme	ISE	ESE	IOE	IPE	EOE	EPE	Total
	30	70	-	-	-	-	100
Pre-requisites(if any)	Structural analysis, Properties of concrete and steel and with the behavior of reinforced concrete as a structural material; also, to develop methods for the design of reinforced concrete structural members such as beams, slabs, footings, and columns. Ultimate strength design and working stress method.						
Course Rationale	This course provides an understanding of design for reinforced concrete structures.						
Course Objectives	The course teacher will 1. To know the design philosophy of reinforced concrete structures, 2. To understand design of singly reinforced beam & doubly reinforced beam 3. To know the design of slab and staircase 4. To understand the design of compression member and footing.						
Course Outcomes	Upon completion of this course, student should be able to 1. Design philosophy of reinforced concrete structures, 2. Design of singly reinforced beam & doubly reinforced beam, 3. Design of slab and staircase 4. Design of design of compression member and footing.						

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	3	2	1	2	2	-	-	-	-	-	2	2
CO 2	3	1	2	2	2	-	-	-	-	-	1	2
CO 3	3	2	1	2	2	-	-	-	-	-	2	2
CO 4	3	1	2	2	2	-	-	-	-	-	1	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Introduction, Different methods of design of reinforced concrete structures, Working stress method, Limit state of collapse	6

II	Design of singly reinforced beam, Design of doubly reinforced beam, Limit state of collapse - shear	7
III	Design of slabs	7
IV	Design of staircases	7
V	Design of compression members, Design of footings	6
VI	Introduction to analysis and design software	6
Reference Books		
1.	Limit state design of reinforced concrete, P. C. Varghese, Prentice-Hall of India, New Delhi, 2001	
2.	Reinforced concrete design, Limit state design, Ashok K. Jain, Nem-Chand & Bros, Roorkee, 2002	
3.	Design of concrete structures, J. N. Bandyopadhyay, Prentice Hall of India, New Delhi, 2008	
4.	Limit state design of reinforced concrete, P. C. Varghese, Prentice-Hall of India, New Delhi, 2001	
Useful web links		
1.	https://onlinecourses.nptel.ac.in/noc21_ce42/preview	
2.	https://www.youtube.com/watch?v=yvU8G0T1ptI&list=PL9RcWoqXmzaKAMBJsHDZYzMPpbFaVW8T0	

<table>
<tr><td>Year, Program, Semester</td><td colspan="8">Exit after Second Year of B. Tech. (Civil Engineering), Diploma Claim</td></tr>
<tr><td>Course Code</td><td colspan="8">DC- CE2</td></tr>
<tr><td>Course Category</td><td colspan="8">Course for Diploma in Civil Engineering</td></tr>
<tr><td>Course title</td><td colspan="8">Software Tools in Civil Engineering</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="3">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>02</td><td>-</td><td>-</td><td colspan="3">02</td><td colspan="2">02</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>-</td><td>-</td><td>-</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="8">Building construction and planning, Engineering mechanics, engineering mathematics</td></tr>
<tr><td>Course Rationale</td><td colspan="8">Computer applications play a very vital role in present day life, more so, in the professional life of engineer. In order to enable the students use the computers effectively in problem solving, this course offers applications of various computer softwares in Civil Engineering.</td></tr>
<tr><td>Course Objectives</td><td colspan="8">The course teacher will
1. Explain the advantages of using CAD in comparison with conventional method.
2. Teach to draw and interpret CAD drawings using drawing, editing and viewing in CAD software.
3. Teach to create 2D plans of building and 3 D views from given 2D plans
4. Explain the use of different software to solve Civil Engineering problems</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">Upon completion of this course, student should be able to
1. Know the advantages of using CAD in comparison with conventional method.
2. Draw and interpret CAD drawings using drawing, editing and viewing in CAD software.
3. Create 2D plans of building and 3 D views from given 2D plans
4. Understand use of different software to solve Civil Engineering problems</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	1	1	-	-	3	-	-	-	-	-	-	2
CO 2	1	1	-	-	3	-	-	-	-	-	-	2
CO 3	1	1	-	-	3	-	-	-	-	-	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Introduction to Computer Aided Drafting (2D) commands of any one software (Auto CAD, ProE, Solid works, Unigraphics etc. (6 drawing sheets) 1.1 Concept of AutoCAD, Tool bars in CAD software, coordinate system, snap, grid, and ortho mode (Absolute, Relative and Polar), setting of units and layout. 1.2 Drawing commands – point, line, arc, circle, ellipse, 1.3 Editing commands – scale, erase, copy, stretch, lengthen and explode. 1.4 Dimensioning and placing text in drawing area 1.5 Sectioning and hatching 1.6 Inquiry for different parameters of drawing entity 1.7 Create layers within a drawing 1.8 Specifying Geometrical Dimensioning & tolerance (GD &T) parameters in drawing	7
II	2-D Plan of a small building	6
III	Isometric Drawing by CAD using any part modeling Software (3D) (one sheet) Drawings of following on computer: - Cone - Cylinder - Cube - Spring - Isometric view of objects	6
IV	Introduction to any modeling software (ProE, Solid works, AutoCAD Civil 3D, Unigraphic, Catia, Revit, BIM, etc.) **Introduction to Sketcher:** Sketch Entities, Sketch Tools, Blocks, Dimensioning **4.1 Part modeling (4 models)** Part Modeling Tools:- 4.1.1 Creating reference planes 4.1.2 Creating Extrude features Creating Revolve Creating Swept features 4.1.3 Creating Loft features 4.1.4 Creating Reference - points, axis, coordinates 4.1.5 Creating curves 4.1.6 Creating Fillet features 4.1.7 Inserting Hole types 4.1.8 Creating Chamfer 4.1.9 Creating Shell 4.1.10 Creating Rib 4.1.11 Environment & Utilities - Working with views and manipulating views. **4.2. Preparing 3-D view of existing 2-D plan**	8
V	Introduction to analysis and design software STAAD Pro, ETABS, etc.	6

VI	Introduction to MS Project Primavera Project Planner, Hit Office, ERP, etc.	6
Reference Books		
1.	Engineering Drawing with AutoCAD 2000 by T. Jeyapooran; Vikas Publishing House, Delhi.	
2.	AutoCAD for Engineering Drawing Made Easy by P. Nageswara Rao; Tata McGraw Hill, New Delhi.	
3.	AutoCAD 2000 for you by Umesh Shettigar and Abdul Khader; Janatha Publishers, Udupi.	
4.	Auto CAD 2000 by Ajit Singh, TMH, New Delhi.	
5.	Instruction Manual of the software used (AutoCAD, ProE, Solidwors, Unigraphic etc.)	
6.	E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh	
Useful web links		
1.	http://swayam.gov.in/	

<table>
<tr><td>Year, Program, Semester</td><td colspan="8">Exit after Second Year of B. Tech. (Civil Engineering), Diploma Claim</td></tr>
<tr><td>Course Code</td><td colspan="8">DC- CE 3</td></tr>
<tr><td>Course Category</td><td colspan="8">Course for Diploma in Civil Engineering</td></tr>
<tr><td>Course title</td><td colspan="8">Estimating, Costing and Valuation</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="3">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>0</td><td>-</td><td>-</td><td colspan="3">03</td><td colspan="2">03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>-</td><td>-</td><td>-</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="8">Calculation of quantities and cost estimates for civil engineering works is one of the major functions for the civil engineer and he has to acquire the knowledge of calculating the quantities of each item of work from available drawings & to prepare the estimate of the work which is necessary for allocation of funds for the required purpose and further continue to execute the work as per the drawings and estimates.</td></tr>
<tr><td>Course Rationale</td><td colspan="8">Apply principles of estimating and costing to prepare estimates of civil engineering works.</td></tr>
<tr><td>Course Objectives</td><td colspan="8">The course teacher will
1. To Summarize the basic principle and standard methods for working out quantities of different civil engineering works.
2. To Demonstrate the detailed estimate of buildings.
3. To Workout rate analysis of the various items of work.
4. To Understand the material requirements as per specified norms and standards.</td></tr>
<tr><td>Course Outcomes</td><td colspan="8">Upon completion of this course, student should be able to
1. Understand the basics requirements and types of estimating & Costing.
2. Evaluate the quantity by long wall short wall and centre line method.
3. Analyse bar bending schedule for reinforcement works.
4. Understand the rate analysis of civil works.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	1	1	2	2	-	-	-	-	-	1	2
CO 2	3	1	1	2	2	-	-	-	-	-	1	2
CO 3	3	1	1	2	2	-	-	-	-	-	1	2
CO 4	3	1	1	2	2	-	-	-	-	-	1	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Overview of Estimating & Costing :** Meaning of the terms estimating, costing, Purpose of estimating and costing, Data required for estimate, General items of work in building – Standard units' principles of working out quantities, Factors to be considered during preparation of estimate, Specification, Quantity availability of material, Location of site.	07
II	**Types of Estimates :** Types of estimate - Approximate and Detailed, for detailed and abstract estimates, approximate method of estimating, detailed estimates of buildings, revised estimate, Supplementary estimate, Maintenance & Repair estimate, Load bearing Structure – Long Wall short wall and Centre line method, Uses of detailed estimate.	07
III	**Mode of Measurements:** General Rules for fixing units of Measurements for different, Desired accuracy in taking measurements, rules for deductions, Procedure for taking out quantities as per IS 1200 and latest PWD hand book,	06
IV	**Framed Structure building.** –Estimate of Reinforcement Concrete structures such as buildings, retaining wall, bridges, water tank, etc.	07
V	**Rate Analysis :** Meaning of term Rate analysis –Factors affecting rate analysis, working out data for various items of work over head, Contingent charges, Materials and labour component, Market rate and labour rate, Transportation of materials,	06
VI	**Earthworks :** Earthwork for roads and canals, various methods of calculation of quantity of earth work, Estimate of rigid and flexible pavement Road of 1km length, Use of software for estimation.	06
Reference Books		
1.	B. N. Dutta, "Estimating and Costing", UBS publishers, 2000.	
2.	G. S. Birdie., "Estimating and Costing", Dhanpat Rai publications, 1988.	
3.	M. Chakraborti, Estimating & costing, Specification and Valuation in Civil Engineering	
4.	S.C. Rangwala, Estimating & costing, Charotar , Publication Anand,	
Useful web links		
1.	https://youtu.be/Jlbk6ndtltg	
2.	https://www.youtube.com/watch?v=RHQESQqrZEY&list=PLDruByDs-j8GRR-5JDxOaG13IMS0ULZBw	

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">Exit after Second Year of B. Tech. (Civil Engineering), Diploma Claim</td></tr>
<tr><td>Course Code</td><td colspan="7">DC-PBI</td></tr>
<tr><td>Course Category</td><td colspan="7">Course for Diploma in Civil Engineering</td></tr>
<tr><td>Course title</td><td colspan="7">In Plant Training</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td colspan="4">One Month</td><td colspan="2">04</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>50</td><td>-</td><td>50</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="7">Completion of All the course of FY B. Tech Civil Engineering Major, also the completion of all the courses to claim Certificate in Civil Engineering.</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The purpose of the In Plant Training course is to provide students with practical exposure to the civil engineering industry. This hands-on experience allows students to apply theoretical knowledge gained in the classroom to real-world scenarios. By engaging in industrial training, students develop essential skills, gain industry insights, and enhance their employability in the civil engineering field.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The training will ensure students
1. To gain practical exposure to industrial processes in Civil engineering.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of the In-Plant Training course, students will be able to
1. Understand industrial processes in civil engineering.
2. Apply theoretical knowledge to practical situations.
3. Utilize tools and techniques effectively in experiments.
4. Identify and mitigate workplace safety hazards.
5. Collaborate effectively in multidisciplinary teams.
6. Communicate findings professionally.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	-	-	-	-	-	-	-	-	-	-
CO 3	-	-	2	-	-	-	-	-	-	-	-	-
CO 4	-	-	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	-	3	-	-	-
CO 6	-	-	-	-	-	-	-	-	-	3	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

The In-Plant Training course encompasses a comprehensive blend of theoretical learning and hands-on experience in an industrial setting. The course content includes:

1. Introduction to Civil Engineering Industry: Overview of different sectors, processes, and applications within the civil engineering domain.
2. Safety Procedures and Protocols: Training on safety regulations, hazard identification, emergency procedures, and personal protective equipment (PPE) usage.
3. Equipment Familiarization: Hands-on experience with common equipment and instrumentation used in civil engineering processes
4. Process Simulation and Optimization: Practical exercises on process simulation software and optimization techniques to enhance efficiency and productivity.
5. Troubleshooting and Maintenance: Practical sessions on diagnosing and resolving equipment malfunctions, conducting routine maintenance, and ensuring operational integrity.
6. Industrial Visits and Guest Lectures: Field trips to industrial facilities and guest lectures by industry experts to provide first hand insights into real-world applications and challenges.
7. Project Work: Collaborative projects or case studies addressing specific engineering problems or process improvements relevant to the host industry.
8. Evaluation and Assessment: Continuous evaluation based on performance during training, report submissions with the components of the report has been separately mentioned under Evaluation Method.

Evaluation Method

1. **Attendance and Participation:** Regular attendance and active participation in training sessions, workshops, and industrial visits will be monitored.
2. **Skills Assessment:** Evaluation of practical skills demonstrated during hands-on training activities, including equipment operation, experimentation, troubleshooting, and safety compliance.
3. **Performance Review:** Ongoing assessment of individual and group performance based on assigned tasks, projects, and team collaborations.

4. **Supervisor Feedback:** Feedback from industry supervisors regarding student performance, professionalism, attitude, and adaptability in the workplace.
5. **Training Report:** Submission of a comprehensive training report summarizing the learning outcomes, experiences, observations, and insights gained during the In Plant Training period.

Training Report Format: The training report should follow a structured format to ensure clarity, coherence, and completeness. Here's a suggested outline:

1. **Title Page:**
   - Title of the report: "In Plant Training Report"
   - Student's name
   - Enrolment number
   - Department/Program
   - Name of the institution
   - Duration of the training period
   - Name and address of the host industry
2. **Acknowledgments (Optional):**
   - Acknowledge any individuals, organizations, or institutions that contributed to the training experience.
3. **Table of Contents:**
   - List of sections and subsections with corresponding page numbers.
4. **Introduction:**
   - Brief overview of the training objectives, scope, and significance.
   - Description of the host industry and the specific department or division where the training was conducted.
5. **Training Objectives:**
   - Recapitulation of the objectives outlined at the beginning of the training period.
6. **Training Activities:**
   - Detailed account of the activities undertaken during the training, including:
   - Description of the tasks assigned and responsibilities undertaken.
   - Summary of workshops, seminars, industrial visits, and hands-on training sessions participated in.
   - Highlights of any notable experiences, challenges faced, and lessons learned.
7. **Skills Acquired:**
   - Discussion of the practical skills and knowledge gained throughout the training period.
   - Reflection on the application of theoretical concepts in real-world industrial scenarios.
8. **Observations and Insights:**
   - Analysis of observations made during the training, including:
   - Observations regarding industry practices, processes, and technologies.
   - Insights into workplace dynamics, organizational culture, and professional etiquettes.

- Suggestions for improvement or areas of further learning identified during the training.

9. **Conclusion:**
    - Summary of key takeaways and learning outcomes from the training experience.
10. **References:**
    - List of sources referenced or consulted during the preparation of the report (if applicable).
11. **Appendices (Optional):**
    - Additional materials such as photographs, diagrams, charts, or supplementary documents supporting the content of the report.
12. **Declaration:**
    - Statement affirming the authenticity and originality of the report, along with the student's signature and date.

The training report should be well-organized, concise, and professionally presented, demonstrating the student's ability to articulate their learning experiences and insights gained during the In-Plant Training period.

Shivaji University

VidyaNagar, Kolhapur, Maharashtra 416004

Department of Technology

As per NEP2020 guidelines

B.Tech. (Civil Engineering Honors and Honors with Research) Curriculum Structure 2024-25 onwards

Shivaji University, Kolhapur
Department of Technology

B.Tech. (Civil Engineering) Honors (An additional but optional one)

Teaching and Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	SWAYAM (NPTEL) or any other MOOCs (Program Core Courses) Or Self-study mode with University's Semester End Examination	HN- 1	Research Methodology	03	-	-	03	03	30:70	00:00
2.		HN - 2	Theory of Elasticity and Plasticity	03	-	-	03	03	30:70	00:00
3.		HN - 3	Air Pollution and Control	03	-	-	03	03	30:70	00:00
4.		HN - 4	Construction Project Management	03	-	-	03	03	30:70	00:00
5.		HN - 5	Retrofitting and Rehabilitation of Civil Infrastructure	03	-	-	03	03	30:70	00:00
6.	Ability Enhancement Course	HNR-AEC1	HNR - Advanced Laboratory Practice	-	-	04	04	02	-	50:50
				-	-	-	-	**17**	**500**	**100**
			Total Hours	15	00	04	**19**	-	-	-

Note: The workload against the B.Tech. Honors will be finalized at the Program Level considering the strength of students opting for the Honors.

Note 1: The Program will fix up these courses either through MOOCs' or from a conventional list for self-studies.

Note 2: These courses / MOOCs will be different than those to be opted in the VIII semester of B.Tech. Major against electives.

Note 3: B. Tech. (Honors) candidate will be eligible to join the Second Year of PG program in the same or allied specialization.

Note 4: Students may earn these credits during **S.Y. B.Tech. to Final Year of their studies.**

<table>
<tr><td>Year, Program, semester</td><td colspan="7">B. Tech. Civil Engineering (Honors/Honors with Research)</td></tr>
<tr><td>Course Code</td><td colspan="7">HN-1</td></tr>
<tr><td>Course Category</td><td colspan="7">Honors Course-I</td></tr>
<tr><td>Course title</td><td colspan="7">Course-I Research Methodology</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="2">03</td><td colspan="2">03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>-</td><td>-</td><td>-</td><td>-</td><td>100</td></tr>
<tr><td>Course Rationale</td><td colspan="7">The course is designed to equip students with the necessary knowledge and skills to conduct research effectively in engineering fields. The course will cover various aspects of research design, data collection, analysis, and reporting. Emphasis will be placed on understanding different research methodologies, ethical considerations, literature review techniques, and research proposal development.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The Course Teacher will:
1. Familiarize students with various research methodologies and approaches used in scientific inquiry.
2. Develop students critical thinking and analytical skills necessary for conducting research.
3. Provide students with practical guidance on designing research studies, including formulating research questions and hypotheses.
4. Equip students with the necessary skills to conduct literature reviews, analyze data, and interpret research findings.
5. Cultivate ethical research practices and promote integrity in the research process.
6. Prepare students for effectively communicating research findings through presentations, reports, and scholarly publications.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">Upon completion of this course, student should be able to –
1. Demonstrate an understanding of different research methodologies, including quantitative, qualitative, and mixed methods approaches.
2. Evaluate existing research literature, identify gaps, and formulate relevant research questions and hypotheses.
3. Develop proficiency in research design, including selecting appropriate methodologies, sampling techniques, and data collection methods.
4. Gain practical experience in data analysis techniques, such as statistical analysis, qualitative coding, and thematic analysis.
5. Adhere to ethical guidelines and principles in research conduct, including obtaining informed consent, ensuring confidentiality, and avoiding plagiarism.
6. Communicate research findings through written reports, oral presentations, and academic publications.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	-	3	2	-	1	-	3	-	3	-	-
CO 2	-	3	-	3	-	-	-	-	-	3	-	2
CO 3	-	3	3	2	-	-	2	-	1	-	3	-
CO 4	-	2	-	3	3	-	-	1	-	-	3	-
CO 5	-	-	-	-	3	-	-	3	-	-	-	-
CO 6	-	-	-	-	-	3	-	-	3	3	-	3

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Introduction to Research Methodology** Understanding the Research Process, Importance of Research in Engineering, Types of Research: Basic vs. Applied, Quantitative vs. Qualitative, Research Paradigms: Positivism, Interpretivism, Pragmatism, Formulating Research Questions and Objectives, Literature Review: Search Strategies, Critical Analysis, Research Ethics and Integrity, Research Design: Experimental, Descriptive, Exploratory, Case Study.	8
II	**Research Design and Sampling Techniques** Research Variables and Hypothesis Formulation, Experimental Design: Control Groups, Randomization, Replication, Survey Design: Questionnaire Construction, Scaling Techniques, Sampling Methods: Probability Sampling, Non-probability Sampling, Sample Size Determination and Power Analysis, Case Study Research Design, Qualitative Research Design: Interviews, Focus Groups, Observations, Mixed-Methods Research Design.	7
III	**Data Collection and Analysis** Surveys, Interviews, Observations, Experiments, Instrumentation and Measurement Tools, Data Quality and Validation, Data Analysis Methods: Descriptive Statistics, Inferential Statistics, Statistical Software Tools: SPSS, R, MATLAB, Qualitative Data Analysis: Coding, Theme Analysis, Narrative Analysis.	6
IV	**Research Proposal Development** Components of a Research Proposal: Title, Abstract, Introduction, Literature Review, Methodology, Timeline, Budget, Writing and Organizing a Research Proposal, Proposal Review Process and Feedback Incorporation, Presentation Skills for Research Proposals, Grant Writing Techniques and Funding Opportunities, Ethical Considerations in Research Proposal Development.	7
V	**Advanced Research Methods** Longitudinal and Cross-Sectional Studies, Meta-Analysis and Systematic Reviews, Action Research and Participatory Research, Simulation and Modeling Techniques, Big Data Analytics in Engineering Research, Emerging Trends in Research Methodology.	6
VI	**Research Proposal Development** Project Planning and Time Management, Collaboration and Teamwork in Research Projects, Data Management and Documentation, Intellectual Property Rights and Patents, Writing and Publishing Research Papers, Peer Review Process and Journal Selection.	6
	Text Books	
1.	Creswell, J. W., & Creswell, J. D., 2017, Research Design: Qualitative, Quantitative, and	

	Mixed Methods Approaches. SAGE Publications, 978-1506386763.
2.	Bryman, A., & Bell, E., 2015, Business Research Methods, Oxford University Press, 978-0199668649.
3.	Kumar, R., 2019, Research Methodology: A Step-by-Step Guide for Beginners, SAGE Publications, 78-9389093014.
Reference Books	
1.	Neuman, W. L., 2013, Social Research Methods: Qualitative and Quantitative Approaches. Pearson, 978-0205914191.
2.	Kothari, C. R. Garg, G., Research Methodology: Methods and Techniques, 5th Edition, New Age Int. Publisher, 978-9389802559.
Useful web links	
1.	https://www.researchgate.net/topic/Research-Methodology
2.	https://www.coursera.org/learn/research-methods
3.	https://www.socialresearchmethods.net/kb
4.	https://onlinecourses.nptel.ac.in/noc23_ge36/preview

Year, Program, semester	B. Tech. Civil Engineering (Honors/Honors with Research)							
Course Code	HN-2							
Course Category	Honors Course-II							
Course title	**Course-II Theory of Elasticity and Plasticity (Theory)**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**		
	3	-	-	3		3		
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	30	70		-	-	-	-	100
Pre-requisites(if any)	Solid Mechanics							
Course Rationale	The objective in Theory of Elasticity and Plasticity is to expose the students to advanced level of material properties and their behavior under unidirectional and multi directional loading.							
Course Objectives	To impart knowledge of various theories of elasticity and apply them to solve 2D Cartesian and polar problems. 1. To impart knowledge of various theories of torsion and apply them to solve 2D torsional problems. 2. To provide knowledge of various theories of plastic behaviour and apply them to solve 2D problems.							
Course Outcomes	Upon completion of this course, student should be able to – 1. **Apply** the knowledge of fundamental methods of elasticity for 2-D Cartesian and Polar problems. 2. **Analyze** torsional problems and apprise various theories to solve 2-D torsional problems. 3. **Discuss** concept of material yielding and plastic behaviour of structures.							

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	3										1
CO 2	2	3										1
CO 3	2	3										1
CO 4		3			2							3

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Introduction to Elasticity** Introduction to Elasticity: Body force, Surface force, Stress at a point, Stress & Strain, Transformation of stress, Equilibrium equations in two and three dimensions in Cartesian co-ordinates, Boundary conditions, Strain displacement relations, Compatibility equations, Generalized Hooke's Law, Stress invariants.	7
II	**Plane Stress and Strain** 2D problems in Cartesian co-ordinates, Equations of equilibrium and compatibility, Plane stress and Plane strain problems, Airy stress function approach, 2D problems in polar coordinates, Thick walled cylinder under radial pressure, Plate with stress	7

	concentration.	
III	**Torsion** Introduction to Torsion: St. Venant's theory, Warping function, Prandtl's membrane analogy, Torsion of circular, thin rectangular and open section. Strain energy in axial, bending and torsion. Principal of virtual work and minimum potential energy.	7
IV	**Plasticity** Introduction to plasticity: Plastic behavior of solids, Idealized plastic solids, Similarities and differences when compared with elasticity, Idealized material behavior, Coulomb friction model for elasticity and plasticity.	7
V	**Hydrostatic Stresses** Hydrostatic stresses, Deviatoric stresses, Invariants of deviatoric stresses, Yield criteria, Graphical representation of yield criteria, Flow rules, Stress-strain relation for perfectly plastic flow, Elastic-plastic analysis of beam in bending, Thick walled cylinder and circular shaft under torsion.	7
VI	**Plastic analysis of structures** Plastic analysis of structures – plastic hinge, Moment – curvature relation, Shape factor, Upper bound, lower bound and uniqueness theorems, Methods of analysis to find collapse loads for beams and frames.	6
Text Books		
1.	Ameen M., "Computational Elasticity", Alpha Science International, 1st Revised Edition, 2008.	
2.	Singh Sadhu, "Theory of Elasticity", Khanna Publishers, 4th Edition, 2012.	
3.	Singh Sadhu, "Theory of Plasticity", Khanna Publishers, 3rd Edition, 2013	
Reference Books		
1.	Timoshenko. S and Goodier. J. N., "Theory of Elasticity", McGraw-Hill book Company, 3rd Edition, 2010.	
2.	Chakrabarthy. J, "Theory of Plasticity", Tata McGraw-Hill P. Co. Ltd., 2nd Edtion, 2007.	
3.	Johnson W. and Mellor P. B., "Engineering Plasticity", Van Nostr and Reinhold, London, 1973	
4.	Timoshenko. S & Goodier. J. N., "Theory of Elasticity", McGraw-Hill book Company, 3rd Edition, 2010.	
Useful web links		
1.	https://nptel.ac.in/courses/105/105/105105177/	
2.	https://nptel.ac.in/courses/105/105/105105108/	
3.	https://nptel.ac.in/courses/105/102/105102090/	
4.	https://onlinecourses.nptel.ac.in/noc21_ce45/preview	

Year, Program, semester	B. Tech. Civil Engineering (Honors/Honors with Research)						
Course Code	HN-3						
Course Category	Honors Course-III						
Course title	**Course-III Air Pollution and Control (Theory)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	03	-	-	03		03	
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	30	70		-	-	-	-	100
Pre-requisites(if any)	Environmental studies, environmental engineering						
Course Rationale	This course provide an understanding of sources of air pollution, their impact on environment and how to control different types of air pollutants along with design of air pollution control devices.						
Course Objectives	1. To provide knowledge on physics of atmosphere, meteorology and its relation to air pollution, 2. To provide knowledge on different types of air pollution control equipment.						
Course Outcomes	Upon completion of this course, student should be able to – 1. Recognize and summarize scientific and engineering principles for air Pollution studies. 2. Apply appropriate dispersion models estimate air pollutant concentrations 3. Design air pollution control strategies with due consideration to technical, environmental, health, safety and social considerations						

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3											
CO 2	3		2	2			1					
CO 3			1	2			2					

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Air pollution** Air pollution: sources and types and effects on biosphere, National and international air emission standards; air pollution emission inventory; emission factor; air quality index; Strategy for effective control of air pollution in India, Introduction to air pollution control act, and international agreements for mitigating global air pollution effects.	7
II	**Meteorology** Physics of atmosphere, Solar radiation, Wind circulation, Lapse rate, Inversion, Stability conditions, Maximum mixing depth, Wind rose, Plume behaviour, Global effects of air pollution: Greenhouse effects, acid rain and ozone layer depletion, Heat island effect, Visibility, Photochemical reaction	6

III	**Dispersion of pollutants in the atmosphere** Point source, Line source, Maximum ground level concentration, the Gaussian dispersion model, Determination of stack height, Definition, Distribution and source of different particulate matter, Terminal settling velocity, Basics of hood and duct design for particulate collection	7
IV	**Particulate Matter** Operation design and component detailing of Settling chamber, Cyclone, Wet collectors, Fabric filter, and Electrostatic precipitator	7
V	**Gaseous pollutants** Principles of absorption, Adsorption, Basic design of absorption and adsorption units, Incineration and after burner, Control of SO2, NOx.	7
VI	**Motor Vehicle Emissions** Automobile Source Emission of pollutants from automobiles, Photochemical smog, Reduction of emissions by different methods, Alternative fuels and their utilizations	6
Text Books		
1.	Wark and Warner, “Air Pollution”, C.F., H.R. Publication, 1st Edition, 1978.	
2.	Nevers N., "Air Pollution Control Engineering" McGraw-Hill, New York, 2nd edition, 1995.	
3.	Martin Crawford, “Air Pollution and Control”, Tata McGraw Hill Publication, 1 st Edition, 1976.	
4.	Rao H.V.N. and Rao M. N., "Air Pollution", Tata McGraw Hill, 1st Edition, 1989.	
Reference Books		
1.	Richard W. Boubel and Bruce Turner, "Fundamentals of Air Pollution", Academic Press, New	
2.	Stern A. C., “Air Pollution Vol. I and II”, Allied Publishers Limited, 1 st Edition, 1994.	
Useful web links		
1.	https://archive.nptel.ac.in/courses/105/107/105107213/	
2.	https://onlinecourses.nptel.ac.in/noc23_ce14/preview	

Year, Program, semester	B. Tech. Civil Engineering (Honors/Honors with Research)						
Course Code	HN-4						
Course Category	Honors Course-IV						
Course title	**Course-IV Construction Project Management (Theory)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	03	-	-	03		03	
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	30	70		-	-	--	-	100
Pre-requisites(if any)	Building Construction, Concrete Technology.						
Course Rationale	The course basically focuses on Construction Management to understand importance and implementation of management in construction industry with specific focus artificial intelligence technique ANN, Fuzzy Logic.						
Course Objectives	1. To familiarize students with basic concepts in engineering management. 2. To study the various aspects of financial management and economic comparison in construction industry. 3. To understand the various on-site aspects like Safety Engineering and details of safety programs..						
Course Outcomes	Upon completion of this course, student should be able to – 1. Understand and concepts in Engineering management. 2. Understand the financial concepts and economic comparison relating to construction industry. 3. Understand the importance of safety Engineering and details of safety programs on site.						

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	2	2	2	2						1
CO 2	2	3	1						1			1
CO 3	2	3		1								1
CO 4	2	3			2					1		1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**A)Basics of Management:** Modern scientific management(Contribution by Fayol , F.W. Taylor , Mayo), Management Functions, Management Styles, SWOT Analysis in construction **B)Project Management:** Basic forms of organization with emphasis on Project and matrix structures; project life cycle, planning for achieving time, cost, quality, project feasibility reports based on socio-techno-economic environmental impact analysis, project clearance procedures and necessary documentation for major works like dams, multi-storeyed structures, ports, tunnels, Qualities, role and responsibilities of project manager, Role of Project Management Consultants, Enterprise Resource Planning (ERP).	7

II	**Project Scheduling:** Construction Scheduling, Work break down structure, activity cost and time estimation in CPM, PERT, RPM (Repetitive Project Modeling) techniques. LOB technique, Mass haul diagrams. Precedence Network Analysis, software in Construction scheduling (MSP, primavera, Construction manager).	5
III	**a) Project Controlling :** Monitoring and Control, Crashing, Resource Leveling, Updating. **b) Construction site management:** Site mobilization – demobilization aspects, various Resources management based on funds availability, 10 coordinating, communicating & reporting Techniques, Application of MIS to construction, Training for Construction Managers, Engineers , Supervisors	7
IV	**Work Study:** a) Definition, Objectives, basic procedure, method study and work measurement, Work study applications in Civil Engineering. b) Method study – Definition, Objective, Procedure for selecting the work, recording facts, symbols, flow process charts, multiple activity charts, string diagrams. c) Work measurement – Time and motion studies, Concept of standard time and various allowances, time study, equipment performance rating. Activity sampling, time-lapse , photography technique, Analytical production studies	8
V	**Safety Engineering:** a) Causes of Accidents on various sites, safety measures and safety policies to be adopted, determination of safety parameters, personal protective equipment. Workmen Compensation Act, Minimum wages act b) Type Of Industrial Hazards-Nature, Causes And Control Measures, Hazard Identifications And Control Techniques - HAZOP, FMEA, FMECA. -Cost of Construction Injuries-Legal Implications c) Safety Organization –Safety Policy, Safety Record Keeping, Safety Culture, Safety and First Line Supervisors, Middle Managers, Top Management Practices, Sub contractual obligation, Project Coordination and Safety Procedure.	6
VI	**Administration of Incentive Schemes** a) Necessity, Merit rating, job evaluation, installation, modification and maintaining of incentive schemes based on implementation experience. b) Introduction to artificial intelligence technique ANN, Fuzzy Logic, Genetic Algorithms Introduction to BIM.	6
Text Books		
1.	P S Gahlot & B M Dhir, Construction Planning & management By New Age International Limited Publishers	
2.	Kumar Neeraj Jha, Pearson,2012 Construction Project Management Theory & practice	
3.	Chitkara, “Construction Project Management”, Tata MC Graw Hill	
4.	S. Seetharaman, “Construction Management”, Umesh Publications S.B. Nath Market, N. Delhi.	
Reference Books		
1.	Barrie Paulsion, “Professional Construction Management”, McGrew Hill Institution Edition. Graw Hill.	
2.	Pilcher R., “Principles of Construction Management	
3.	Senagupta, “Construction Management and Planning”, Tata McGraw Hill Publication	
Useful web links		
1.	https://www.youtube.com/watch?v=W2EdffbwgcM&list=PLyqSpQzTE6M88imldbh5qcexw-qXNikWR	

2.	https://youtu.be/Y31de75MstI
3.	https://www.youtube.com/watch?v=gnkjcRDQkw0&list=PLLy_2iUCG87CBuNhvti0h6W54ZmqrSDMJ
4.	https://www.youtube.com/watch?v=jFDWlKayrTc&list=PLbRMhDVUMngdXebaRB59KdKwstzuAovua

Year, Program, semester	B. Tech. Civil Engineering (Honors/Honors with Research)							
Course Code	HN – 5							
Course Category	Honors Course -V							
Course title	**Course -V Retrofitting and Rehabilitation of Civil Infrastructure (Theory)**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**		
	3	-	-	3		3		
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	30	70		-	-	-	-	100
Pre-requisites (if any)	Concrete Technology							
Course Rationale	All civil engineering design and consultancy firms, construction companies, material manufacturers related to concrete technology will recognize this course for its practical applications							
Course Objectives	The major objective of this course is to give an in-depth understanding of the various methods of repair, retrofitting and rehabilitation techniques for masonry and concrete structures. The causes and types of deterioration, the evaluation of the existing condition of infrastructure, the materials for repair and retrofitting, the maintenance and strengthening techniques is covered in detail in this course. Seismic retrofitting and design of retrofitted structural components using recent techniques and materials have been included in the course. The course covers the challenging issues for efficient retrofitting and rehabilitation in order to extend the durability of existing structure in a sustainable manner.							
Course Outcomes	Upon completion of this course, student should be able to – 1. Analyze the damages 2. Apply advanced methods for strengthening and retrofitting of structures. 3. Predict the performance of the structure after strengthening.							

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	2	3										1
CO 2	2	3										1
CO 3	2	3										1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Introductions to composites** Material required for strengthening like- a) Fiber Reinforced Concrete - Introduction, Properties of constituent materials, Mix proportion, mixing, casting methods, properties of freshly mixed concrete (fiber reinforced concrete), workability tests, mechanical properties, behavior of fiber reinforced concrete under compression, tension flexure, research findings, and application of fibre reinforced concrete. Resins and FRP, micromechanics of composites, manufacturing of FRP composites	7

	b) Use of silica fume and fly ash. Concrete adhesives properties and application.	
II	**General strengthening and retrofitting techniques** Causes of deterioration, material related distresses, load associated distresses, Overview of Retrofitting and Rehabilitation of Civil Infrastructure. Condition evaluation and testing. General repair and strengthening of concrete structures. Global and local strengthening methods. NDT tests.	7
III	**Rehabilitation and repair of road pavements** Concrete overlays, types of overlays, benefits of overlaying, processes of overlaying	7
IV	**Retrofitting of Masonry Structures** Basic approaches in retrofitting masonry structures, material used, methods for stone and brick masonry. Techniques of strengthening ancient temples, forts and historical monuments.	7
V	**Seismic strengthening and retrofitting of buildings and bridges** Damage analysis, preliminary and detailed investigation of damage, Strengthening methods. Strengthening of foundations.	7
VI	**Retrofitting of Steel Structures** Strengthening of connections, strengthening of elements for various structural actions, Use of bracing systems.	6
Text Books		
1.	S 13935: Seismic Evaluation, Repair and Strengthening of Masonry Buildings - Guidelines	
2.	Neville A. M. and Brooks J. J.," Concrete Technology", Prentice Hall	
3.	Thomas Dyer, "Concrete Durability", CRC Press, Taylor and Francis Group	
4.	Handbook on Non destructive Testing of Concrete; Edited by Malhotra, V. M. and Carino, N. J., CRC Press	
5.	L. C. Bank, "Composites for Construction", John Wiley and Sons, Inc.	
6.	ACI 440.2R-08. Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures, American Concrete Institute	
Reference Books		
1.	R. N. Swamy, "Concrete Technology & Design", Surrey University Press., illustrated, 1984.	
2.	P.N. Balaguru, S.P. Shah, "Fiber Reinforced Cement Composites, McGraw Hill., illustrated, 1992.	
3.	D. J. Hannant, "Fiber Cement and Fiber Concrete", John Wiley & Sons.illustrated,1978	
4.	Structural Analysis: M. M. Das, B. M. Das—PHI Learning Pvt Ltd. Delhi.	
Useful web links		
1.	https://archive.nptel.ac.in/courses/105/105/105105213/	
2.	https://onlinecourses.nptel.ac.in/noc22_ce20/preview	
3.	NPTEL :: Civil Engineering - Concrete Engineering and Technology	
4.	NPTEL :: Civil Engineering - NOC:Advanced Concrete Technology	
5.	NPTEL :: Metallurgy and Material Science - NOC:Theory and Practice of Non Destructive Testing	
6.	Module 12 (nptel.ac.in)	

Year, Program, Semester	B. Tech Civil Engineering (Honors/Honors with Research)						
Course Code	HNR-AEC1						
Course Category	Ability Enhancement Course						
Course title	**Advanced Laboratory Practice**						
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits		
	-	-	04	04	02		
Evaluation Scheme	ISE	ESE	IOE	IPE	EOE	EPE	Total
	-	-	-	50	50	-	100
Pre-requisites(if any)							
Course Rationale	This course is designed to provide students with advanced laboratory skills and techniques relevant to Civil engineering. The focus will be on hands-on experiments, data analysis, and the application of theoretical concepts to practical situations.						
Course Objectives	The course is aimed at 1. Explain theoretical knowledge to design and conduct advanced experiments in Civil engineering. 2. Enhance skills in data acquisition, analysis, and interpretation. 3. Develop proficiency in utilizing advanced laboratory equipment and techniques. 4. Promote teamwork, communication, and presentation skills through collaborative laboratory projects. 5. Understand safety protocols and ethical considerations in a laboratory setting.						
Course Outcomes	Upon completion of this course, student should be able to 1. Design and execute experiments independently, demonstrating a comprehensive understanding of the underlying principles. 2. Analyze and interpret experimental data using statistical methods and present results effectively. 3. Demonstrate proficiency in using advanced laboratory equipment and techniques, including spectroscopy, chromatography. 4. Work collaboratively in a team setting, fostering effective communication and problem-solving skills. 5. Tackle on to safety protocols and ethical standards in a laboratory environment.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	2	1	-	-	-	3	-	-	2
CO 2	1	3	2	2	-	-	-	-	2	3	-	2
CO 3	3	1	3	2	-	-	-	-	3	-	-	2
CO 4	-	2	-	3	-	-	-	3	3	2	3	2
CO 5	-	-	-	-	3	-	3	3	3	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

General Instructions: Any 6 experiments to be performed from the list, any 2 experiments to be studied as demonstration.

Sr. No.	Details of Experiment
1.	To Measure ambient air temperature
2.	To Measure relative humidity of ambient air

3.	To Measure dew point temperature of ambient air
4.	To study the functioning of Fine Dust Sampler-FDS
5.	To determine the concentration of RSPM (PM10 and PM2.5) in ambient air
6.	To determine the concentration of oxides of Sulfur in and oxides of Nitrogen in ambient air
7.	To study the sampling procedure of Stack Gas Monitoring KIT
8.	Development of Simulation/analysis/Design Modules for air quality modelling, emission inventory by using spreadsheet/C programming/MATLAB/VB
9.	Introduction to artificial intelligence technique ANN, Fuzzy Logic , Genetic Algorithms Introduction to BIM for Construction Management
10.	MS Project Primavera Project Planner, Construction manager, Hit Office, ERP, etc. for Construction Management
11.	Preparation of Research paper, Research proposal, Research Report, IPR, etc.
12.	Case study on Retrofitting and rehabilitation of structures
13.	Development of Simulation/analysis/Design Modules for Retrofitting and rehabilitation of structures
14.	Elastic analysis of structures
15.	Plastic analysis of continuous beam and portal frame
Text Books	
1.	Chemistry for Environmental Engineering and Science by Sawyer, McCarty and Parkin
2.	Wayne T. D., Air Pollution Engineering Manual, John Wiley & Sons, 2000.
Reference Books	
1.	Guidelines for Ambient Air Qulaity Monitoring-Central Pollution Control Board, (2003).
2.	Air Pollution Sampling and Analysis (Laboratory Manual)- Dr. Sharad Ghokale, IIT Guwahati
3.	Laboratory Manual for Air Quality Sampling and Analysis, IIT Delhi
4.	Timoshenko. S and Goodier. J. N., “Theory of Elasticity”, McGraw-Hill book Company, 3rd Edition, 2010.
5.	Chakrabarthy. J, “Theory of Plasticity”, Tata McGraw-Hill P. Co. Ltd., 2nd Edtion, 2007.
Useful Web links	
1.	https://onlinecourses.nptel.ac.in/noc23_ce14/preview

Shivaji University, Kolhapur
Department of Technology

MDM Featured B.Tech. (Civil Engineering) Honors with Research

Teaching and Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	SWAYAM (NPTEL) or any other MOOCs Or Self-study mode with University's End Semester Examination (Program Core Courses)	HNR- 1	Research Methodology	03	-	-	03	03	30:70	00:00
2.		HNR- 2	Theory of Elasticity and Plasticity	03	-	-	03	03	30:70	00:00
3.		HNR - 3	Air Pollution and Control	03	-	-	03	03	30:70	00:00
4.		HNR - 4	Construction Project Management	03	-	-	03	03	30:70	00:00
5.		HNR - 5	Retrofitting and Rehabilitation of Civil Infrastructure	03	-	-	03	03	30:70	00:00
6.	Ability Enhancement Course	HNR-AEC1	HNR - Advanced Laboratory-Practice		-	04	04	02	-	50:50
7.	Project Based Learning	HNR –PBL	*Additional Research Project	-	-	06	06	03	-	50:50
				-	-	-	-	**20**	**500**	**200**
			Total Hours	**15**	**-**	**10**	**25**	**-**	**-**	**-**

Note: For Honors with Research, the courses and the credits as that for Honors will be the same. In addition, there will be 3 credits against an additional research project completion with success in publishing at least one research paper in a peer reviewed journal.

Year, Program, Semester	B. Tech Civil Engineering (Honors with Research)							
Course Code	HNR-PBL							
Course Category	Core							
Course title	**Additional Research Project**							
Teaching Scheme and Credits	L	T	P	Total Contact Hours		Total Credits		
	-	-	06	06		03		
Evaluation Scheme	ISE	ESE	IOE	IPE	EOE	EPE	Total	
	-	-	-	50	50	-	100	
Pre-requisites(if any)	All the courses underlying MDM Featured B.Tech (Civil Engineering) Major.							
Course Rationale	The Additional Research Projects course allows B.Tech Civil Engineering Major students to pursue advanced research, enhancing their skills and contributing to the field. This course aims to foster critical thinking, problem-solving skills, and research acumen among students while allowing them to explore topics of personal interest and relevance to the discipline. Completion of this course and the attainment of the B.Tech Honors with research Degree make students eligible for Ph.D. studies, facilitating their academic and research progression in Civil engineering or related fields.							
Course Objectives	The Course Teacher will 1. To facilitate exploration of focused research areas in civil engineering.							
Course Outcomes	Upon completion of this course, student should be able to 1. Formulate research questions and design methodologies. 2. Analyze and interpret data effectively. 3. Synthesize literature to contextualize research. 4. Present findings effectively through oral and written communication. 5. Demonstrate critical thinking and problem-solving in research.							

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	-	-	-	3	-	-	-	-	2	-	-	2
CO 2	3	-	-	3	2	-	-	-	-	-	-	-
CO 3	3	-	-	-	-	2	-	-	-	-	-	2
CO 4	-	-	-	-	-	-	-	-	-	3	2	-
CO 5	-	3	2	-	-	-	-	2	2	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content
I	**Topic Selection and Proposal Development:** • Identifying research gaps and formulating research questions. • Writing a research proposal outlining objectives, methodology, and expected outcomes. • Conducting rigorous ‘ research topic relevant literature survey’
II	**Research Methodologies:** • Introduction to research design and planning. • Data collection techniques and tools. • Statistical analysis methods.

III	**Conducting Research:** • Implementing the proposed methodology. • Data collection, analysis, and interpretation. • Troubleshooting research challenges.
IV	**Presentation and Communication:** • Preparing and delivering oral presentations. • Writing research reports following standard scientific formats. • Communicating research findings effectively to diverse audiences.

Course Assessment Method
Assessment in this course will be based on the following criteria: 1. Research Proposal (20%): Evaluation of the clarity, feasibility, and originality of the research proposal. 2. Research Progress (30%): Assessment of the student's progress in conducting the research project, including data collection, analysis, and interpretation. 3. Final Research Report (30%): Evaluation of the quality of the written research report, including organization, clarity, depth of analysis, and adherence to scientific standards. 4. Oral Presentation (20%): Assessment of the student's ability to effectively communicate research findings through a formal presentation. Additionally, continuous engagement, participation in research discussions, and adherence to deadlines will be considered in the overall assessment of the course.

Shivaji University

Vidya Nagar, Kolhapur, Maharashtra 416004

Department of Technology

As per NEP2020 guidelines

Pool of Specialization Minors for

MDM Featured B. Tech (Civil Engineering), Detailed Curriculum, w.e.f. 2024-25

2024-25 onwards

Specialization Minor
In
Environmental Engineering
For
B.Tech. (Civil Engineering)

Shivaji University, Kolhapur
Department of Technology

B.Tech. (Civil Engineering), Minor Degree (Specialization)

Teaching and Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation Scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1	Preferably on SWAYAM (NPTEL) or any other MOOCs (Minor Program Core) Or In a Face-to-Face mode	SPM 1.1	Green Building	03	-	-	03	03	30:70	00:00
2		SPM 1.2	Water and Waste Water Engineering	03	-	-	03	03	30:70	00:00
3		SPM 1.3	Solid and Liquid Waste Management	03	-	-	03	03	30:70	00:00
4.	Minor Program Based Internship	SPM 1.4	Environmental Industry Internship*	One Month Internship				03	-	50:50
5.	Project Based Learning	SPM 1.5	Mini Project*	-	-	-	-	02	-	50:50
				-	-	-	-	**14**	**300**	**200**
			Total Hours	**09**	**00**	**00**	**09**	-	-	-

Note: The workload against the B.Tech. Minors will be finalized at the Program Level considering the strength of students opting for the Minor.

1. For MDM, there will be three choices while there will be four choices for Specialization Minors. The credits 176 required for the B.Tech. (Major) include 14 credits against the compulsory MDM, while specialization minor (SPM) will be purely an option.
2. *MDM based internship to be completed during vacations between 4th Semester to 7th Semester. MDM based Mini Project to be completed during 4th Semester to 8th Semester.

Year, Program, semester	Specialization Minor II, 4th Semester onwards							
Course Code	SPM 1.1							
Course Category	Pool of Courses against Minors							
Course title	**Green Building (Theory)**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**		
	3	-	-	3		3		
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	30	70		-	-	-	-	100
Pre-requisites(if any)	NA							
Course Rationale	To expose the students to the concepts of sustainability in the context of building and conventional engineered building.							
Course Objectives	1. Understand the Definition, Concept & Objectives of the terms cost effective construction and green building. 2. Apply cost effective techniques in construction. 3. Understand the Problems due to Global Warming. 4. State the Concept of Green Building.							
Course Outcomes	On completion of the course, the student is expected to 1. Explain the importance and necessity of green building. 2. Choose materials and technologies to improve energy efficiency of building 3. Interpret the various rating systems for green building. 4. Identify the recent techniques of water conservation and effective use water							

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	3						1					1
CO 2	3		3		2		3					1
CO 3	3		3		2		3					1
CO 4	3		3		2		3					1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Introduction** Concept of green building, History of green building, Need of green building in present scenario, Importance of green building, merits and demerits. **Sustainable Site Selection** Orientation, Building envelop, Building plan layout, Design of Doors and windows, Direct and indirect lighting, comparison of various lighting devices- electric tubes, incandescent lamps, CFL and LED lamps, Indirect lighting devices -Light Tubes, Fibre optic, Fresnel lens.	7
II	**Passive and Active Architecture** Natural ventilation and air conditioning, Hybrid system of active and passive refrigeration and air conditioning. Energy audit of building, **Utility of Solar energy in buildings** Concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.	7
III	**Building materials** Concept of Embodied Energy, Embodied energy of various common building	8

	materials, Thermal properties of building components, Thermal storage, emissivity, reflectivity. Selection of materials and surface treatment for improvement in thermal comfort with minimum energy input. Green building materials and products- Bamboo, Rice husk ash concrete, plastic bricks, Bagasse particle board etc Use of materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, foundry sand, other inert solid wastes in buildings, Reuse of waste and salvaged materials.	
IV	**Green Building Rating Systems-** BREEAM – LEED - GREEN STAR -GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings – Purpose - Key highlights - Point System with Differential weight age. Green Design – Definition - Principles of sustainable development in Building Design - Characteristics of Sustainable Buildings – Sustainably managed Materials - Integrated Lifecycle design of Materials and Structures (Concepts only)	7
V	**Indoor Environmental Quality** Low- VOC Emitting Materials - Adhesives & Sealants, Paints & Coatings, Carpet Systems, Composite Wood & Agro-fibre Products like coconut, jute, bamboo and their use as interiors	5
VI	**Green Composites for Buildings** Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.	5
Text Books		
1.	HarharaIyer G, Green Building Fundamentals, Notion Press	
2.	Dr. Adv. Harshul Savla, Green Building: Principles & Practices	
3.	Energy Efficient Buildings in India by Milli Mujumdar	
Reference Books		
1.	Green Building – Guidebook for Sustainable Architecture	
2.	"Green Building A to Z: Understanding the Language of Green Building" by Yudelson and Jerry	
3.	Manual of solar passive architecture - by Nayak J.K. R. Hazra J. Prajapati	
4.	Solar Energy in Architecture and Urban Planning by Herzog Thomas	
Useful web links		
1.	https://archive.nptel.ac.in/courses/105/102/105102195/	
2.	https://onlinecourses.swayam2.ac.in/arp19_ap75/preview	
3.	https://www.youtube.com/watch?v=DRO_rIkywxQ	
4.	https://www.youtube.com/watch?v=THgQF8zHBW8	

Year, Program, semester	Specialization Minor II, 4th Semester onwards						
Course Code	SPM 1.2						
Course Category	Pool of Courses against Minors						
Course title	**Water and Waste Water Engineering (Theory)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**		
	3	-	-	3	3		
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	30	70		-	-	-	-	100
Pre-requisites(if any)	NA						
Course Rationale	The aim of this course is to introduce the students to the area of water and wastewater treatment. The course will cover water chemistry; characteristics of water & wastewater; primary, secondary & tertiary treatment processes; sludge disposal; and design of water and wastewater treatment plants.						
Course Objectives	To introduce students to various components and design of water supply scheme, water treatment methods, water storage distribution system, sewage treatment and disposal and design of intake structures and sewerage system.						
Course Outcomes	On completion of the course, the student is expected to 1. Understand the various components of water supply scheme and design of intake structure and conveyance system for water transmission. 2. Understand on the characteristics and composition of sewage, ability to estimate sewage generation and design sewer system including sewage pumping stations. 3. Understand the process of conventional treatment and design of water and wastewater treatment system and gain knowledge of selection of treatment process and biological treatment process 4. Ability to design and evaluate water distribution system and water supply in buildings and understand the self-purification of streams and sludge and septage disposal methods. 5. Able to understand and design the various advanced treatment system and knowledge about the recent advances in water and wastewater treatment process and reuse of sewage						

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO 1	2	1	2									1
CO 2	2	1	2	2			1					1
CO 3	2	1	2	2			1					1
CO 4	2	1	2									1
CO 5	2	1	2	2			1					1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Water Supply** Estimation of surface and subsurface water resources - Predicting demand for water- Impurities of water and their significance - Physical, chemical and bacteriological analysis - Waterborne diseases - Standards for potable water. Intake of water: Pumping and gravity schemes	6

II	**Water Treatment** Objectives - Unit operations and processes - Principles, functions, and design of water treatment plant units, aerators, flash mixers, Coagulation and flocculation - Clarifloccuator - Plate and tube settlers - sand filters - Disinfection - softening, removal of iron and manganese- Defluoridation – Softening, Construction, Operation and Maintenance aspects	7
III	**Water Storage and Distribution** Storage and balancing reservoirs types, location and capacity. Distribution system: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, maintenance of distribution systems, pumping stations and their operations - House service connections.	6
IV	**Introduction to Water Audit and Leak Detection** Water Audit, Energy Audit, Leak Detection and Prevention, different software's used for Hydraulic Modeling.	6
V	**Planning and Design of Sewerage System** Characteristics and composition of sewage - Population equivalent - Sanitary sewage flow estimation - Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design - Storm drainage-Storm runoff estimation - Sewer appurtenances - Corrosion in sewers - Prevention and control - Sewage pumping-drainage in buildings - Plumbing systems for drainage	7
VI	**Sewage Treatment and Disposal** Objectives - Selection of Treatment Methods - Principles, Functions, - Activated Sludge Process and Extended aeration systems - Trickling filters - Sequencing Batch Reactor(SBR) - UASB - Waste Stabilization Ponds - Other treatment methods - Reclamation and Reuse of sewage Recent Advances in Sewage Treatment - Construction, Operation and Maintenance aspects. - Discharge standards-sludge treatment -Disposal of sludge	7

Text Books

1.	Garg, S.K. Environmental Engineering, Vol. I Khanna Publishers, New Delhi, 2010.
2.	P.N., Water Supply Engineering, Vol. I Standard Book House, New Delhi, 2016.
3.	Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2015. 4.
4.	Duggal K.N., "Elements of Environmental Engineering" S. Chand and Co. Ltd., New Delhi, 2014.
5.	Punmia, B.C., Jain, A.K., and Jain. A.K.., Environmental Engineering, Vol. II, Laxmi Publications, 2010

Reference Books

1.	Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2.	Manual On Sewerage And Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2012.
3.	Metcalf and Eddy - Waste water Engineering - Treatment and Reuse, Tata Mc. Graw-Hill Company, New Delhi, 2010.
4.	Punmia B.C, Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi 2010.
5.	Syed R. Qasim and Edward M. Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.
6.	Syed R.Qasim "Waste water Treatment Plants", CRC Press, WashingtonD.C.,2010
7.	Gray N.F, "Water Technology", Elsevier India Pvt. Ltd. New Delhi, 2006.

Useful web links	
1.	https://archive.nptel.ac.in/courses/105/105/105105201/
2.	https://archive.nptel.ac.in/courses/105/105/105105178/
3.	https://nptel.ac.in/courses/105107207
4.	https://kanchiuniv.ac.in/coursematerials/EE-II-%20Unit%20I%20-%20Planning%20of%20Sewerage%20System-Lecture%20notes.pdf

Year, Program, semester	Specialization Minor II, 4th Semester onwards						
Course Code	SPM 1.3						
Course Category	Pool of Courses against Minors						
Course title	**Solid and Liquid Waste Management (Theory)**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**		
	3	-	-	3	3		
Evaluation Scheme	**ISE**	**ESE**	**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	30	70	-	-	-	-	100
Pre-requisites(if any)	NA						
Course Rationale	The course gives the student an overview of municipal solid waste management including collection, transfer, transport, and disposal and Liquid Waste Management						
Course Objectives	The objective of the present course is to make the students Understanding of problems of municipal waste, biomedical waste, hazardous waste, ewaste, industrial waste etc. Knowledge of legal, institutional and financial aspects of management of solid and liquid wastes. Become aware of Environment and health impacts solid and liquid waste mismanagement Understand engineering, financial and technical options for solid and liquid waste management.						
Course Outcomes	Upon completion of this course, student should be able to – 1. Describe the major sources and types of Solid Waste 2. Demonstrate common Solid Waste disposal methods. 3. Describe public health importance of liquid waste. 4. Demonstrate common liquid waste disposal methods.						

Course Outcome and Program Outcome Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	2										1
CO 2	2	2	3	2		1	2					1
CO 3	2	2										1
CO 4	2	2	3	2		1	2					1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Solid waste management** Objectives, Functional elements, Environmental impact of mismanagement. Solid waste: Sources, Types, Composition, Quantities, Physical, Chemical and Biological properties.	6
II	Solid waste generation rate: Definition, Typical values for Indian cities, Factors affecting. Storage and collection: General considerations for waste storage at source, Types of collection systems. Transfer station: Meaning, Necessity, Location, Economic analysis. Transportation of solid waste: Means and methods, Routing of vehicles.	7
III	Sorting and material recovery, Composting of solid waste, Pyrolysis, Incineration, Advantages and disadvantages of various technological options. Landfills: Definition,	7

	Essential components, Site selection, Land filling methods, Leachate and landfill gas management.	
IV	**Liquid Waste Management** Introduction, Public health importance of waste water/sewage , Classification of liquid waste/sewage , Waste water/sewage composition , Points to be conceder before selecting one particular sewage disposal techniques , Liquid waste disposal methods at the rural communities/household level, Sewage/wastewater treatment	7
V	**Contaminated Waste Management** Introduction, Purpose of contaminated waste management, Collection and disposal of contaminated waste, How to dispose solid contaminated wastes, How to dispose liquid contaminated wastes, How to dispose contaminated sharps, Biomedical Waste, Hazardous waste management.	7
VI	**Indian scenario** Present scenario and measures to improve system for different functional elements of solid and liquid waste management system. Elements of financial management plan for solid and liquid waste system.	5
Text Books		
1.	Integrated Solid Waste Management – George Tchobanoglous.	
2.	Solid Waste Management – A. D. Bhide.	
3.	Solid Waste Management handbook– Pavoni	
4.	Solid and Liquid Waste Management: Waste to Wealth- Rajaram Vasudevan	
5.	Solid Waste Management- Sasikumar K	
Reference Books		
1.	Manual on municipal solid waste management – Government of India publication.	
2.	Training Module on Sustainable Sanitation (Solid and Liquid Waste Management)- WASH Institute	
3.	Solid and Liquid Waste Management- Esayas Alemayehu, Jimma University	
4.	Solid and Liquid Waste Management in Rural Areas- Technical Note -Unisef	
5.	Technological Options for Solid and Liquid Waste Management in Rural Areas- Ministry of Drinking Water and Sanitation Swachh Bharat Mission (Gramin) Government Of India.	
6.	Scaling up Solid and Liquid Waste Management in Rural Areas-Handbook	
Useful web links		
1.	https://archive.nptel.ac.in/courses/105/103/105103205/	
2.	https://archive.nptel.ac.in/courses/105/106/105106056/	
3.	https://onlinecourses.nptel.ac.in/noc23_ce89/preview	
4.	https://vikaspedia.in/energy/environment/waste-management/solid-and-liquid-waste-management-in-rural-areas	
5.	https://swachhbharatmission.gov.in/sbmcms/writereaddata/images/pdf/technical-notes-manuals/Scaling-up-SLWM-in-Rural-areas.pdf	

Year, Program, Semester	Specialization Minor II, 4th Semester onwards							
Course Code	SPM-1.4							
Course Category	Program Based Internship							
Course title	**Environmental Industry Internship**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**		
	One Month					03		
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	00	00		50	-	50	-	100
Pre-requisites(if any)	Basics of unit processes and unit operations.							
Course Rationale	The Industrial Internship course caters specifically to B.Tech Civil Engineering students pursuing additional specialization through the B.Tech. Minor program in areas such as Environmental Engineering. This course offers practical exposure to industry settings aligned with their chosen sub-specialization, aiming to bridge the gap between theoretical knowledge and practical application. By engaging in a one-month internship, students gain firsthand experience, essential skills, and insights crucial for their future careers in specialized sectors of Civil engineering.							
Course Objectives	The course teacher will 1. Help expose students to the 'real' working environment. 2. Promote hands-on experience to the students' in their related field. 3. Develop synergetic collaboration between industry and the university in promoting a knowledgeable society. 4. Assist in providing the opportunity for students to test their interest in a particular career before permanent commitments are made. 5. Elaborate the dynamic and challenging nature of industrial environments.							
Course Outcomes	Upon completion of this course, student should be able to 1. Understand industrial processes and operations related to their minor sub-specializations. 2. Apply theoretical concepts to solve practical problems in the industry. 3. Communicate effectively with industry professionals, colleagues, and supervisors. 4. Collaborate efficiently in team environments to complete tasks and projects. 5. Adapt to the dynamic and challenging nature of industrial environments. 6. Reflect on internship experiences for personal and professional growth.							

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	2	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	2	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	-	-	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content	Hours
The course consists of a one-month internship in a relevant specialized industry. Students will be placed in companies or organizations that align with their chosen sub-specialization within the field of Civil engineering. During the internship, students will engage in various activities, including but not limited to: 1. Shadowing industry professionals to observe and learn about different processes and operations. 2. Assisting with ongoing projects or research initiatives within the organization. 3. Participating in hands-on tasks related to their minor sub-specialization, under the guidance of experienced mentors. 4. Attending training sessions, workshops, and seminars conducted by the industry to enhance their knowledge and skills. 5. Engaging in discussions and meetings with supervisors and colleagues to gain insights into industry practices, challenges, and innovations. 6. Documenting their internship experience through reports, presentations, or reflective journals. The period of one month for this internship will be during the winter or summer vacations, any such slots 4th Semester onwards.	4 weeks

Course Evaluation Method

This particular evaluation will be the part of the structure of 7th Semester.
The evaluation for the Industrial Internship course will be conducted as follows:

- **Internal Evaluation (50 marks):**
  - Assessment by course teachers based on students' performance during the internship, including attendance, participation, attitude, and contribution to assigned tasks.
  - Evaluation by industrial supervisors on students' professional conduct, technical skills, problem-solving abilities, and overall performance in the workplace.
- **External Evaluation (50 marks):**

Evaluation by an external examiner appointed by the institute, who will assess students' internship reports, presentations, or any other documentation submitted at the end of the internship period.

The external examiner will review the quality of students' reflections on their internship experience, their ability to apply theoretical knowledge to practical situations, and the depth of their understanding of industry practices and challenges.

The final grades for the Industrial Internship course will be determined based on the combined assessment from both internal and external evaluations.

Reference Books

1.	Howard S. Peavy, George Tchobanoglous and Donald R. Rowe, “Environmental Engineering” , Tata McGraw-Hill Education
2.	Sincero and Sincero, “Environmental Engineering: A Design Approach”, Environmental Engineering: A Design Approach

Year, Program, Semester	Specialization Minor II, 4th Semester onwards							
Course Code	SPM 1.5							
Course Category	Project Based Learning							
Course Title	**Mini Project**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**		
	-	-	-	-		02		
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	00	00		50	-	50	-	100
Pre-requisites(if any)	Basics of unit processes and unit operations.							
Course Rationale	This course aims to provide students with practical exposure and hands-on experience in real-world industrial settings, fostering a deeper understanding of theoretical concepts through application. By engaging in this mini project, students will develop essential skills such as problem-solving, teamwork, and communication, preparing them for future challenges in the professional arena in green aspects of Industry.							
Course Objectives	The course teacher will 1. Facilitate application of theoretical knowledge. 2. Guide the students about enhancement of practical skills. 3. Explain about development of industry-relevant competencies.							
Course Outcomes	Upon completion of this course, student should be able to 1. Demonstrate application of theoretical concepts with instructor guidance. 2. Collaborate effectively in instructor-led team-based projects. 3. Communicate findings and insights professionally under instructor supervision.							

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	-	-	2	-	-	-	2	-	-	-
CO 2	-	-	3	-	-	-	-	-	3	-	2	1
CO 3	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

Specialization Minor Program Based Mini Project is a dynamic course designed to bridge the gap between classroom learning and real-world application. All the students will engage themselves in a series of tasks and challenge that will enable them to apply theoretical concepts learned in previous courses to solve practical problems. The project work need to be carried out independently covering a range of topics relevant to their field of study, allowing them to explore different facets of the particular discipline and develop versatile skill sets pertaining to application of Green Technology.

This activity may be planned after 4th Semester and can be completed prior to 8th Semester of their Major studies.

Course Assessment Process

This particular evaluation will be the part of 8th Semester of the major structure.

The course evaluation for the internals will be at the course teacher end while there will also be the external evaluation of the Project work.

The teachers will follow the instructions as below:

Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including:

- Rubric-based assessment for the project work and its report.
- Peer evaluation for project.

• Instructor-led discussions or presentations to evaluate communication skills and critical thinking.
• Overall course grading based on a weighted average of individual assessments and participation.

The evaluation format should be transparent, fair, and aligned with the course objectives and outcomes. Regular feedback and communication with students will ensure that the evaluation process remains supportive of their learning journey.