Shivaji University Kolhapur

Revised Syllabus as per
National Education Policy -2020

T. Y. B. Tech.
Civil Engineering

To be implemented from

Academic Year 2026-27

SHIVAJI UNIVERSITY, KOLHAPUR

NANE OF FACULTY: SCIENCE AND TECHNOLOGY **PROGRAMME**

NAME AND CODE: CIVIL ENGINEERING **PART:** THREE

Preamble

The Third Year B.Tech. Civil Engineering Curriculum of Shivaji University is designed to equip students with comprehensive theoretical knowledge, practical skills, and emerging technological competencies required to address the challenges of modern infrastructure development and sustainable construction practices. The curriculum emphasizes the integration of core Civil Engineering concepts with advanced technologies such as **Building Information Modelling (BIM), Artificial Intelligence (AI), Machine Learning (ML), Geographic Information Systems (GIS), Remote Sensing, Drone Surveying, Internet of Things (IoT), Digital Twins, and Smart Infrastructure Monitoring** to meet the evolving demands of Industry 4.0 and the construction sector.

The curriculum provides a balanced blend of structural engineering, geotechnical engineering, transportation engineering, environmental engineering, water resources engineering, construction management, surveying, and infrastructure planning. Courses such as **Design of Reinforced Concrete Structures, Steel Structures, Geotechnical Engineering, Highway Engineering, Environmental Engineering, Water Resources Engineering, Quantity Surveying and Estimation, Construction Planning and Management, and Advanced Surveying** strengthen students' analytical, design, and problem-solving abilities while developing a strong engineering foundation. Laboratory courses, fieldwork, design studios, and project work encourage experiential learning, practical exposure, innovation, teamwork, and industry-oriented skill development.

Special emphasis has been given to multidisciplinary learning and emerging domains through programme electives and minor courses including **Building Information Modelling (BIM), Computational Structural Analysis, Smart Cities, Green Buildings, Sustainable Construction, Advanced Concrete Technology, Earthquake Engineering, Disaster Management, Construction Automation, GIS and Remote Sensing Applications, and Infrastructure Asset Management**. These subjects prepare students to address real-world engineering challenges related to resilient infrastructure, environmental sustainability, urban development, intelligent transportation systems, resource optimization, and climate-resilient engineering solutions.

The inclusion of **Artificial Intelligence (AI), Machine Learning (ML), Digital Construction Technologies, and Data Analytics** across various subjects reflects the rapidly evolving needs of the Civil Engineering profession. Students are introduced to intelligent structural health monitoring, predictive maintenance of infrastructure, construction scheduling optimization, traffic modelling, flood forecasting, geospatial data analysis, and AI-enabled decision-support systems that improve engineering efficiency, safety, and sustainability.

The curriculum also focuses on **Outcome-Based Education (OBE)** by promoting critical thinking, innovation, communication skills, ethical values, environmental consciousness, and lifelong learning. Through laboratory experiments, surveying camps, industrial visits, internships, design assignments, seminars, and major projects, students gain exposure to professional engineering practices and develop competencies required for higher education, research, entrepreneurship, consultancy, and employment in both public and private sectors.

Overall, this curriculum aims to develop competent, innovative, environmentally responsible, and socially committed Civil Engineers capable of planning, designing, constructing, managing, and maintaining sustainable infrastructure while contributing effectively to technological advancement, national development, and global engineering practices.

Program Learning Outcomes (PLOs) / Program Outcomes (POs)

- **PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
- **PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
- **PO3: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
- **PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis and interpretation of data to provide valid conclusions. (WK8).
- **PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
- **PO6: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
- **PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national and international laws. (WK9)
- **PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
- **PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- **PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
- **PO11: Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Educational Objectives (PEOs)

1. **Professional Competence and Career Growth**
   Graduates will apply fundamental knowledge of Civil engineering to solve real-world engineering problems and establish successful careers through professional employment, higher education, research, or entrepreneurship in core and allied fields.

2. **Lifelong Learning and Technological Adaptability**
   Graduates will engage in continuous learning and adapt to emerging technologies such as automation, artificial intelligence, and advanced manufacturing to meet evolving industrial and societal needs.

3. **Ethics, Leadership, and Social Responsibility**
   Graduates will demonstrate ethical practices, environmental awareness, leadership qualities, teamwork, and effective communication skills while contributing to sustainable development in multidisciplinary environments.

Eligibility for Admission-

Eligibility for F.Y. B.Tech.

(First Year - Engineering or Technology (4 years duration))

(1) Maharashtra State Candidature Candidate.-

The candidate,-

(i) should be a citizen of India;

(ii) (ii) should have Passed 10+2 examination or its equivalent examination with Physics and Mathematics as compulsory subjects along with Chemistry or Biotechnology or Biology or Technical Vocational subject or Computer Science or Information Technology or Informatics Practices or Agriculture or Engineering Graphics or Business Studies or Electronics or Entrepreneurship and obtained at least forty five per cent marks (at least forty per cent marks, in case of Reserved categories, Economically Weaker Section and Persons with Disability candidates belonging to the Maharashtra State only) in the above subjects taken together and The Candidate should have appeared in all the subjects in PCM MHT-CET 2026 and obtained non zero score in PCM MHT-CET 2026 conducted by the Competent Authority; (There candidates are eligible to apply for all 29 major disciplines declared by AICTE)

Or

(iii) Should have passed 10+2 examination or its equivalent examination with Physics and Chemistry as compulsory subjects along with the Mathematics or Biotechnology or Biology or Technical Vocational subject or Computer Science or Information Technology or Informatics Practices or Agriculture or Engineering Graphics or Business Studies or Electronics or Entrepreneurship as one of the subject and obtained at least forty five per cent marks (at least forty per cent marks, in case of Reserved categories, Economically Weaker Section and Persons with Disability candidates belonging to the Maharashtra State only) in the above subjects taken together and the candidate should have appeared in all the subjects in MHT-CET 2025 and obtained non zero score in Physics, Chemistry and Biology (PCB) MHT-CET 2025 conducted by the Competent Authority is eligible for admission to any of the following Courses under major disciplines declared by concerned Appropriate Authority or All India Council for Technical Education (AICTE), namely:- (a)Agriculture Engineering; (b)Biotechnology; (c)Food Engineering; (d)Leather Technology; (e)Packaging Technology; (f) Pharmaceutical Engineering; (g)Printing Engineering; (h)Fashion Technology; or (i) Textile Chemistry;

Or

(iv) Should have passed minimum three years Diploma in Engineering and Technology and obtained at least forty five per cent marks (at least forty per cent marks, in case of Reserved categories, Economically Weaker Section and Persons with Disability candidates belonging to the Maharashtra State only) ;

Or

(v) Passed three years Diploma of Vocation (D. Voc.) stream in the same or allied sector;

Eligibility for Direct Second Year B.Tech.

(Direct Second Year (Lateral Entry)- Engineering /Technology (3 Years duration)

The candidate,-
should be a citizen of India;
should have passed minimum three years or two years (Lateral Entry) Diploma Course in Engineering and Technology with at least forty five per cent. marks (at least forty per cent. marks in case of Candidates of Reserved categories, Economically Weaker Section and Persons with Disability category belonging to Maharashtra State) in any branch of Engineering and Technology from an All India Council for Technical Education (AICTE) or Central Government or State Government approved Institution or its equivalent;

Or

should have passed B.Sc. Degree from a University Grants Commission (UGC) or Association of Indian Universities recognized University with at least forty five per cent. marks (at least forty per cent. marks in case of candidates of Reserved categories, Economically Weaker Section and Persons with Disability category belonging to Maharashtra State) and passed HSC or its equivalent examination with Mathematics as a subject;

Or

should have passed three years D. Voc. Stream in the same or allied sector;
and Any other eligibility criteria and requirement declared from time to time by the appropriate authority as defined under the Act.

STANDARD OF PASSING AND DETERMINATION OF SGPA/CGPA, GRADING AND DECLARATION OF RESULTS

Passing criteria:

1. Passing with 40% marks is mandatory in ESE theory. The duration of ESE theory examination will be 02:30 Hrs. For Engineering Graphics subject of F. Y. B. Tech, it will be of 03:00 Hrs. Combined passing marks (MSE+ISE/CA+ESE) for theory course are 40%.
2. MSE will be based on 50% syllabus from beginning (First Three Units).
3. No compulsory passing for MSE.
4. Compulsory passing percentage for ISE/CA of theory and practical is 40%.
5. Compulsory passing percentage for ESE practical / oral examination 40%.
6. Student should clear all first year passing heads before admits to third year and clear all second year passing heads before admits to fourth year.
7. Aggregate of a particular year (both the semesters) shall considered as a separate head of passing for the result of that concerned year and 45 % aggregate score is mandatory. The student not fulfilling this criterion can improve the score of 45% aggregate through appearing in re-examination for maximum of three theory courses.
8. If student fails to improve the score of 45% aggregate through appearing in re-examination then he/she can improve the score of 45% aggregate by re-appearing in subsequent concern odd semesters (3, 5, 7) or concern even semesters (4, 6, 8) ESE of theory course examination in next academic year.

The Semester Grade Point Average (SGPA) shall be calculated for each semester and Cumulative Grade Point Average (CGPA) shall be calculated at the end of all semesters.
The standard of passing shall be in accordance with the following table :

Marks Obtained	**Numerical Grade (Grade Point)**		**CGPA**	**Letter Grade**
Absent	0 (zero)		-	-
0 – 39	0 (zero)		0.0 – 4.99	F (Fail)
40 – 49	5		5.00 – 5.49	C
50 – 59	6		5.50 – 6.49	B
60 – 69	7		6.50 – 7.49	B+
70 – 79	8		7.50 – 8.49	A
80 – 89	9		8.50 – 9.49	A+
90 – 100	10		9.50 – 10.0	O (Outstanding)

Note :
The award of the final Grade for the degree of B. Tech. shall be calculated based on CGPA.

Calculation of SGPA and CGPA:

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

$$\mathbf{SGPA} = \frac{\sum(\text{Course credits} \times \text{Grade points obtained}) \text{ of a Semester}}{\sum(\text{Course credits}) \text{ of respective Semester}}$$

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

$$\mathbf{CGPA} = \frac{\sum(\text{Total credits of a Semester} \times \text{SGPA of respective Semester}) \text{ of all Semesters}}{\sum(\text{Total course credits}) \text{ of all Semesters}}$$

1. Marks obtained > = 0.5 shall be rounded off to next higher digit.
2. The SGPA & CGPA shall be rounded off to 2 decimal points.
3. CGPA will be calculated cumulatively from Sem. I to Sem. VIII for regular students and from Sem. III to Sem. VIII for lateral entry students.

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.

Awards of Grades for Re-Examination:

1. There will be Re-examination for all failure ESE theory/practical courses in a year after even semester immediately the result declaration of ESE and before the commencement of next academic year.
2. A student will apply for re-examination before the last date of such application and will appear for re-examination.
3. In such cases In Semester Examination performance of a student will not be wiped out.
4. The weightage similar to ESE will be given to re-examination.
5. A student who is eligible for re-examination but remains absent for re-examination will be given grade 'Absent'.
6. If the student fails in an odd semesters (1, 3, 5, 7) and/or even semesters (2, 4, 6, 8) in ESE of theory/practical credit course in an academic year shall be allowed to appear for re-examination.
7. There will be ESE examination of theory and practical courses of semester 1, 3, 5 and 7 at the end of odd semester, there will be ESE examination of theory and practical courses of semester 2, 4, 6 and 8 at the end of even semester and there will be re-examination for all ESE theory and practical courses from semester 1 to semester 8 after one month of declaration of result of even semester.

8. If the student fails to clear the ESE of theory/practical course even in re-examination conducted after even semesters (2, 4, 6, 8) in a year, he/she shall have to re-appear in subsequent concern odd semesters (3, 5, 7) or concern even semesters (4, 6, 8) ESE of theory/practical credit course examination in next academic year for the failed ESE of theory/practical credit course examination of concern odd semester or concern even semester that she/he has failed in previous academic year.
9. The candidate can apply for revaluation of photocopy of re-examination for ESE of theory/practical course conducted after even semesters (2, 4, 6, 8).
10. A student will be awarded a grade given in Table of **R. R. B. Tech. 9** depending upon the cumulative marks obtained by him/her in Re-examination.

Shivaji University, Kolhapur

T.Y.B.Tech. (NEP 2.0 Pattern)

Question Paper Patten

Question Number	Chapter	Marks	Total Marks	Details
Q.No.01	01,02,03	05	15	Solve any 03 out of 04
Q. No. 02	04	05	15	Solve any 03 out of 04
Q. No. 03	05	05	15	Solve any 03 out of 04
Q. No. 04	06	05	15	Solve any 03 out of 04

Q.1 Solve any Three (5*3)=15 Marks
a)
b)
c)
d)
Q.2 Solve any Three (5*3)=15 Marks
a)
b)
c)
d)
Q.3 Solve any Three (5*3)=15 Marks
a)
b)
c)
d)
Q.4 Solve any Three (5*3)=15 Marks
a)
b)
c)
d)

Second Year Exit: Teaching Methodology, Assessment and Evaluation

[I] As per R. R. B. Tech. 12.2 Rule: Award of Degree

If a student passes all the courses of first year, second year and earns the requisite number of credits, the student will become entitled to Undergraduate Diploma (Two years or four semesters) in the programme of his/her major subject. If he/she wants to exit, can exit the programme with UG Diploma certificate. However, for the award of two years UG Diploma Certificate in Major with 88 credits, an additional 8 credits from Exit Courses are required to earn.

[II] Second Year Exit Course:

Methodology 1:

1. The students should complete two online certification courses (NPTEL) related to their programme, each of 3 credits. In addition to this, they will also need to complete 2 credits worth of two Virtual Lab work related to online certification courses. These additional 8 credits earn by students shall be based upon skill based vocational courses or internship/Apprenticeship.

2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study or programme. The skill based vocational courses shall be analogous to the Baskets/Areas provided by the concerned BoS.

3. The student must complete two virtual lab work that adds 2 credits to simulate practical or experimental learning experiences in a controlled virtual environment.

4. **Examination scheme:** The marks gained from the two NPTEL Courses (3 credits each) are converted to a total of 100 marks. The report for the two Virtual Lab work of 2 credits will be

evaluated for 25 marks. The report should include a detailed write-up and analysis of the virtual lab experiments conducted, encompassing the methodology, results, and conclusions.

5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course. Similarly, for Virual Lab, the students are required to visit to website https://www.vlab.co.in and create their account. Log in the account and join the required lab and follow the instructions to compete the course (need to perform all listed experiments under that Lab). To fulfill the requirement of 06 credits, students can go for two courses each of 12 weeks.

Methodology 2:

1. The students should complete two online certification courses (NPTEL) related to their programme, each carrying 2 credits. In addition to this, they will also need to complete 4 credits worth of two physical internship/Apprenticeship (each of 40 hrs) work from relevant industry. These additional 8 credits earned by the students shall be based upon skill based vocational courses or internship/Apprenticeship.

2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study/programme. The skill-based vocational courses shall be analogous with the list provided by the concerned BoS.

3. The student should complete two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices that adds 4 credits to simulate practical or experimental learning experiences in a controlled virtual environment.

4. **Examination scheme:** The marks gained from the two NPTEL Courses (2 credits each) are converted to a total of 100 marks. The report for the performed two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices of 4 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of two physical internship/Apprenticeship (each of 40 hrs) work along with certificate of internship/Apprenticeship from relevant industrial practices conducted, encompassing the methodology, results, and conclusions.

5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course.

Guidelines for Open Elective Courses: Teaching Methodology, Assessment and Evaluation

Open Elective (OE) courses other than faculty of Science and Technology through Massive Open Online Courses (MOOCs) allowing students to engage with a broad spectrum of ideas and knowledge areas. The OE courses are likely to be available online and can be completed at the student's own pace within a set timeframe. For OE course, students are required to visit to the website https://swayam.gov.in for registration and create an account. Afterward, students should Login the account and join the course assigned by the course coordinator and follow the instructions to compete the course through self-learning mode. Additionally, the respective institution should download the relevant study materials to ensure students have access to them as needed. Minimum 25 students can register for one OE course in the concerned institute. There will be one course coordinator for one OE course. Students need to cover OE Courses of 08 credits. These 08 credits over semesters III to V. OE courses are chosen from faculty other than Faculty of Science and Technology. It is offered in Second and Third year as per Semester wise credit distribution table. Students need to take up the courses of 08 credits over semesters III to V.

1. **For Semester-III,** OE theory course of 3 credits consists of Mid Semester Examination (MSE) of 30 Marks, In Semester Evaluation/Continuous Assessment (ISE/CA) of 10 Marks and End Semester Examination (ESE) of 60 Marks.
2. **For Semester-III,** OE practical lab course of 1 credit consists of In Semester Evaluation/Continuous Assessment (ISE/CA) of 25 Marks

and End Semester Examination-Practical Oral Examination (ESE-POE) of 25 Marks. Course Coordinator assigned by Institute should complete the selected course practical through expert of that course. The lab exercises and demonstrations prepared by concern expert must be aligned with the specific OE course that the students have chosen.

3. **For Semester-IV,** OE theory course of 2 credits consists of Mid Semester Examination (MSE) of 30 Marks, In Semester Evaluation/Continuous Assessment (ISE/CA) of 10 Marks and End Semester Examination (ESE) of 60 Marks.
4. **For Semester-V,** OE theory course of 2 credits consists of Mid Semester Examination (MSE) of 30 Marks, In Semester Evaluation/Continuous Assessment (ISE/CA) of 10 Marks and End Semester Examination (ESE) of 60 Marks.
5. The Mid Semester Examination (MSE) of 30 Marks based on selected OE Course will be conducted by Concerned Departmental Course Coordinator. The course expert of concerned faculty should set question paper of MSE and evaluate the same.
6. Online submitted assignments by students using SWAYAM platform for concerned OE course will be used for In Semester Evaluation/Continuous Assessment (ISE/CA) of 10 Marks by Concerned Departmental Course Coordinator appointed for particular course by Principal of the Institute. Assignments may be of varied in nature for OE course.
7. The ESE of OE courses will be conducted by the University. The setting of question papers for both MSE and ESE, as well as the evaluation of the concerned OE course, should be carried out by the course expert from the Board of Studies (BoS) of the respective faculty

in accordance with the provisions under Panel of Paper Setters, Examiners, and Moderators – Clauses 41(f) and 48(3)(a).

8. MSE will be based on 50% syllabus from beginning (First 50% Weeks).
9. ESE paper setting weightage will be 25% on syllabus covered for MSE (First 50% Weeks) and 75% on remaining syllabus (Last 50% Weeks). The number of optional questions marks in a theory paper shall be 25 to 30 percent of the maximum marks.

Note: One OE course may be floated by the institute for 60 intake.

Open Electives Courses Offered to the students under Faculty of Science and Technology

In line with New Education Policy 2020

(Effective from Academic year 2025-26)

Open Electives

The students need to cover Open Elective Courses (OE) of 08 credits. These 08 credits over semesters III to V.

Semester wise credit distribution table for OE is given below

Sr. No.	Semester	Open Elective	Teaching scheme			Credits
			L	T	P	
01	III	OE-01	3	-	-	3
	III	OE-01 Lab	-	-	2	1
	IV	OE-02	2	-	-	2
02	V	OE-03	2	-	-	2
	Total		**7**	**-**	**2**	**8**

Semester wise baskets of OE from faculty other than Faculty of Science and Technology, Viz. Faculty of Commerce and Management, Faculty of Humanities and Faculty of Interdisciplinary Studies is given below

List of Open Elective Courses might be taken by students under Faculty of Science and Technology

Semester – III

Note: Choose any one course from the below basket of other than faculty in such way that the course with same name should not comes under or taught by major programme or the MDM.

Sr. No.	Name of the Course	Category	Duration (Weeks)	Credit Points	Institute Offering Course	Name of Professor/ Resource person	Link
01	Principles of Economics	Economics	12	03	IIT Madras	Prof. Sabuj Kumar Mandal	https://onlinecourses.nptel.ac.in/noc25_ec15/preview
02	German - I	Humanities and Social Science	12	03	IIT Madras	Prof. Milind Brahme	https://onlinecourses.nptel.ac.in/noc25_hs121/preview
03	Science, Technology and Society	Humanities and Social Science	12	03	IIT Guwahati	Prof. Sambit Mallick	https://onlinecourses.nptel.ac.in/noc25_hs189/preview
04	Environment and Development	Humanities and Social Science	12	03	IIT Guwahati	Prof. Ngamjahao Kipgen	https://onlinecourses.nptel.ac.in/noc25_hs195/preview
05	Logistics & Supply Chain Management	Humanities and Social Science	12	03	IIT Kharagpur	Prof. Vikas Thakur	https://onlinecourses.nptel.ac.in/noc25_hs205/preview
06	Introduction to Film Studies	Humanities and Social Sciences English studies	12	03	IIT Madras	Prof. Aysha Viswamohan	https://onlinecourses.nptel.ac.in/noc25_hs138/preview
07	Entrepreneurship	Management	12	03	IIT Madras	Prof. C Bhaktavatsala Rao	https://onlinecourses.nptel.ac.in/noc25_mg81/preview
08	Managerial Skills for Interpersonal Dynamics	Management	12	03	IIT Roorkee	Prof. Santosh Rangnekar	https://onlinecourses.nptel.ac.in/noc25_mg91/preview
09	Automation in Production Systems and Management	Management	12	03	IIT Kharagpur	Prof. Pradip Kumar Ray	https://onlinecourses.nptel.ac.in/noc25_mg135/preview
10	Numerical Methods for Engineers	Multidisciplinary	12	03	IIT Madras	Prof. Niket Kaisare	https://onlinecourses.nptel.ac.in/noc25_ge59/preview

Semester – IV

Note: Choose any one course from the below basket of other than faculty in such way that the course with same name should not comes under or taught by major programme or the MDM.

Sr. No.	Name of Course	Category	Duration (Weeks)	Credit Points	Institute Offering Course	Name of Professor/ Resource person	Link
01	Indian Business History	Humanities And Social Sciences	08	02	IIT Guwahati	Prof. Vipul Dutta	https://onlinecourses.nptel.ac.in/noc25_hs32/preview
02	Probability and Stochastic for Finance	Economic Sciences	08	02	IIT Kanpur	Prof. Joydeep Dutta	https://onlinecourses.nptel.ac.in/noc25_ma58/preview
03	Enhancing Soft Skills and Personality	Humanities and Social Sciences	08	02	IIT Kanpur	Prof. T. Ravichandran	https://onlinecourses.nptel.ac.in/noc25_hs87/preview
04	Mastering Speaking and Presentations: A case Based Approach	Humanities and Social Sciences	08	02	IIT Kharagpur	Prof. Seema Singh	https://onlinecourses.nptel.ac.in/noc25_hs96/preview
05	The Science of Happiness and Wellbeing	Humanities and Social Sciences	08	02	IIT Kharagpur	Prof. Priyadarshi Patnaik Prof. Manas K Mandal	https://onlinecourses.nptel.ac.in/noc25_hs103/preview
06	Philosophical Foundations Of Social Research	Humanities And Social Sciences	08	02	IIT Guwahati	Prof. Sambit Mallick	https://onlinecourses.nptel.ac.in/noc25_hs63/preview
07	Emotional Intelligence	Humanities and Social Science	08	02	IIT Kharagpur	Prof. Rabindra Kumar Pradhan	https://onlinecourses.nptel.ac.in/noc25_hs16/preview
08	Employment Communication: A Lab based course	Humanities and Social Science	08	02	IIT Kharagpur	Prof. Seema Singh	https://onlinecourses.nptel.ac.in/noc25_hs17/preview
09	Soft Skill Development	Humanities and Social Science	08	02	IIT Kharagpur	Prof. Priyadarshi Patnaik Prof. V. N. Giri Prof. D. Suar	https://onlinecourses.nptel.ac.in/noc25_hs72/preview
10	Social Behavior and the Brain: An Introduction to Social Neuroscience	Humanities and Social Science, Psychology, Neuroscience, Cognitive Science	08	02	IIT Kanpur	Prof. Ark Verma	https://onlinecourses.nptel.ac.in/noc25_hs101/preview
11	Economic Growth And Development	Humanities and Social Sciences	08	02	IIT Guwahati	Prof. Rajshree Bedamatta	https://onlinecourses.nptel.ac.in/noc25_hs11/preview

12	Effective Writing	Humanities and Social Sciences	08	02	IIT Roorkee	Prof. Binod Mishra	https://onlinecourses.nptel.ac.in/noc25_hs14/preview
13	Centre-State Relations in India	Law	08	02	IIT Kharagpur	Prof. Uday Shankar	https://onlinecourses.nptel.ac.in/noc25_lw04/preview
14	Foundation Course in Managerial Economics	Management	08	02	IIT Kharagpur	Prof. Barnali Nag	https://onlinecourses.nptel.ac.in/noc25_mg25/preview
15	International Marketing	Management	08	02	IIT Kharagpur	Prof. Biswarup Ghosh	https://onlinecourses.nptel.ac.in/noc25_mg32/preview
16	Introduction to System Dynamics Modeling	Management	08	02	IIT Bombay	Prof. Jayendran Venkateswaran	https://onlinecourses.nptel.ac.in/noc25_mg37/preview
17	Management of New Products and Services	Management	08	02	IIT Kharagpur	Prof. KBL Srivastava	https://onlinecourses.nptel.ac.in/noc25_mg44/preview
18	Business Forecasting	Management	08	02	IIT Bombay	Prof. Pankaj Dutta	https://onlinecourses.nptel.ac.in/noc25_mg66/preview
19	Yoga and Positive Psychology for Managing Career and Life	Management	08	02	IIT Bombay	Prof. Ashish Pandey	https://onlinecourses.nptel.ac.in/noc25_mg75/preview
20	Roadmap for patent creation	Multidisciplinary	08	02	IIT Kharagpur	Prof. Gouri Gargate	https://onlinecourses.nptel.ac.in/noc25_ge30/preview

Semester – V

Note: Choose any one course from the below basket of other than faculty in such way that the course with same name should not comes under or taught by major programme or the MDM.

Sr. No.	Name of Course	Category	Duration (Weeks)	Credit Points	Institute Offering Course	Name of Professor/ Resource person	Link
01	Enhancing Study Skills	Multidisciplinary	08	02	Indira Gandhi National Open University, New Delhi	Dr. P. Lakshmi; Dr. G. Mythili	https://onlinecourses.swayam2.ac.in/nou25_ge69/preview
02	Community Engagement and Social Responsibility	Multidisciplinary	10	02	Dayalbagh Educational Institute, Agra, Uttar Pradesh	Prof. Akshay Kumar Satsangi	https://onlinecourses.swayam2.ac.in/ugc25_ge10/preview
03	Economic Environment and Business Strategy	Economics	8	02	IIT Kanpur	Prof. Sukumar Vellakkal	https://onlinecourses.nptel.ac.in/noc25_ec16/preview
04	Corporate Social Responsibility	Management	8	02	IIT Kharagpur	Prof. Aradhna Malik	https://onlinecourses.nptel.ac.in/noc25_mg139/preview
05	Soft Skill Development	Humanities and Social Science	8	02	IIT Kharagpur	Prof. Priyadarshi Patnaik, Prof. V. N. Giri, Prof. D. Suar	https://onlinecourses.nptel.ac.in/noc25_hs142/preview
06	Developing Soft Skills and Personality	Humanities and Social Science	8	02	IIT Kanpur	Prof. T Ravichandran	https://onlinecourses.nptel.ac.in/noc25_hs174/preview
07	Introduction to Advanced Cognitive Processes	Humanities and Social Science	8	02	IIT Kanpur	Prof. Ark Verma	https://onlinecourses.nptel.ac.in/noc25_hs177/preview
08	Entrepreneurship and IP Strategy	Humanities and Social Science	8	02	IIT Kharagpur	Prof. Gouri Gargate	https://onlinecourses.nptel.ac.in/noc25_hs213/preview
09	Artificial Intelligence, Law and Justice	Law	8	02	NALSAR University of Law	Prof. Krishna Ravi Srinivas	https://onlinecourses.nptel.ac.in/noc25_lw12/preview
10	Innovation, Business Models and Entrepreneurship	Management	8	02	IIT Roorkee	Prof. Rajat Agrawal Prof. Vinay Sharma	https://onlinecourses.nptel.ac.in/noc25_mg95/preview
11	Organization Development and Change in 21st Century	Management	8	02	IIT Bombay	Prof. Ashish Pandey	https://onlinecourses.nptel.ac.in/noc25_mg103/preview

Guidelines for Multidisciplinary Minor (MDM) Programmes

As per the directives of the Government of Maharashtra, engineering colleges are encouraged to update their curricula in alignment with the guidelines of the National Education Policy (NEP) 2020. As part of this transformative initiative, the 'Minor Programme' has been introduced to promote multidisciplinary learning at the undergraduate level. These programmes are structured to provide students with interdisciplinary knowledge, enhancing their core academic disciplines and preparing them to meet the evolving demands of the global job market.

Minor programmes across various disciplines have been introduced to provide students with the opportunity to explore fields beyond their core B. Tech curriculum. These programmes enable students from specific branches to broaden their knowledge and skill sets. For example, a student pursuing Mechanical Engineering can opt for a Minor in Computer Science and Engineering, thereby acquiring interdisciplinary expertise that enhances both academic depth and professional flexibility. However, students enrolled in the Computer Science and Engineering (CSE) programme are restricted from choosing MDM's in Artificial Intelligence and Data Science, CSE (Data Science), and CSE (Artificial Intelligence and Machine Learning) in order to prevent overlap between the core curriculum of CSE and the content of these minors, ensuring that students gain diverse and non-redundant knowledge through their minor specializations. **(Refer Table: MDM Courses)**

Common guidelines to students:

1. The Multidisciplinary Minor (MDM) must be compulsorily chosen from engineering discipline different from the student's Major engineering programme. Students should take MDM from the list of MDM Offered by Other Departments/Branches/ programmes only. Ex: A Student of Mechanical Engineering should take MDM from other departments/branches/Programmes except MDM offered by Mechanical Engineering Dept. **(Refer Table: MDM Courses)**
2. The entry point for any compulsory MDM programme is the 3rd semester. The required credits for MDM courses must be acquired from the 3rd semester of second year to the final year of UG Programme.
3. A student is required to continue with the selected Minor programme consistently throughout all six semesters.
4. No changes to the selected Minor programme will be permitted under any circumstances.
5. A student may choose only one Minor programme (track), from the list of MDM courses offered by the institute.
6. The allotment of the MDM course will be based on the marks obtained by the student in the first year for Sem-I and Sem-II combinely.
7. The compulsory MDM programme will admit a maximum of 75 students into its minor course, with selection strictly based on first-year academic merit. Preference order for allocating MDM minor will follow the hierarchy: Candidates with no backlogs first, then those with one backlog, followed by those with two backlogs, and so on.

8. All students must complete the Google form provided by the Institute, indicating their preferences to MDM programme within the specified deadline. Students should ensure that they enter their accurate first year marks in the form along with the attachment of marksheets of Sem-I and Sem-II to avoid any discrepancies.

(Refer Table: MDM Courses)

List of S. Y. B. Tech. and T.Y.B.Tech MDM Courses Offered by the Various Programmes under the Faculty of Science and Technology at Shivaji University, Kolhapur

Sr. No.	Name of the Programme (Major) Offering MDM	Name of the corresponding Minor Programme to be offered	Semester	Name of the MDM Course offered by the Major Programme	Teaching scheme			Credits
					L	T	P	
01	Mechanical Engineering	1. Computer Science and Engineering 2. Electronics and Computer Science 3. Computer Science and Engineering (AIML) 4. Civil Engineering 5. Electronics and Telecommunication Engineering 6. Computer Science and Engineering (Data Science) 7. Electrical Engineering 8. Artificial Intelligence & Data Science 9. Electrical and Computer Engineering	III	MDM 01: Thermodynamics	2	-	-	2
			IV	MDM 02: Theory of Machines	2	-	-	2
			V	MDM 03:Heat Power Engineering	3	-	2	4
			VI	MDM 04: Machine Design	2	-	-	2
02	Computer Science and Engineering	1. Mechanical Engineering 2. Civil Engineering 3. Electronics and Telecommunication Engineering 4. Electrical Engineering 5. Mechanical and Mechatronics Engineering	III	MDM 01: Data Structures using C	2	-	-	2
			IV	MDM 02: Object Oriented Programming	2	-	-	2
			V	MDM 03: Java Programming	3	-	2	4

		(Additive Manufacturing)	VI	MDM 04: Database Engineering	2	-	-	2

03	Electronics and Computer Science	1. Mechanical Engineering 2. Civil Engineering 3. Electrical Engineering 4. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: Logic Design	2	-	-	2
			IV	MDM 02: Electronics Measurements	2	-	-	2
			V	MDM 3 : Microprocessor and Microcontroller	3	-	2	4
			VI	MDM 4 : Introduction to IOT	2	-	-	2
04	Computer Science and Engineering (AIML)	1. Mechanical Engineering 2. Civil Engineering 3. Electronics and Telecommunication Engineering 4. Electrical Engineering 5. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: Object Oriented Programming	2	-	-	2
			IV	MDM 02: Introduction to AI	2	-	-	2
			V	MDM 03: Database Management	3	1	-	4
			VI	MDM 04: Internet of Things	2	-	-	2
05	Civil Engineering	1. Mechanical Engineering 2. Computer Science and Engineering 3. Electronics and Computer Science 4. Computer Science and Engineering (AIML) 5. Electronics and Telecommunication Engineering 6. Computer Science and Engineering (Data	III	MDM 01: Building Construction	2	-	-	2
			IV	MDM 02: Waste Management	2	-	-	2
			V	MDM 3 : Infrastructure Engineering	3	-	2	4

		Science) 7. Electrical Engineering 8. Artificial Intelligence & Data Science 9. Electrical and Computer Engineering 10. Mechanical and Mechatronics Engineering (Additive Manufacturing)	VI	MDM 4: Concrete Technology	2	-	-	2
06	Electronics and Telecommunication Engineering	1. Mechanical Engineering 2. Computer Science and Engineering 3. Computer Science and Engineering (AIML) 4. Civil Engineering 5. Computer Science and Engineering (Data Science) 6. Electrical Engineering 7. Artificial Intelligence & Data Science 8. Electrical and Computer Engineering 9. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: Electronics System	2	-	-	2
			IV	MDM 02: Electronics Measurements	2	-	-	2
			V	MDM-3: Communication Engineering	3	-	2	4
			VI	MDM-4:Mobile Technology	2	-	-	2
07	Computer Science and Engineering (Data Science)	1. Mechanical Engineering 2. Civil Engineering 3. Electronics and Telecommunication Engineering 4. Electrical Engineering 5. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: C Programming	2	-	-	2
			IV	MDM 02: Python Programming	2	-	-	2
			V	MDM 03:Programming using Java	3	-	2	4
			VI	MDM 4:Database concepts and Design	2	-	-	2
		1. Mechanical Engineering 2. Computer Science and Engineering 3. Electronics and Computer Science 4. Computer Science and Engineering (AIML)	III	MDM 01: Introduction to Electrical and Electronics Circuits	2	-	-	2
			IV	MDM 02: Electrical Power System	2	-	-	2

08	Electrical Engineering	5. Civil Engineering 6. Electronics and Telecommunication Engineering 7. Computer Science and Engineering (Data Science) 8. Artificial Intelligence & Data Science 9. Mechanical and Mechatronics Engineering (Additive Manufacturing)	V	MDM 03:Electrical Machines	3	-	2	4
			VI	MDM 04:Power Electronics and Embedded System	2	-	-	2
09	Artificial Intelligence & Data Science	1. Mechanical Engineering 2. Civil Engineering 3. Electronics and Telecommunication Engineering 4. Electrical Engineering 5. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: Fundamentals of AI	2	-	-	2
			IV	MDM 02: Python for Data Science	2	-	-	2
			V	MDM 03: Machine Learning	3	-	2	4
			VI	MDM 04: Deep Learning	2	-	-	2
10	Electrical and Computer Engineering	1. Mechanical Engineering 2. Civil Engineering 3. Electronics and Telecommunication Engineering 4. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: Renewable Energy Sources	2	-	-	2
			IV	MDM 02: Python Programming	2	-	-	2
			V	MDM 03: Operating System	3	-	2	4
			VI	MDM 04: Electrical Design Estimation And Costing	2	-	-	2
11	Mechanical and Mechatronics Engineering (Additive Manufacturing)	1. Computer Science and Engineering 2. Electronics and Computer Science 3. Computer Science and Engineering (AIML) 4. Civil Engineering 5. Electronics and Telecommunication Engineering 6. Computer Science and Engineering (Data	III	MDM 01: Computer Aided Design (CAD)	2	-	-	2
			IV	MDM 02: Product Design & Development	2	-	-	2
			V	MDM 03: Fundamentals of Design for Product Manufacturing (FDPM)	3	-	2	4

		Science) 7. Electrical Engineering 8. Artificial Intelligence & Data Science 9. Electrical and Computer Engineering	VI	MDM 04:Ergonomics & Human Factors	2	-	-	2

Third Year Exit: Teaching Methodology, Assessment and Evaluation

[I] As per R. R. B. Tech. 12.3 Rule: Award of Degree

If a student passes all the courses of first year, second year and third year and earns the requisite number of credits, the student will become entitled to three years Bachelor's Degree in Vocational in the faculty of his/her major subject. If he/she wants to exit, can exit the programme with three years Bachelor's Degree in Vocational. However, for the award of three years Bachelor's Degree in Vocational in the faculty of his/her major subject with 132 credits, an additional 8 credits from Exit Courses are required to earn.

[II] Third Year Exit Course:

Methodology 1:

1. The students should complete two online certification courses (NPTEL) related to their programme, each of 3 credits. In addition to this, they will also need to complete 2 credits worth of two Virtual Lab work related to online certification courses. These additional 8 credits earn by students shall be based upon skill based vocational courses or internship/Apprenticeship.
2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study or programme. The skill based vocational courses shall be analogous to the Baskets/Areas provided by the concerned BoS.

3. The student must complete two virtual lab work that adds 2 credits to simulate practical or experimental learning experiences in a controlled virtual environment.
4. **Examination scheme:** The marks gained from the two NPTEL Courses (3 credits each) are converted to a total of 100 marks. The report for the two Virtual Lab work of 2 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of the virtual lab experiments conducted, encompassing the methodology, results, and conclusions.
5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course. Similarly, for Virual Lab, the students are required to visit to website https://www.vlab.co.in and create their account. Log in the account and join the required lab and follow the instructions to compete the course (need to perform all listed experiments under that Lab). To fulfill the requirement of 06 credits, students can go for two courses each of 12 weeks.

Methodology 2:

1. The students should complete two online certification courses (NPTEL) related to their programme, each carrying 2 credits. In addition to this, they will also need to complete 4 credits worth of two physical internship/Apprenticeship (each of 40 hrs) work from relevant industry. These additional 8 credits earned by the students shall be based upon skill based vocational courses or internship/Apprenticeship.
2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study/programme. The skill-based vocational courses shall be analogous with the list provided by the concerned BoS.
3. The student should complete two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices that adds 4 credits to simulate practical or experimental learning experiences in a controlled virtual environment.
4. **Examination scheme:** The marks gained from the two NPTEL Courses (2 credits each) are converted to a total of 100 marks. The report for the performed two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices of 4 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of two physical internship/Apprenticeship (each of 40 hrs) work along with certificate of internship/Apprenticeship from

relevant industrial practices conducted, encompassing the methodology, results, and conclusions.

5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course.

S.Y. Exit Course

To earn **8 credits**, the student must successfully complete **two NPTEL courses** and **two Virtual Labs** related to **Surveying & Geomatics** or **Building Information Modelling (BIM) and Computer-Aided Civil Engineering**.

1. Certificate Course in Surveying and Geomatics (8 Credits)

NPTEL Courses (Choose Any Two) ***(3 Credits each)***

1. Introduction to Geographic Information Systems (GIS) (3)
2. Remote Sensing Essentials (3)
3. Fundamentals of Geographical Information System (3)
4. Drone-based Surveying and Mapping (3)
5. GPS and GNSS for Surveying Applications (3)

Virtual Labs (Choose Any Two) ***(1 Credit each)***

1. Surveying Virtual Lab (IIT Roorkee) (1)
2. Geomatics Engineering Virtual Lab (IIT Roorkee) (1)
3. Remote Sensing and GIS Virtual Lab (IIT Bombay) (1)
4. Measurement and Surveying Virtual Experiments (IIT Roorkee) (1)

2. Certificate Course in Building Information Modeling (BIM) and Computer-Aided Civil Engineering (8 Credits)

NPTEL Courses (Choose Any Two) ***(3 Credits each)***

1. Building Information Modelling (BIM) (3)
2. Computer-Aided Civil Engineering Design (3)
3. Construction Planning and Management (3)
4. Project Planning and Control (3)
5. Digital Technologies in Construction (3)

Virtual Labs (Choose Any Two) ***(1 Credit each)***

1. Structural Analysis Virtual Lab (IIT Kharagpur) (1)
2. Concrete Technology Virtual Lab (IIT Delhi) (1)
3. Strength of Materials Virtual Lab (IIT Guwahati) (1)
4. Civil Engineering Materials Virtual Lab (IIT Delhi) (1)

Credit Distribution

Component	**Credits**
NPTEL Course 1	3
NPTEL Course 2	3
Virtual Lab 1	1
Virtual Lab 2	1
Total Credits	**8**

Note: Students shall complete **any two NPTEL courses** and **any two Virtual Labs** from the selected certificate course to earn **8 credits**. The department may update the list of courses based on the latest offerings on the NPTEL and Virtual Labs portals.

Design Thinking Course: Teaching Methodology, Assessment, and Evaluation

- The Non Credit Course under Design Thinking Category is offered to the students in Fifth or Sixth Semester through Massive Open Online Courses (MOOCs), and students may select a course from the following list or relevant course available on the respective online platform at that time. The course should have duration of not less than 4 weeks and not more than 6 weeks with minimum of 20 lectures and maximum of 30 lectures.
- The course is learned in online mode and can be completed by the student at their own pace within the prescribed duration.
- For enrollment, students are required to visit the SWAYAM or Coursera platform, register, and create their individual accounts.
- After successful registration, students must log in to their accounts, enroll in the course, and follow all instructions provided to complete the course.
- A Departmental Course Coordinator shall be appointed for the respective course.
- Students must submit all weekly assignments available on the respective platform, or those assigned by the Course Coordinator with prior approval from the respective Course Coordinator for assessment and evaluation.
- The Institute shall issue a Course Completion Certificate to students only after fulfilment of the following requirement:

  - Successful Completion and submission of 100% of the weekly assignments.

- Students are expected to adhere to all course guidelines and complete the course within the stipulated timeframe specified on the respective platform or by the Course Coordinator.

Online Platform- Swayam

1] Course Title- Design Thinking

Instructor-

Dr. Rajeshwari Patil, Dr. Manisha Shukla, Dr. Deepali Raheja, Dr. Mansi

Kapoor Sri Balaji University Pune

Course Information

Welcome to the captivating world of Design Thinking! This online course is designed to introduce you to the essential principles and techniques of Design Thinking—a powerful approach to problem-solving and innovation that has gained widespread recognition across various sectors in today's contemporary era.

In this course, you will discover that Design Thinking is much more than mere thinking. It is a mindset—an innovative and human-centric approach to identifying problems, designing effective solutions, and delivering outcomes that address unmet human needs.

Are you ready to unlock your creative potential and become a visionary leader in the business world? Join us on an exhilarating journey as we dive deep into the transformative power of design thinking through our immersive MOOC course on "Design Thinking."

Prepare to embark on a dynamic adventure where you will explore cutting-edge methodologies, challenge conventional thinking, and develop the essential skills to drive innovation. By participating in this course, you will be equipped with actionable strategies to tackle complex problems, discover untapped opportunities, and create value in today's ever-evolving business landscape.

Get ready to unleash your imagination, collaborate with like-minded individuals, and revolutionize your approach to problem-solving. Enroll now and embrace the boundless possibilities that await you!

This course adopts the Learner-Centric Model approach developed by IIT Bombay while planning, designing, and conducting this MOOC.

Learning Objectives-

This course will help you gain a strong foundation in design thinking principles and equip you with the necessary skills to apply this methodology in your future endeavors. Also, this course will help you to develop a problem-solving mindset and the ability to approach challenges from a human-centered perspective.

Course outline-

Week 0: Welcome to the course

Week 1: Foundation of Design Thinking

Week 2: Empathy-Foundation and Tools of Empathy
Week 3: Define-Foundation and Tools

Week 4: Ideate-Foundation and Tools
Week 5: Prototype & Foundation and Tools Week 6: Learn From Practitioner

Syllabus-

Week/ Module	Topics
Week 0	• Demo Video • Welcome to the course • Course Schedule • Grading Policy • Exam Details • FAQ
Week 1	**Foundation of Design Thinking** • Introduction to Design Thinking • Significance of Design Thinking • Key Tenets of Design Thinking • Design Thinking Process- 4 Critical Questions • Design Thinking Process • Wicked Problems • How Design Thinking is Different from Traditional Thinking • The Knowledge Funnel • Cognitive Bias: What Design Thinkers Should Avoid •
Week 2	**Empathy-Foundation and Tools of Empathy** • Foundation of Empathy • Purpose of empathy • Observation as a tool of empathy • Methods of Observation • Empathetic Interview • Stakeholder maps • Jobs to be done • Empathy Maps
Week 3	**Define- Foundation and tools** • Rules of Defining • Importance of Defining • Customer Journey Map • Customer experience • Persona
Week 4	**Ideate-Foundation and Tools** • Introduction to Ideation • Double Diamond • Brainstorming • Rules for Brainstorming • Mind Mapping • Worst Possible Idea

Week 5	**Prototype -Foundation and Tools** • Concept of Prototyping • Paper prototype • Story Board prototype • Scenario prototype • Low fidelity and high fidelity Test Foundation and Tools • Introduction to Test
Week 6	**Learn from Practitioner** • Interview 1 Mr Rohit Dubepatil – Director ORAH Nutrichem.Pvt.Ltd • Interview 2 Dr Bala Ramadurai • Interview 3Mr Abhijeet Kumar- Founder StepBeta • Interview 4 Ms Savita Rajiv

Online Platform- Coursera

Course Title- Design Thinking and Innovation

Instructor:

B K
Chakravarthy
– IIT Bombay

Syllabus-

Module 1-Innovation by Design:

Introducing the fundamental concepts of design thinking and the 7 Concerns for Innovation. This module will establish the foundation for understanding how design can solve complex problems by focusing on user needs and iterative innovation. Understand the principles of design thinking. Familiarize yourself with the 7 Concerns for Innovation. Recognize the importance of collaboration in the innovation process.

Module 2- The resolve to solve a problem:

Every design project is initiated by a _need‘, which becomes _The Cause‘ of the entire journey that follows. This need may be a commercial requirement, a social necessity or a specific niggling problem with an existing product. The recognition of such a need is a key trigger for the project and it can be identified by any of the stakeholders connected to the product – a product manufacturer or marketer, a user or a product designer.

Module 3- Understanding the problem space:

To study and understand an existing product or similar products in the market, it is critical that the environment in which the product is used, which designers like to call 'The Context' is understood comprehensively. This means that a designer must study the users and their perspectives on the product. Often, this involves several rounds of interaction and observation.

Module 4- Arriving at a Design insight:

At this stage, the designer analyses all the information gathered and methodically lists out their observations and perceptions of any notable issues in the use of the product. Such analysis results in the thorough, all-round 'Comprehension' of the product as it functions within the context of its use. The design insights thus arrived at give rise to creative ideas, and form the basis of the intervention that follows.

Module 5- Creating a product brief:

The Check‘ is an essential step in understanding what requirements the product should ultimately meet and what problems the design intervention should address. The check, which is often a document in the form of a product brief, is created from the design insights and must be approved by the client. The product brief is an important point of reference throughout the journey as concepts and prototypes are created and evaluated.

Module 6- Generating ideas and concepts:

At this stage called 'The Conception' , designer arrives at multiple ideas to come up with solutions for the problems listed using the product brief. At this crucial stage, ideas are proposed and grouped into clusters. This makes possible the consideration of multiple

concepts. Finally, the team zeros in on one all-encompassing concept that best addresses all aspects of the product.

Module 7- Building Mockups and prototypes:

The final concept is further refined with reference to criteria like materials available or desirable, and the conditions in which the product is to be manufactured. At this penultimate stage, the designer creates several style options according to the user profile and selects one that best addresses all the aesthetic concerns. The chosen product design is showcased by 'Crafting' small-scale mock-up models, CAD models, or working prototypes. A final version of the product that meets all conditions in the product brief is then taken up for mass production.

Module 8- Delighting the user:

The last but critically important concern is 'The Connection' the new product makes with the user. This connection or the bond between the user and the product is formed only when the user is satisfied with the product‘s performance and begins to cherish it, which in turn creates an increasing demand for the product. In fact, it is the customer‘s satisfaction that makes a winning project and functions as the most important criterion for innovation.

SCHEME OF INSTRUCTION & SYLLABI

Programme Civil Engineering

Scheme of Instructions: Third Year B.Tech. in Civil Engineering

Semester–V

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC	CE0251	Theory of Structures	3	--	--	3	3	30	10	60	100
2	PCC	CE0252	Geotechnical Engineering	3	--	--	3	3	30	10	60	100
3	PCC	ME0253	Environmental Engineering	3	--	--	3	3	30	10	60	100
4	PEC	ME0254	Programme Elective - 01	3	--	--	3	3	30	10	60	100
5	MDM	CE0255	Multi-disciplinary Minor – 03	3	--	--	3	3	30	10	60	100
6	OE	CE0256	Open Elective -03	2	--	--	2	2	30	10	60	100
7	PCC	CE0257	Geotechnical Engineering Lab	--	--	2	2	1	-	25	25	50
8	PCC	CE0258	Environmental Engineering Lab	--	--	2	2	1	-	25	25	50
9	PEC	CE0259	Programme Elective – 01 Lab	--	--	2	2	1	-	25	--	25
10	MDM	CE02510	Multi-disciplinary Minor– 03 Lab	--	--	2	2	1	-	50	--	50
11	EL	CE02511	Minor Project 01	--	--	2	2	1	-	25	--	25
			Total	**17**	**--**	**10**	**27**	**22**	**180**	**210**	**410**	**800**

L-Lecture T-Tutorial P-Practical MSE-Mid Semester Examination ISE/CA-In Semester Evaluation/Continuous Assessment ESE-End Semester Examination (For Laboratory End Semester performance)

SCHEME OF INSTRUCTION & SYLLABI

Programme Civil Engineering

Scheme of Instructions: Third Year B.Tech. in Civil Engineering

Semester–VI

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC	CE0261	Design of Concrete Structures -I	3	--	--	3	3	30	10	60	100
2	PCC	CE0262	Concrete Technology	3	--	--	3	3	30	10	60	100
3	PCC	CE0263	Transportation Engineering	3	1	--	4	4	30	10	60	100
4	PEC	CE0264	Programme Elective - 02	3	--	--	3	3	30	10	60	100
5	PEC	CE0265	Programme Elective - 03	3	--	--	3	3	30	10	60	100
6	MDM	CE0266	Multi-disciplinary Minor – 04	2	--	--	2	2	30	10	60	100
7	PCC	CE0267	Structural Design and Drawing I Lab	--	--	2	2	1	-	50	25	75
8	PCC	CE0268	Transportation Engineering Lab	--	--	2	2	1	-	50	25	75
9	EL	CE0269	Industrial Training*	--	--	4	4	2	-	50	--	50
			Total	**17**	**1**	**8**	**26**	**22**	**180**	**210**	**410**	**800**

L-Lecture T-Tutorial P-Practical MSE-Mid Semester Examination ISE/CA-In Semester Evaluation/Continuous Assessment ESE-End Semester Examination (For Laboratory End Semester performance)

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

CE0251: Theory of Structures (Programme Core Course)

Teaching Scheme			Examination Scheme	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	-		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: Strength of Material, Structural Mechanics

Course Objectives:

1	**To understand** the concepts of structural classification, static and kinematic indeterminacy, and **apply** the Consistent Deformation Method for analyzing indeterminate beams.
2	**To understand** the principles of Clapeyron's Three-Moment Theorem and **apply** it to continuous beams with varying support conditions.
3	**To understand and apply** approximate methods for analyzing multi-storey building frames subjected to vertical loads.
4	**To understand and apply** the slope-deflection equations for the analysis of indeterminate beams and rigid frames.
5	**To apply** the Moment Distribution Method for the analysis of indeterminate beams and rigid frames.
6	**To understand and apply** the flexibility and direct stiffness methods for the analysis of indeterminate structures.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	**Analyze** statically indeterminate beams such as propped cantilevers, fixed beams, and continuous beams (S.I. ≤ 2) using the Consistent Deformation Method.
CO2	**Analyze** continuous beams with support settlement and varying moments of inertia using Clapeyron's Three-Moment Theorem.
CO3	**Analyze** multi-storey building frames and **estimate** internal forces using the Portal and Cantilever Methods
CO4	**Analyze** continuous beams and rigid frames (without sway) using the Slope-Deflection Method.
CO5	**Analyze** continuous beams and rigid frames (with and without sway) using the Moment Distribution Method
CO6	**Analyze and evaluate** indeterminate structures by using the Flexibility Method and Direct Stiffness Method.

	Course Contents	COs	Hours
Unit 1	**Fundamentals of Structure and Analysis of Redundant Beams** Types and classification of structures based on structural forms. Concept of indeterminacy: static and kinematic indeterminacy (with numerical). Analysis of propped cantilever, fixed beam with indeterminacy up to second degree by Consistent Deformation Method. (Degree of S.I. ≤ 2).	**CO1**	**(06)**

Unit 2	**Unit 2: Clapeyron's Theorem** Clapeyron's theorem of three moments, application to Continuous beams, sinking of supports and Beams with different M.I. indeterminacy up to second degree.	**CO2**	**(06)**
Unit 3	**Approximate Methods of Frame Analysis** Approximate analysis of multi-storey building frames for vertical loads and Horizontal loads by Portal Method and Cantilever Method and their use to estimate maximum internal forces.	**CO3**	**(08)**
Unit 4	**Classical Displacement Methods for Indeterminate Structures** by Slope-Deflection equations and applications to continuous beams and simple rigid frames (without sway). (Degree of K.I. ≤ 2)	**CO4**	**(06)**
Unit 5	**Classical Displacement Methods for Indeterminate Structures** by Moment Distribution Method for continuous beams and rigid frames (sway and non-sway). (Degree of K.I. ≤ 2)	**CO5**	**(06)**
Unit 6	**Force (Flexibility) Method of Analysis / Displacement (Stiffness) Method** Basic concept of flexibility method. Selection of redundant and formulation of compatibility equations. Application to beams, indeterminate trusses, and simple frames (Degree of S.I. ≤ 2). Introduction to stiffness method. Member stiffness matrices for beam and frame elements and global assembly. Direct stiffness formulation and basic solution procedures (hand calculations). (Degree of K.I. ≤ 2)	**CO6**	**(08)**

Text Books

Structural Analysis – A Matrix Approach Author: G. S. Pandit & S. P. Gupta Publisher: Tata McGraw-Hill

Structural Analysis – Vol. II Author**:** S. S. Bhavikatti Publisher**:** Vikas Publishing House

"Analysis of Structures" -Vazirani and Ratwani,Vol. I &II, Khanna Publishers

"Mechanics of Structures" - S. B. Junnarkar, H.J. Shah, Vol-I & II,Charotar Publishers.

Reference Books

Basic Structural Analysis Author: C. S. Reddy Publisher**:** Tata McGraw Hill

Matrix Analysis of Structures Author**:** Aslam Kassimali Publisher**:** Cengage Publications

"Indeterminate structural analysis"- C.K. Wang

"Basic Structural Analysis" - K.U. Muthu, Azmi Ibrahim, M. Vijyan, MagantiJanadharn. I.K. International Publishing House Pvt. Ltd.

Shivaji University, Kolhapur

Third Year (Sem–V) B.Tech. Civil Engineering

CE0252: Geotechnical Engineering (Programme Core Course)

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/Week		MSE	30 Marks
Tutorials	–		ISE/CA	10 Marks
Total Credits	**3**		ESE	60 Marks
			Total Marks	**100 Marks**

Prerequisites: Applied Mechanics, Engineering Mathematics, Fluid Mechanics

Course Objectives

Sr. No.	**Objectives**
01	To study index properties of soil, their significance, determination and interrelationships.
02	To understand engineering properties of soil and their significance in Civil Engineering.
03	To study shear strength parameters of soil, understand the concept of earth pressure and evaluate slope stability.
04	To understand the basics of foundation engineering, types of foundations, design concepts and design criteria.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Explain the significance of Geotechnical Engineering, fundamental soil relationships and classify soils.
CO2	Illustrate index and engineering properties of soil.
CO3	Evaluate soil stresses, shear strength, earth pressure and slope stability.
CO4	Explain the basics of foundation engineering and geotechnical design aspects.

Unit	**Course Contents**	**COs**	**Hours**
Unit 1	**Soil Properties and Classification** Origin of soil, application areas of Geotechnical Engineering, soil phase system, weight-volume relationships, index properties of soil (unit weight, water content, specific gravity, void ratio, porosity), particle size distribution by sieve and sedimentation analysis, Atterberg's consistency limits, consistency indices, activity number, soil structure, IS soil classification system and Casagrande plasticity chart.	**CO1**	**(07)**
Unit 2	**Soil Hydraulics: Permeability and Seepage Analysis** Modes of occurrence of water in soil, Darcy's law and its validity, factors affecting permeability, coefficient of permeability by constant head and variable head methods, permeability of layered soil, total stress, pore pressure, effective stress, seepage pressure, seepage force, critical hydraulic gradient, quicksand condition, piping, flow net, applications and seepage loss.	**CO2**	**(06)**
Unit 3	**Compaction and Consolidation** Concept of compaction, Standard and Modified Proctor test, dry density-moisture content relationship, zero air void line, field compaction control, compaction equipment, placement water content, factors affecting compaction, consolidation concept, Terzaghi's theory, compression index, coefficient of compressibility, coefficient of volume change, NC, OC and UC soils, laboratory consolidation test and determination of coefficient of consolidation.	**CO2**	**(07)**

Unit 4	**Shear Strength of Soil** Concept of shear stress and shear strength, Mohr-Coulomb theory, failure envelopes, Terzaghi's total and effective stress approach, factors affecting shear strength, Direct Shear Test, Triaxial Compression Test (UU, CU & CD), Unconfined Compression Test and Vane Shear Test.	**CO3**	**(07)**
Unit 5	**Earth Pressure and Analysis of Slope Stability** Earth pressure at rest, active and passive earth pressure, Rankine's theory, surcharge loading, tension cracks, critical height, Coulomb's wedge theory, slope classification, infinite and finite slopes, Taylor's stability number, Swedish slip method, method of slices, friction circle method, slope improvement methods and landslides.	**CO3**	**(07)**
Unit 6	**Concepts and Fundamentals of Foundation Engineering** Necessity, objectives, requirements and selection of foundations, bearing capacity concepts, analytical and field methods, foundation design criteria, classification of foundations, shallow foundations (isolated footing, combined footing and raft foundation), settlement calculations, pile foundations, pile capacity estimation and under-reamed piles.	**CO4**	**(06)**

Text Books
Soil Mechanics and Foundation Engineering **Author:** B. C. Punmia **Publisher:** Laxmi Publications
Soil Mechanics and Foundation Engineering **Author:** K. R. Arora **Publisher:** Standard Publishers
Soil Mechanics and Foundation Engineering **Author:** S. K. Garg **Publisher:** Khanna Publishers
Geotechnical Engineering **Author:** V. N. S. Murthy **Publisher:** CRC Press
Geotechnical Engineering **Author:** C. Venkatramaiah **Publisher:** New Age International Publications
Principles of Geotechnical Engineering **Author:** Braja M. Das **Publisher:** Cengage Learning
Geotechnical Engineering **Author:** Purushottam Raj **Publisher:** McGraw Hill Publications (4th Edition)
Reference Books
Geotechnical Engineering: Principles and Practice **Author:** Donald P. Coduto **Publisher:** McMillan Press (PHI)
Soil Mechanics **Author:** Terzaghi & Peck **Publisher:** John Wiley & Sons, New York
Soil Testing **Author:** T. W. Lambe **Publisher:** Wiley Eastern Ltd., New Delhi
Geotechnical Testing and Instrumentation **Author:** Alam Singh **Publisher:** CBS Publishers
IS 2720 – Methods of Test for Soils **Publisher:** Bureau of Indian Standards (BIS)

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

CE0253: Environmental Engineering (Programme Core Course)

Teaching Scheme			Examination Scheme	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	-		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: Nil

Course Objectives:

1	Provide fundamental knowledge of water supply systems.
2	Explain principles and design concepts of water treatment processes.
3	Develop understanding of water distribution systems.
4	Introduce concepts of wastewater engineering.
5	Familiarize students with secondary and sludge treatment processes.
6	Create awareness of environmental pollution control and management.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Understand water supply systems and water quality requirements.
CO2	Analyze and design water treatment processes.
CO3	Design water distribution and appurtenance systems.
CO4	Understand wastewater collection and treatment systems.
CO5	Evaluate sludge treatment and pollution control methods.
CO6	Apply environmental management principles and Environmental Impact Assessment (EIA).

	Course Contents	COs	Hours
Unit 1	**Water Supply Planning and Water Quality** Introduction to water supply schemes: data collection, components and layout. Design period and factors affecting design period. Water demand and its types, factors affecting demand and population forecasting methods. Water quality parameters and their significance. Drinking water standards as per BIS and WHO.	**CO1**	**(08)**
Unit 2	**Water Treatment Processes** Principles of water treatment and flow sheets. Intake structures: river, canal and reservoir intakes. Water supply layout plan. Aeration: principles, necessity, methods and design of cascade aerator. Coagulation and flocculation: theory, destabilization of colloids, factors affecting	**CO2**	**(06)**

	coagulation and coagulant selection. Sedimentation: theory, types, design of sedimentation tanks, tube and plate settlers.		
Unit 3	**Tertiary Water Treatment, Distribution & Appurtenances** Filtration mechanisms, head loss and negative head loss. Types and design of filters: slow sand, rapid sand and pressure filters. Disinfection principles and methods, break-point chlorination. Water softening and demineralization processes. Service reservoirs: necessity, location and capacity determination. Distribution system layout plan. Transmission mains, pipe materials, testing, corrosion control, thrust blocks. Valves, hydrants, meters, service connections, water audit and DPR preparation.	**CO3**	**(06)**
Unit 4	**Wastewater Collection & Primary Treatment** Sources and characteristics of wastewater. Flow variations and BOD calculations. Storm water estimation. Sewerage systems: types, layouts and sewer types. Design and maintenance of sanitary and storm sewers. Preliminary and primary treatment units: screening, grit chambers, oil and grease traps and primary settling tanks.	**CO4**	**(08)**
Unit 5	**Secondary Treatment, Sludge Treatment & Stream Pollution** Activated Sludge Process: principles, design parameters, modifications and operational issues. Trickling filters. Sludge treatment: anaerobic digestion and reactors. Low-cost wastewater treatment systems. Stream pollution: self-purification, DO sag curve, Streeter–Phelps equation. Wastewater disposal methods and effluent standards as per CPCB and MPCB.	**CO5**	**(06)**
Unit 6	**Solid Waste, Air & Noise Pollution and Environmental Impact Assessment (EIA)** Solid waste: types, sources, characteristics and functional elements. Treatment methods: composting, incineration, pyrolysis and sanitary landfill. Environmental Impact Assessment (EIA), Environmental Health and Safety (EHS).	**CO6**	**(06)**

Text Books

Environmental Engineering (Vol. I): Water Supply Engineering Author: B. C. Punmia, Ashok K. Jain & Arun K. Jain **Publisher:** Laxmi Publications

Water Supply Engineering Author: S. K. Garg **Publisher:** Khanna Publishers

Water Supply and Sanitary Engineering Author: G. S. Birdie & J. S. Birdie **Publisher:** Dhanpat Rai Publications

Water and Wastewater Engineering Author: Fair, Geyer & Okun **Publisher:** John Wiley & Sons

Reference Books

Environmental Engineering Author: Howard S. Peavy, Donald R. Rowe & George Tchobanoglous **Publisher:** McGraw-Hill

Wastewater Engineering: Treatment and Resource Recovery Author: Metcalf & Eddy, Inc. **Publisher:** McGraw-Hill Education
CPHEEO Manual on Water Supply and Treatment Publisher: Ministry of Housing and Urban Affairs, Government of India
CPHEEO Manual on Sewerage and Sewage Treatment Systems Publisher: Ministry of Housing and Urban Affairs, Government of India

Shivaji University, Kolhapur

Third Year (Sem–V) B.Tech. Civil Engineering

CE0254: Program Elective - 01 (Advanced Structural Analysis)

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/Week		MSE	30 Marks
Tutorials	–		ISE/CA	10 Marks
Total Credits	**3**		ESE	60 Marks
			Total Marks	**100 Marks**

Prerequisites: Applied Mechanics, Engineering Mathematics, Fluid Mechanics

Course Objectives

Sr. No.	**Objectives**
01	Understand and apply advanced methods of structural analysis for indeterminate structures.
02	Analyze special structural systems such as portal frames, arches, cables, and frames using classical and modern approaches.
03	Interpret influence line diagrams for evaluating responses due to moving loads.
04	Develop fundamental understanding of Finite Element Method and its application to structural problems.
05	Analize structures considering plastic behavior, stability, and collapse mechanisms.
06	Relate theoretical concepts with real-life structural behavior and design philosophy.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Analyze single-bay portal frames with inclined legs and gable frames using the slope deflection method.
CO2	Analyze indeterminate beams and arches using influence line diagrams for moving load effects.
CO3	Determine reactions, tension, and geometric parameters of cable structures under various loading and support conditions.
CO4	Apply fundamental finite element concepts to analyze plane stress, plane strain, axisymmetric, and basic structural problems.
CO5	Analyze two-hinged and three-hinged arches using influence line concepts under moving loads.
CO6	Analyze indeterminate structures considering plastic behavior, collapse mechanisms, stability, and second-order effects.

Unit	**Course Contents**	**COs**	**Hours**
Unit 1	**Slope Deflection Method:** Analysis of single bay portal frames with inclined legs, gable frames.	**CO1**	**(07)**
Unit 2	**Influence Lines:** Influence line concept and applications ILD for reactions, shear force and bending moment. Determinate and indeterminate beams. Influence lines for arches.	**CO2**	**(06)**
Unit 3	**Cables Structures:** Introduction, Equation of the cable, General Cable theorem Horizontal reaction for uniformly loaded cable, Tension in the cable supported at same and different levels.	**CO3**	**(07)**
Unit 4	**Finite Element Method** Basics of variational and energy principles; fundamentals of finite element method including discretization Element properties, stiffness formulation, assembly, and boundary	**CO4**	**(07)**

	conditions; applications of FEM to plane stress		
Unit 5	**Arches:** Types and behavior of arches. Analysis of three-hinged arches. Analysis of two-hinged arches. Horizontal thrust in arches. Influence line concept for arches	**CO5**	**(07)**
Unit 6	**Plastic Analysis and Stability:** Stress–strain behaviour of structural steel, Plastic hinge concept and shape factor,Plastic analysis of statically indeterminate beams, Collapse mechanism ofportal frames, Upper bound and lower bound theorems.	**CO6**	**(06)**

Text Books

Strength of Materials & Structural Analysis Author: S. Ramamrutham & R. Narayanan **Publisher:** Dhanpat Rai Publications

Advanced Structural Analysis Author: Devdas Menon **Publisher:** Narosa Publishing House **Edition:** Revised Edition **ISBN:** 978-81-7319-939-4

Structural Analysis (Vol. I & II) Author: S. K. Duggal, V. N. Vazirani & M. M. Ratwani **Publisher:** Khanna Publishers **Edition:** Revised Edition **ISBN:** 978-81-7409-140-8

Structural Analysis Author: S. S. Bhavikatti **Publisher:** Vikas Publishing

Reference Books

Structural Analysis Author: R. K. Bansal **Publisher:** Laxmi Publications

Advanced Structural Analysis Author: A. K. Jain **Publisher:** Nem Chand Bros. **Edition:** Commonly Used Core Edition

Basic Structural Analysis Author: C. S. Reddy **Publisher:** Tata McGraw Hill **Edition:** Latest Edition

Structural Analysis Author: R. C. Hibbeler **Publisher:** Pearson Education **Edition:** 10th / 11th Edition

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

CE0254 (Programme Elective-01): Construction Methods and Equipment Management

Teaching Scheme			**Examination Scheme**	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	-		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: Basic Knowledge of construction equipment

Course Objectives:

1	Understand modern construction methods used in civil engineering projects
2	Study selection, operation, and management of construction equipment
3	Introduce planning, productivity, and cost aspects of construction machinery
4	Develop basic decision-making skills in equipment selection and site operations

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Explain various construction methods used in civil engineering projects
CO2	Identify and select appropriate construction equipment
CO3	Understand productivity and cost aspects of construction equipment
CO4	Apply equipment management principles in construction projects
CO5	Analyze safety and maintenance requirements of construction machinery

	Course Contents	**COs**	**Hours**
Unit 1	**Introduction to Construction Industry and Construction Planning** **Overview of construction industry:** Characteristics of construction projects, Types of construction projects (Building, Industrial, Infrastructure), Stakeholders in construction projects **Construction planning concepts:** Importance of construction planning, Relationship between planning, scheduling, and control, Work breakdown structure (WBS) **Construction methods:** Conventional vs modern construction methods, Factors affecting selection of construction methods, Role of Artificial Intelligence in modern construction Methods **Productivity in construction:** Definition of productivity, Factors affecting construction productivity, Methods to improve productivity	**CO1**	**(08)**
Unit 2	**Overview of construction industry:** Characteristics of construction projects, Types of construction projects (Building, Industrial, Infrastructure), Stakeholders in construction projects **Construction planning concepts:** Importance of construction planning, Relationship between planning, scheduling, and control, Work breakdown	**CO2**	**(06)**

	structure (WBS) **Construction methods:** Conventional vs modern construction methods, Factors affecting selection of construction methods, Role of Artificial Intelligence in modern construction Methods **Productivity in construction:** Definition of productivity, Factors affecting construction productivity, Methods to improve productivity		
Unit 3	**Earthwork and Excavation Equipment** **Earthwork in construction:** Types of earthwork operations, Soil classification for excavation, Volume calculations for earthwork (Theory) **Excavation equipment:** Power shovels – types and applications, Backhoes and draglines, Clamshell and trenching machines **Bulldozers and scrapers:** Types of bulldozers, Applications of scrapers, Dozing and ripping operations. **Selection of excavation equipment:** Factors affecting equipment selection, Equipment productivity basics, Advantages of mechanized excavation	**CO3**	**(06)**
Unit 4	**Hauling, Lifting, and Material Handling Equipment** **Hauling equipment:** Dump trucks – types and capacities, Tippers and wagons, Selection of hauling equipment **Conveying equipment:** Belt conveyors, Screw conveyors, Applications in construction **Lifting equipment:** Cranes – types (mobile, tower, crawler), Hoists and winches, Load charts and safety considerations **Material handling planning:** Site layout planning, Equipment coordination, Reduction of material handling cost	**CO4**	**(08)**
Unit 5	**Road Construction Equipment and Methods** **Highway construction process:** Subgrade preparation, Base and sub-base construction, Pavement layers **Road construction equipment:** Motor graders, Road rollers – types and functions, Bitumen sprayers **Bituminous construction equipment:** Hot mix plant, Pavers and finishers, Compaction equipment for bituminous layers Quality control and safety: **Field quality control tests, Equipment safety measures, Maintenance of road construction equipment**	**CO5**	**(06)**
Unit 6	**Equipment Management, Maintenance, and Economics** **Construction equipment management:** Objectives of equipment management, Equipment planning and scheduling, Equipment fleet management **Equipment ownership and operating cost:** Fixed costs, Operating costs, Cost comparison of equipment **Equipment maintenance:** Preventive maintenance, Breakdown maintenance, Maintenance planning, **Replacement and safety:** Equipment replacement policy, Factors affecting replacement decisions, Safety practices in equipment operation	**CO4**	**(06)**
Text Books			

Construction Planning, Equipment, and Methods Author: R. L. Peurifoy, C. J. Schexnayder, A. Shapira & R. Schmitt **Publisher:** McGraw Hill **Edition:** 10th Edition
Construction Project Management Author: K. K. Chitkara **Publisher:** McGraw Hill
Construction Project Management: Theory and Practice Author: Kumar Neeraj Jha **Publisher:** Pearson
Reference Books
Construction Planning and Equipment Author: S. C. Rangwala **Publisher:** Khanna Publications, Delhi **Edition:** December 2020 **ISBN-10:** 8900120905
Construction Planning and Equipment Author: H. K. Das **Publisher:** S. Chand Publications **Edition:** December 2007 **ISBN-10:** 8121903459
Advanced Engineering Mathematics Author: Jack Goldberg **Publisher:** Oxford University Press

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

CE0254: Bridge and Tunnel Engineering (Programme Elective–01)

Teaching Scheme			Examination Scheme	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	-		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: NIL

Course Objectives:

1	Introduce the fundamental concepts of bridge engineering,
2	Develop understanding of bridge superstructures**,** design methodologies, bearings, expansion joints, and parapets.
3	Familiarize students with bridge substructures, foundations, and soil–structure interaction.
4	Provide knowledge of tunnel engineering fundamentals**, i**ncluding classification, investigation and surveying methods.
5	Understand various tunneling methods**,** construction techniques, and problem-solving measures.
6	To create awareness about tunnel support systems, ground treatment methods, services,and safety considerations**.**

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Understand Classification of bridge and site selection criteria.
CO2	Understand the importance of different types of bridge bearings.
CO3	Understand basic principles of bridge construction and Maintenance.
CO4	Explain tunnel development in India, classify tunnels, and interpret tunnel investigation methods and cross-sections.
CO5	Understand tunneling methods conforming to site conditions.
CO6	Identify tunnel support systems, ground treatment measures, tunnel services, and safety practices for underground construction.

Course Contents		COs	Hours
Unit 1	**Study of IRC Codes for Road Bridges** Study of relevant IRC codes(IRC:5,6,18,27,45,78) with emphasis on loads, clearances and design provisions.	**CO1**	**(08)**
Unit 2	**Study of Bridge Components** Identification and detailed study of superstructure, substructure, foundations, bearings, and expansion joints using drawings/models	**CO2**	**(06)**
Unit 3	**Bridge Construction & Maintenance Study of Bridge Bearings and Expansion Joint** Construction methods and maintenance of bridges, Study of types, functions, forces on bearings, and expansion joints used in highway bridges.	**CO3**	**(06)**

Unit 4	**Tunnel Classification, History and Cross-Sections** History of tunnel development in India Classification of tunnels based on: Purpose, Conveyance, Geological strata, Alignment Shape and size Standard cross-sections: Highway tunnels Railway tunnels	**CO4**	**(08)**
Unit 5	**Tunneling Methods and Shallow Tunneling Techniques** Tunneling methods: Soft ground tunneling**,** Hard rock tunneling **,** Shallow tunneling Methods of muck disposal, Problems encountered and remedial measures	**CO5**	**(06)**
Unit 6	**Tunnel Support Systems, Ground Treatment and Safety** • Tunnel support systems: Timbering Steel ribs**,** Shotcrete • Introduction to ground treatment methods: Grouting, Dewatering, Tunnel services: Lighting, Ventilation and dust control Drainage system • Tunneling hazards: Explosions, Flooding, Safety and preventive measures	**CO6**	**(06)**

Text Books

Design of Bridge Structures Author: T. R. Jagadeesh & M. A. Jayaram **Publisher:** PHI Publications

Bridge Engineering Author: Rangwala **Publisher:** Charotar Publications

Bridge Engineering Author: S. Ponnuswamy **Publisher:** Tata McGraw Hill

Reference Books

Failures and Repair of Concrete Structures Author: S. Champion **Publisher:** John Wiley & Sons

Tunnel Engineering Author: Subhash C. Saxena **Publisher:** Dhanpat Rai & Sons, New Delhi **Edition:** 1998

Introduction to Tunnel Construction Author: David Chapman, Nicole Metje & Alfred Stark **Publisher:** CRC Press

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

CE0255: Multi-disciplinary Minor-03: - Infrastructure Engineering

Teaching Scheme			Examination Scheme	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	-		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: NIL

Course Objectives:

1	To give overview of Indian infrastructure assets
2	To learn methodologies for sustainable infrastructure and working of public private partnership models
3	To learn about urban and rural infrastructure

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Outline and learn the salient features of the infrastructure assets of India
CO2	Understand in details the primary infrastructure assets like Highways, Railways, Airports, Power sector, Renewable energy sector, Ports and Dams.
CO3	Learn about working of public private partnership models
CO4	Build concepts about the rural infrastructure in India

	Course Contents	COs	Hours
Unit 1	**Overview of Indian Infrastructure Assets** Concept of infrastructure - Need for infrastructure planning and engineering, Infrastructure development scenario in India, Scope for infrastructure management.	**CO1**	**(08)**
Unit 2	**Urban Infrastructure and Rural Infrastructure** Urban infrastructure- Water- Dams- Bridges- Canals Housing- Roads- Railways- Ports- Airports- Energy- Power Rural Infrastructure: Alternate construction materials- Rural housing technologies- Rural roads Rural water supply and sanitation	**CO2**	**(06)**
Unit 3	**Energy Infrastructure** Energy Infrastructure- Components of energy- Power generation- Transmission- Distribution- Oil &gas- Coal- Renewable energy sources like solar, wind, tidal, geothermal	**CO3**	**(06)**

Unit 4	**Sustainable Infrastructure** Methodologies for development and management of sustainable infrastructure- Privatization of Infrastructure- Working of public private partnership models (Build Operate and Transfer, Build Operate Lease and Transfer, Build Own Operate)- Infrastructure laws for cost estimation, designing and maintaining infrastructure.	**CO4**	**(08)**
Unit 5	**Strategies for Infrastructure Projects** Risk Management Framework For Infrastructure Projects, Shaping The Planning Phase of Infrastructure Projects To Mitigate Risks, Designing Sustainable Contracts, Sustainable Development Of Infrastructure, Innovative Design And Maintenance Of Infrastructure Facilities.	**CO1**	**(06)**
Unit 6	**Challenges in Infrastructure Planning** Mapping And Facing The Landscape Of Risks In Infrastructure Projects, Economic And Demand Risks, Socio-Environmental Risks, Cultural Risks In International, Infrastructure Projects, Legal And Contractual Issues In Infrastructure, Challenges In Construction And Maintenance Of Infrastructure	**CO2**	**(06)**

Text Books

Railway, Bridge and Tunnel Engineering Author: Ketki B. Dalal & K. S. Rangwala **Publisher:** Rangwala Publications

Tunnel Engineering *(2015)* **Author:** S. C. Saxena **Publisher:** Dhanpat Rai Publications

Elements of Bridge, Tunnel & Railway Engineering Author: S. P. Bindra **Publisher:** Dhanpat Rai Publications

Reference Books

Tunnel Engineering Author: S. K. Arora & S. P. Bindra **Publisher:** Dhanpat Rai Publications

Concrete Bridge Practice (Analysis, Design and Economics) Author: V. K. Raina **Publisher:** Shroff Publishers, Mumbai **Edition:** 4th Edition

Bridge Engineering Author: J. S. Alagia **Publisher:** Charotar Publication House, Anand

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

CE0257: Geotechnical Engineering Laboratory

Teaching Scheme			Examination Scheme	
Practical	02Hrs/Week		MSE	----
Tutorials	-		ISE/CA	25 Marks
Total Credits	1		ESE	25 Marks
			Total Marks	50 Marks

Prerequisites: NIL

Course Objectives:

1	To impart skills to perform laboratory experiments for determination of index and engineering properties of soil
2	To interpret the experiment results and draw valid conclusions

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Demonstrate skill to conduct laboratory experiments as per standard procedure to determine soil properties.
CO2	Analyze soil properties and describe soil performance

Term Work /List of Experiments/ List of Assignments

Any 8 Experiments based on following list

Expt. No	Name of Experiment	CO
1.	Determination of specific gravity by pycnometer / density bottle method	**CO1**
2.	Determination of water content by oven drying method / Pycnometer method	**CO2**
3.	Determination of particle size distribution by dry sieve analysis	**CO1**
4.	Determination of particle size distribution by hydrometer analysis	**CO2**
5.	Determination of consistency limits (LL, PL, SL) (minimum two)	**CO1**
6.	Determination of field density by core cutter method	**CO2**
7.	Determination of field density by sand replacement method	**CO1**
8.	Determination of MDD & OMC by standard / Modified proctor test	**CO2**
9.	Determination of coefficient of permeability by variable head method/Constant head method	**CO1**
10.	Determination of shear strength parameters of soil by using direct shear test	**CO2**
11.	Determination of shear strength of soil by Triaixal, Unconfined and Vane	**CO1**

	shear Test (any one)	
Text Books		
Soil Mechanics and Foundation Engineering Author: B. C. Punmia, Ashok K. Jain & Arun K. Jain **Publisher:** Laxmi Publications		
Soil Mechanics and Foundation Engineering Author: K. R. Arora **Publisher:** Standard Publishers Distributors		
Basic and Applied Soil Mechanics Author: Gopal Ranjan & A. S. R. Rao **Publisher:** New Age International Publishers		
Reference Books		
Principles of Geotechnical Engineering Author: Braja M. Das **Publisher:** Cengage Learning		
Geotechnical Engineering Author: C. Venkatramaiah **Publisher:** New Age International Publishers		
Geotechnical Engineering: Principles and Practices Author: Donald P. Coduto, Man-Chu Ronald Yeung & William A. Kitch **Publisher:** Pearson Education		

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

PCC CE0258: Environmental Engineering Laboratory

Teaching Scheme			Examination Scheme	
Practical	02Hrs/Week		MSE	----
Tutorials	-		ISE/CA	25 Marks
Total Credits	1		ESE	25 Marks
			Total Marks	50 Marks

Prerequisites: NIL

Course Objectives:

1	To develop practical skills in determining the physical, chemical, and biological characteristics of water and wastewater using standard laboratory procedures.
2	To familiarize students with laboratory techniques for assessing water quality, wastewater quality, and treatment process performance.
3	To develop the ability to analyze and interpret laboratory results for the design and operation of water supply and wastewater treatment systems.
4	To provide practical exposure to water treatment plants (WTP) and sewage treatment plants (STP), enabling students to understand treatment processes, unit operations, and field practices.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Perform laboratory tests to determine the physical, chemical, and biological characteristics of water and wastewater in accordance with standard procedures.
CO2	Analyze laboratory results to assess water quality, wastewater quality, and the efficiency of water and wastewater treatment processes.
CO3	Apply laboratory data for the analysis and basic design of water treatment units, water distribution systems, sanitary sewers, and wastewater treatment units.
CO4	Prepare technical reports based on laboratory experiments and field visits to water and sewage treatment plants, demonstrating an understanding of treatment processes, plant components, and operational practices.

Term Work /List of Experiments/ List of Assignments

Any 8 Experiments based on following list

Expt.No	Name of Experiment	CO
A. Water Quality Analysis (Any six experiments)		
1.	pH, Acidity and Alkalinity of Water	**CO1**
2.	Determination of Chlorides Content	**CO2**
3.	Determination of Hardness – Total, Temporary and Permanent	**CO3**
4.	Measurement of Turbidity	**CO4**

5.	Residual Chlorine Determination	**CO1**
6.	Total Dissolved Solids (TDS) using Electrical Conductivity	**CO2**
7.	Dissolved Oxygen (DO) by Winkler Method/DO meter	**CO3**
8.	Most Probable Number (MPN) Test	**CO4**
9.	Optimum Dose of Alum by Jar Test	**CO1**
10.	Determination of Fluoride / Iron Content(any one)	**CO2**
B.	**Municipal Wastewater Characterization (Any 4 Experiments)**	
1.	pH and Alkalinity of Wastewater	**CO4**
2.	Total Solids, Suspended Solids and Dissolved Solids	**CO1**
3.	Biochemical Oxygen Demand (BOD)	**CO2**
4.	Chemical Oxygen Demand (COD)	**CO3**
5.	Sulphates / Oil & Grease(any one)	**CO4**
C.	**Design / Analysis Problems (Mandatory)**	
1.	Design/analysis of water treatment units	**CO1**
2.	Design/analysis of water distribution systems	**CO2**
3.	Design/analysis of sanitary sewers and wastewater treatment units	**CO3**
D.	**Field Visits to water treatment and sewage treatment plant and preparation of reports (Mandatory).** **The report should contain:** Process flow diagram, Description of units, Plant capacity, Observations and learning outcomes	**CO4**

Text Books

Environmental Engineering (Vol. I): Water Supply Engineering Author: B. C. Punmia, Ashok K. Jain & Arun K. Jain **Publisher:** Laxmi Publications

Environmental Engineering (Vol. II): Wastewater Engineering Author: B. C. Punmia, Ashok K. Jain & Arun K. Jain **Publisher:** Laxmi Publications

Water Supply Engineering Author: S. K. Garg **Publisher:** Khanna Publishers

Water and Wastewater Engineering Author: Fair, Geyer & Okun **Publisher:** John Wiley & Sons

Reference Books

Standard Methods for the Examination of Water and Wastewater Author: APHA, AWWA & WEF **Publisher:** American Public Health Association (Latest Edition)

Wastewater Engineering: Treatment and Resource Recovery Author: Metcalf & Eddy, Inc. **Publisher:** McGraw-Hill Education

CPHEEO Manual on Sewerage and Sewage Treatment Systems Publisher: Ministry of Housing and Urban Affairs, Government of India

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

CE02509: Programme Elective – 01 Laboratory

Teaching Scheme			Examination Scheme	
Practical	02Hrs/Week		MSE	----
Tutorials	-		ISE/CA	25 Marks
Total Credits	1		ESE	
			Total Marks	25 Marks

Prerequisites: NIL

Course Objectives:

1	To provide hands-on experience in conducting laboratory experiments related to the selected Programme Elective and strengthen the understanding of theoretical concepts.
2	To develop analytical, problem-solving, and technical communication skills through experimentation, interpretation of results, and preparation of laboratory reports.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Perform laboratory experiments using appropriate equipment, software, and standard procedures related to the selected Programme Elective, and interpret the experimental results.
CO2	Analyze experimental observations, prepare technical reports, and demonstrate professional skills in presenting findings and solving engineering problems.

Term Work /List of Experiments/ List of Assignments

Any 8 Experiments based on following list

Expt. No	Name of Experiment	CO
1.	Assignment on Unit-1	**CO1**
2.	Assignment on Unit-2	**CO2**
3.	Assignment on Unit-3	**CO1**
4.	Assignment on Unit-4	**CO2**
5.	Assignment on Unit-5	**CO1**
6.	Assignment on Unit-6	**CO2**
7.	Study Visit Report	**CO1**
8.	Activity report based on Subject	**CO2**

Text Books

Soil Mechanics and Foundation Engineering Author: B. C. Punmia, Ashok K. Jain & Arun K. Jain
Publisher: Laxmi Publications

Reference Books
Principles of Geotechnical Engineering Author: Braja M. Das **Publisher:** Cengage Learning

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

CE02510: Multi-disciplinary Minor– 03 Lab

Teaching Scheme			Examination Scheme	
Practical	02Hrs/Week		MSE	----
Tutorials	-		ISE/CA	25 Marks
Total Credits	1		ESE	
			Total Marks	25 Marks

Prerequisites: NIL

Course Objectives:

1	To impart skills to perform laboratory experiments for determination of index and engineering properties of soil
2	To interpret the experiment results and draw valid conclusions

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Demonstrate skill to conduct laboratory experiments as per standard procedure to determine soil properties.
CO2	Analyze soil properties and describe soil performance

Term Work /List of Experiments/ List of Assignments

Any 8 Experiments based on following list

Expt. No	Name of Experiment	CO
1	Assignment on Unit-1	**CO1**
2	Assignment on Unit-2	**CO2**
3	Assignment on Unit-3	**CO1**
4	Assignment on Unit-4	**CO2**
5	Assignment on Unit-5	**CO1**
6	Assignment on Unit-6	**CO2**
7	Study Visit Report	**CO1**
8	Activity report based on Subject	**CO2**

Text Books

Soil Mechanics and Foundation Engineering Author: B. C. Punmia, Ashok K. Jain & Arun K. Jain **Publisher:** Laxmi Publications

Reference Books

Principles of Geotechnical Engineering Author: Braja M. Das **Publisher:** Cengage Learning

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

CE02511: Minor Project

Teaching Scheme			**Examination Scheme**	
Practical	02Hrs/Week		MSE	----
Tutorials	-		ISE/CA	25 Marks
Total Credits	1		ESE	
			Total Marks	25 Marks

Prerequisites: NIL

Course Objectives:

1	Develop critical thinking and problem-solving skills for planning, analyzing, and executing civil engineering projects.
2	Foster creativity and innovation in designing sustainable and practical engineering solutions.
3	Enhance collaboration, leadership, and teamwork through multidisciplinary group-based project work.
4	Improve technical communication skills through effective project planning, documentation, report writing, and presentations.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Apply civil engineering principles and engineering concepts to develop and execute a mini-project from problem identification to implementation.
CO2	Analyze technical challenges encountered during project execution and propose efficient, sustainable, and innovative engineering solutions.
CO3	Demonstrate teamwork, project planning, and project management skills while executing multidisciplinary engineering projects.
CO4	Prepare comprehensive technical reports and deliver professional presentations to effectively communicate project objectives, methodology, results, and conclusions.

Term Work /List of Experiments/ List of Assignments

Expt. No	Name of Experiment	CO
1.	**Course Contents** Mini Project shall involve practical, experimental, analytical, computational, or field-based work addressing technical, societal, and environmental issues related to Civil Engineering. The project shall encourage students to apply engineering knowledge, develop innovative solutions, and strengthen problem-solving, teamwork, and communication skills. The project may be undertaken in, but is not limited to, the following areas: • **Experimental Studies:** Conducting laboratory or field experiments to investigate civil engineering problems and develop practical solutions. • **Computer-Based Analysis and Design:** Application of software	**CO1, CO2,CO3, CO4**

tools for analysis, design, modelling, and simulation of civil engineering systems and structures.

- **Structural Audit and Health Monitoring:** Assessment of existing structures, identification of defects, evaluation of structural performance, and recommendation of maintenance or rehabilitation measures.
- **Innovative Construction Materials:** Investigation and application of sustainable, high-performance, recycled, or advanced construction materials.
- **Environmental Impact Assessment:** Evaluation of environmental impacts of civil engineering projects and development of appropriate mitigation measures.
- **Water Resources Engineering:** Planning and design of water supply systems, irrigation schemes, rainwater harvesting, watershed management, and groundwater conservation.
- **Sanitation and Waste Management:** Planning and design of sewerage systems, wastewater treatment, solid waste management, and resource recovery techniques.
- **Transportation Engineering:** Analysis and improvement of transportation systems, traffic management, pavement performance, road safety, and sustainable mobility solutions.
- **Surveying and Geomatics:** Applications of Total Station, GPS, GIS, Remote Sensing, Drone Surveying, and digital mapping in civil engineering projects.
- **Construction Engineering and Management:** Construction planning and scheduling, Building Information Modelling (BIM), project management, cost estimation, quality control, and safety management.
- **Geotechnical and Foundation Engineering:** Site investigations, soil characterization, slope stability, retaining structures, and foundation-related studies.
- **Smart and Sustainable Infrastructure:** Development of smart city solutions, green buildings, energy-efficient infrastructure, and climate-resilient engineering practices.
- **Artificial Intelligence and Digital Technologies in Civil Engineering:** Application of Artificial Intelligence (AI), Machine Learning (ML), Internet of Things (IoT), Digital Twins, and data analytics for civil engineering applications.

The above list is **illustrative only** and does not limit the scope of the Mini Project. Students may undertake any other project relevant to Civil Engineering with the approval of the course coordinator or department.

Workload: One Mini Project shall be carried out by a group of **four to five students**. The **minimum workload shall be 1 hour per week per group**, in accordance with **AICTE Guidelines**.

Guidelines

1. **Group Formation:**

The Mini Project shall be undertaken in groups consisting of **four (4) to five (5) students**.

2. **Batch Structure:**

Each batch shall consist of **five (5) to six (6) groups**. A faculty member

	shall normally be assigned to supervise only one batch. Domain-specific faculty members may act as project guides depending on the project area. 3. **Project Identification:** Students shall identify a suitable project topic through interaction with the course coordinator, faculty guide, industry experts, or community stakeholders. A comprehensive literature survey and/or need assessment shall be carried out to finalize the project title, aim, objectives, and scope. 4. **Project Proposal:** Each group shall prepare and submit a detailed project proposal during the **first week of the semester**. The proposal shall include the problem statement, objectives, methodology, expected outcomes, software and hardware requirements, work plan, and anticipated challenges. 5. **Project Execution:** The project shall involve appropriate experimental investigations, field studies, analytical work, software-based analysis and design, modelling, simulation, or prototype development, depending on the selected topic. The use of modern engineering software and digital tools is encouraged. 6. **Progress Monitoring:** Students shall maintain a project diary/logbook documenting weekly progress, discussions, observations, and outcomes. Regular review meetings with the faculty guide shall be conducted throughout the semester. 7. **Project Report and Submission:** A comprehensive technical report containing the literature review, methodology, analysis, results, discussions, conclusions, and future scope shall be submitted before the End-Semester Evaluation. 8. **Presentation and Evaluation:** The project shall be evaluated through the following stages: ○ **Synopsis Presentation:** Presentation of the project proposal, objectives, methodology, and work plan. ○ **Progress Presentations (ISE):** Periodic presentations (preferably every two weeks) to evaluate the progress of the project as part of the In-Semester Evaluation. ○ **Final Presentation (ESE):** Presentation and demonstration of the completed project along with the final technical report during the End-Semester Evaluation. 9. **Project Continuity:** Students are encouraged to select a project that extends the work carried out during the **Community Field Project** in the fifth semester. Such projects may be further developed into the **Major Project** during the final year of the B.Tech. programme. 10. **Originality and Ethics:** The Mini Project shall be an original contribution by the student group. Proper citation of references, adherence to ethical practices, and avoidance of plagiarism are mandatory.	
Text Books		
Construction Project Management: Theory and Practice Author: Kumar Neeraj Jha **Publisher:** Pearson Education		
Project Management: A Systems Approach to Planning, Scheduling and Controlling Author: Harold Kerzner **Publisher:** Wiley India		
Research Methodology: Methods and Techniques Author: C. R. Kothari & Gaurav Garg **Publisher:** New Age International Publishers		
Reference Books		

Project Management for Engineering, Business and Technology Author: John M. Nicholas & Herman Steyn **Publisher:** Routledge (CRC Press)
Engineering Research Methodology Author: R. Panneerselvam **Publisher:** PHI Learning Pvt. Ltd.
Technical Communication: Principles and Practice Author: Meenakshi Raman & Sangeeta Sharma **Publisher:** Oxford University Press

Shivaji University, Kolhapur

Third Year (Sem- VI) B.Tech. Civil Engineering

CE0261: Design of Concrete Structures-I (Programme Core Course)

Teaching Scheme			Examination Scheme	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	---		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: Basic knowledge of Engineering Mechanics, Strength of Materials, Structural Analysis, and the properties of concrete and steel is required.

Course Objectives:

1	To understand the fundamental concepts of Reinforced Cement Concrete (RCC) structural design.
2	To develop the ability to conceive and design basic RCC structural elements.
3	To impart knowledge of the strength determination and design of various reinforced concrete structural elements in accordance with the relevant Indian Standard (IS) Codes.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Understand the basic principles of Engineering Mechanics, Mathematics, Strength of Materials, and Structural Analysis required for the design of concrete structures.
CO2	Understand the complete design process of reinforced concrete structures based on relevant IS Codes and the Limit State Method.
CO3	Apply the Limit State Method to design RCC structural elements such as slabs, beams, columns, footings, and staircases.
CO4	Design individual RCC structural members and integrate them into the design of a complete building structure.

	Course Contents	COs	Hours
Unit 1	**Introduction to RCC** Introduction- Stress strain behavior of concrete and steel, Behavior of RCC, Permissible stresses in steel and concrete, Design philosophies, Various limits states, Characteristics strength and Characteristic load, Load factor, Partial safety factors. Limit state of collapse (flexure): Analysis and Design of Singly Reinforced rectangular sections	**CO1**	**(08)**
Unit 2	**Limit state of collapse (flexure)** Analysis and Design of Doubly Reinforced rectangular sections, Singly reinforced T and L beams.	**CO2**	**(06)**
Unit 3	**Limit state of collapse(shear and bond)** Limit state of collapse (shear and bond): Shear failure, Types of Shear reinforcement, Design of Shear reinforcement, Bond-types, Factors affecting bond Resistance, Check for development length. (No Numerical on bond)	**CO3**	**(06)**
Unit 4	**Design of slabs & staircase** One-way, two way with different support conditions as per IS:456, Cantilever slab. And Design of Simply Supported Doglegged staircase.	**CO4**	**(08)**

Unit 5	**Design of Columns** Analysis and Design of axially loaded column introduction of eccentrically (uniaxial) loaded circular and rectangular columns, Introduction of Interaction diagram.	**CO5**	**(06)**
Unit 6	**Design of Footings** Design of isolated rectangular column footing with constant depth subjected to axial load and moment	**CO6**	**(06)**

Text Books

Fundamentals of Reinforced Concrete – Sinha and Roy, S. Chand & Company Ltd., Ram Nagar, New Delhi.

Limit State Theory and Design of Concrete Structures – Shah and Karve, Structures Publications.

Reinforced Concrete Design – Limit State – A. K. Jain, Chand Brothers, Roorkee.

Reference Books

Design of Reinforced Concrete Structures – S. Ramamrutham, Dhanpat Rai Publications.

Limit State Design of Reinforced Concrete – P. C. Varghese, Prentice Hall, New Delhi.

SP: 16 – Design Aids for Reinforced Concrete to IS 456 – Bureau of Indian Standards (BIS).

Shivaji University, Kolhapur

Third Year (Sem- VI) B.Tech. Civil Engineering

CE0262: Concrete Technology

Teaching Scheme			Examination Scheme	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	---		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: NIL

Course Objectives:

1	To understand process of concrete manufacturing and to study properties of fresh concrete.
2	To study mix design of concrete by using IS code method and ACI method
3	To study different Non Destructive Tests (NDT).
4	To study different types of special concrete and their manufacturing.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Explain the fundamentals of process of making good quality concrete and its elastic properties.
CO2	Understand the fresh and hardened properties of concrete.
CO3	Design the concrete mix proportion as per Indian standard code of practice.
CO4	Demonstrate Non Destructive Testing (NDT) and evaluate quality of existing concrete.
CO5	Understand different types of special concrete and their applications.

	Course Contents	COs	Hours
Unit 1	**Ingredients of Concrete: Cement:** Manufacturing process of cement, chemical composition, grades of cement, hydration, types of cement, Tests for cement: fineness, Standard consistency, setting time, soundness and compressive strength. **Aggregates**: classification, requirements, Tests for coarse aggregates: specific gravity, grading of aggregate, Flakiness index, Elongation Index, Impact value, abrasion value, crushing value. Tests for fine aggregates: specific gravity, sieve analysis, fineness modulus. Alkali aggregate reaction, bulking of sand, Artificial and Recycled aggregate. **Water**: general requirements, quality of water.	**CO1**	**(08)**
Unit 2	**Fresh Concrete:** Workability: factors affecting, different tests for measurement of workability. Segregation, bleeding. Manufacturing process of concrete: batching, mixing, transportation, compaction, curing of concrete, curing methods.	**CO2**	**(06)**
Unit 3	**Admixtures in concrete:** a) Chemical Admixtures: Plasticizers, Super plasticizers, Retarders, Air entraining agents, IS 9103Specifications b) Mineral Admixtures: Fly ash, Silica Fume, GGBS, Rice husk ash, metakaolin	**CO3**	**(06)**

Unit 4	**Concrete Mix Design:** Objectives of mix design, different methods of mix design, factors affecting mix proportions, quality control of concrete, statistical methods, acceptance criteria, Numerical on mix design by ACI 211.1-1991, IS 10262- 2009andIS 456 -2000. Mix design of fly ash concrete by IS 10262 – 2009.	**CO4**	**(08)**
Unit 5	**Hardened concrete:** Strength of concrete: w/c ratio, gel/space ratio, gain of strength with age, maturity concept of concrete, effect of maximum size of aggregate on strength. Test on hardened concrete: compressive strength, comparison of compressive strength between cube test and cylinder test, flexural strength. Relation between compressive and tensile strength. Elastic constants, factors affecting modulus of elasticity, definition and factors affecting creep and shrinkage. Nondestructive testing: Schmidt's rebound hammer, Ultrasonic pulse velocity method.	**CO5**	**(06)**
Unit 6	**Special Concretes and Durability of concrete:** a. Special Concretes: Light weight concrete, Polymer modified concrete, concept of fibre reinforced concrete, High performance concrete, Pumpable concrete, Roller compacted concrete, Self compacting concrete. b. Durability of concrete: Significance, Permeability and Durability, Chemical Attack, Sulphate attack, Attack by Seawater, Acid attack, Chloride attack, Carbonation of concrete and its determination.	**CO6**	**(06)**

Text Books

Concrete Technology – M. S. Shetty, S. Chand Publications.

Concrete Technology – M. L. Gambhir, Tata McGraw-Hill.

Concrete Technology – A. R. Santhakumar, Oxford University Press.

Reference Books

Properties of Concrete – A. M. Neville, Pearson Education India.

Concrete Technology – R. S. Varshney, Oxford & IBH Publishing.

Microstructure and Properties of Concrete – P. Kumar Mehta, Prentice Hall.

IS Codes

IS 10262:2019 – Concrete Mix Proportioning – Guidelines. *(Latest revision; replaces IS 10262:2009.)*

IS 456:2000 – Plain and Reinforced Concrete – Code of Practice.

Shivaji University, Kolhapur

Third Year (Sem- VI) B.Tech. Civil Engineering

CE0263: TRANSPORTATION ENGINEERING

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/Week		MSE	30 Marks
Tutorials	1 Hrs/Week		ISE/CA	10 Marks
Total Credits	4		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: Engineering Mechanics, and Basic Civil Engineering.

Course Objectives:

1	To understand the process of road development and highway planning.
2	To familiarize students with the current highway development programmes and schemes in India.
3	To understand the planning, components, and design aspects of railway infrastructure.
4	To impart knowledge of airport planning, aviation infrastructure, and runway systems.
5	To introduce the planning, design, and functional elements of harbor and waterfront structures.
6	To understand the importance, planning, and construction methods of tunnels in transportation infrastructure.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Understand road development, highway planning principles, geometric design, sight distance, drainage, and highway cross-sectional elements as per IRC standards.
CO2	Apply concepts of traffic flow, traffic analysis, traffic regulation, intersection design, and highway capacity for developing safe and efficient transportation systems.
CO3	Explain the components of permanent way, track behavior, geometric design, points and crossings, and modern railway transportation systems.
CO4	Understand airport planning, site selection, runway design, airport layout, markings, lighting, and passenger terminal facilities.
CO5	Explain harbor planning, layout, coastal protection works, dock types, and terminal facilities for safe and efficient ship operations.

	Course Contents	**COs**	**Hours**
Unit 1	**Introduction to Highway Engineering:** Brief History of Road Development in India, Current Road Network Statistics. Objects of Planning, Planning Surveys and their Interpretation. Introduction to, IRC, NHAI, NHDP Phases. Terrain classification, design speed, vehicular characteristics, highway cross-section elements. Sight distance: Introduction to sight distance, reaction time, analysis of safe sight distance, analysis of overtaking sight distance, intersection sight distance.	**CO1**	**(08)**
Unit 2	**Geometric Design of Highways:** Design of horizontal alignment: Highway alignment & Surveys, horizontal curves, super elevation, radius at horizontal curves, widening of pavements, transition curves. Design of vertical alignment: types of gradients, grade compensation, analysis of vertical curves, Safe system approach. Design of Highway Drainage: Objects, Requirements, Importance and Types of Highway Drainage.	**CO2**	**(06)**

Unit 3	**Introduction to Traffic Engineering:** Introduction to Traffic Engineering: Definition, objectives and scope of Traffic Engineering, Traffic Flow, Statistical Analysis of Traffic Data, Traffic Regulation and Control, Types of intersection, Highway capacity	**CO3**	**(06)**
Unit 4	**Introduction to Railway Engineering:** Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Track Stress, coning of wheels, creep in rails, defects in rails–Route alignment surveys, conventional and modern methods Geometric design of railways, gradient, super elevation, widening of gauge on curves, Points and Crossings. Electrification of railways, sleeper-less tracks, Modern Transit Rail Transport such as Metro, Hyper loop, Bullet Train etc	**CO4**	**(08)**
Unit 5	**Introduction to Airport Engineering:** Air transport characteristics, airport classification, airport planning: objectives, components, criteria for airport site selection and typical airport layouts, Runway Design, Orientation, Wind Rose Diagram, Runway length, Passenger Facilities and Services, Runway and Taxiway Markings, Pavement and lighting, recent development in International Airports..	**CO5**	**(06)**
Unit 6	**Introduction to Docks, Harbors, and Tunnel Engineering:** Definition of Basic Terms, Planning and Design of Harbors, Requirements, Classification, Harbor Layout and Terminal Facilities, Wave action on Coastal Structures and Coastal Protection Works. Dry dock and wet dock differentiation. Introduction,SizeandShapeofTheTunnel,TunnelingMethodsinHardRock&Soft Material, Tunnel Lining, Tunnel Lighting, Drainage and Ventilation, Tunneling using Tunnel Boring Machine, Trenchless Construction Method (TCM).	**CO6**	**(06)**

Text Books

Highway Engineering – S. K. Khanna and C. E. G. Justo, Nem Chand & Bros., Roorkee.

Highway Engineering – L. R. Kadiyali, Khanna Publishers, New Delhi.

A Course in Railway Engineering – Subhash C. Saxena and Satya Pal Arora, Dhanpat Rai & Sons, New Delhi.

Reference Books

Principles, Practice and Design of Highway Engineering – S. K. Sharma, S. Chand Publishing, New Delhi.

Principles of Transportation Engineering – Partha Chakraborty and Animesh Das, Prentice Hall.

Transportation Engineering – K. P. Subramanyam, Scitech Publications, Chennai.

Shivaji University, Kolhapur

Third Year (Sem- VI) B.Tech. Civil Engineering

CE0264: Program Elective 02:- Advanced Design of RC Structures

Teaching Scheme			Examination Scheme	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	---		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: Engineering Mechanics, and Basic Civil Engineering.

Course Objectives:

1	To understand the concept and design of large span concrete roofs and deep beam
2	To analyze the stresses in chimney, design of chimney
3	To understand the design of elevated water tank and its elements and retaining wall
4	To understand yield line analysis and design of slab.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Analysis and design of large span concrete roofs anddesign flat slab as per IS 456-2000
CO2	Analysis and design deep beams
CO3	Analysis of stresses in concrete chimney and design the chimney
CO4	Analysis and design overhead water tank with codal provision of 3370-2009
CO5	Analysis and design of cantilever and counter fort retaining wall
CO6	Describe yield line theory and analyze rectangular and circular slab by yield linet heory

	Course Contents	COs	Hours
Unit 1	Large span concrete roofs with detail Classification Behavior of Flat slabs, Direct design and equivalent frame method with Codal provisions	**CO1**	**(06)**
Unit 2	Analysis of deep beams and design as per IS 456-2000	**CO2**	**(06)**
Unit 3	Analysis of stresses in concrete chimneys with un cracked and cracked sections, Codal provisions, Design of chimney.	**CO3**	**(06)**
Unit 4	Overhead water tanks, rectangular and circular with flat bottom, spherical and conical tank roofs, Staging, Design based on IS 3370 -2009	**CO4**	**(08)**
Unit 5	Analysis and Design of cantilever and counter fort retaining walls with horizontal and inclined surcharge.	**CO5**	**(06)**
Unit 6	Yield line analysis of slabs, virtual work and equilibrium method of analysis, simply supported rectangular slabs with corners held down uniform and concentrated loads, design	**CO6**	**(06)**

	of simply supported rectangular and circular slabs		

Text Books

Reinforced Concrete Structural Elements – P. Purushothaman, Tata McGraw-Hill.

Design and Construction of Concrete Shell Roofs – G. S. Ramaswamy.

Reinforced Concrete – Ashok K. Jain, Nem Chand & Bros., Roorkee.

Reference Books

Advanced Reinforced Concrete Design – P. C. Varghese, Prentice Hall of India.

Reinforced Concrete Design – S. Unnikrishna Pillai and Devdas Menon, Tata McGraw-Hill.

Limit State Design of Reinforced Concrete – P. C. Varghese, PHI Learning.

Shivaji University, Kolhapur

Third Year (Sem- VI) B.Tech. Civil Engineering

CE0264 Program Elective 02: -Air Pollution and Control

Teaching Scheme			Examination Scheme	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	---		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: NIL

Course Objectives:

1	To introduce the fundamentals of air pollution including atmospheric structure, sources, and characteristics of particulate and gaseous pollutants.
2	To understand the effects of air pollutants on living and non-living systems and the role of meteorological factors in air pollution dispersion.
3	To familiarize students with air pollution monitoring methods, air quality standards, and regulatory control mechanisms.
4	To impart knowledge of engineering control techniques for particulate and gaseous pollutants and air pollution management strategies in India.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Explain the structure of the atmosphere, sources, and characteristics of particulate and gaseous air pollutants.
CO2	Analyze the effects of air pollution on human health and the environment, considering major air pollution episodes and meteorological influences.
CO3	Apply air pollution monitoring techniques, air quality standards, and regulatory frameworks for air quality assessment.
CO4	Select and describe suitable control technologies for the removal of particulate and gaseous pollutants and outline air pollution control strategies in India.

Course Contents		COs	Hours
Unit 1	The structure of the atmosphere, Definition and Scope of Air Pollution, Sources of air pollution: Natural and artificial, quantity and composition of particulate & gaseous pollutant, Unit of measurements.	**CO1**	**(06)**
Unit 2	Effect of different air pollutants on living and non-living things. Preventive measures to overcome bad effects. Various air pollution Episodes.	**CO2**	**(06)**
Unit 3	The meteorology and air pollution: Different Meteorological factors &there effects, lapse rate and stability of atmosphere, inversion phenomenon, various meteorological factors like precipitation, humidity, temperature. wind patterns, direction, velocity and fluctuations, models of diffusion and dispersion plume behavior.	**CO3**	**(06)**

Unit 4	Introduction to application of software for air quality. Air pollution monitoring and regulatory control, Ambient Air quality standards, emission limits, ambient air & stack sampling, equipment for ambient air and stack sampling, methods of sampling, pollution monitoring of existing sources and new installations.	**CO4**	**(08)**
Unit 5	Control of pollutant emission at source, alternative fuels, process change, removal methods for particulate, principles of particulate removals, various types of particulate control equipment, settling chamber, cyclone separators and scrubbers, fabric filters, electrostatic precipitators.	**CO5**	**(06)**
Unit 6	a) Principles of removal of gaseous pollutants. Vehicular pollution, composition, quantity &control. b) Status of air pollution in India, air pollution control act and strategy for effective control of air pollution.	**CO6**	**(06)**

Text Books

Environmental Engineering – Howard S. Peavy, Donald R. Rowe, and George Tchobanoglous.

Air Pollution: Its Origin and Control – Kenneth Wark and Cecil F. Warner, Harper & Row.

Air Pollution and Control – Martin Crawford, Tata McGraw-Hill, 1st Edition.

Reference Books

Air Pollution – Martin Crawford.

Air Pollution and Industry – R. D. Ross.

Environmental Pollution Control Engineering – C. S. Rao, Wiley Eastern Ltd., New Delhi.

Shivaji University, Kolhapur

Third Year (Sem- VI) B.Tech. Civil Engineering

CE0264 Program Elective 02:-Foundation Engineering

Teaching Scheme			Examination Scheme	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	---		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: NIL

Course Objectives:

1	To study different types of soils, foundation and their applications.
2	To learn the stability analysis of structure using specific foundation system.
3	To study the analysis of load carrying capacity of foundations.
4	To enhance the knowledge about structural foundations in weak soils.
5	To learn dynamic analysis of foundations for industrial machines
6	To study the types & analysis process for earth & water retaining structures.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Understand the different types of foundations & their necessities.
CO2	Select the suitable foundation system based on soil and loading conditions.
CO3	Calculate dimensions and capacity of shallow foundations
CO4	Design the foundations for Industrial machines under dynamic loadings.
CO5	Understand suitable technique for weak soil to enhance the stability of foundations.
CO6	Analyze the earth and water retaining structures used for special functions.

	Course Contents	COs	Hours
Unit 1	**Shallow Foundations** 1.1 Types & shapes of shallow foundation, minimum depth of foundation 1.2 Calculation of bearing capacity of soil by Terzaghi's theory, IS Code method &Skempton's approach 1.3 Concept of proportioning of footings (Isolated), calculation of immediate and consolidation settlement, foundation on slopping ground etc. 1.4Different shapes, bending moment diagrams & Dimensional analysis of rectangular & Trapezoidal combined footings 1.5 RCC design of Isolated box & slopped type footings wither enforcement details	**CO1**	**(06)**
Unit 2	**Raft Foundation** 2.1 Introduction to raft or mat foundation, necessity & types of rafts	**CO2**	**(06)**

	2.2 Analysis of bearing capacity and settlements of raft or mat foundation 2.3 Design guidelines for raft foundation, types of raft design, floating foundation & problems associated with floating foundation. 2.4 Analysis of raft or mat foundation by Rigid method (Conventional method)& Elastic plate method (IS Code method) 2.5 Calculation of soil pressure at different points in a raft foundation		
Unit 3	**Pile Foundation** 3.1 Introduction, necessity, advantages and classification of piles 3.2 Calculation of load capacity of single pile by static formulae in cohesive & cohesion less soils and by dynamic formulae, pile load test etc. 3.3 Group action of files, efficiency of group of piles, Feld's rule, Seiler-Keeney formula, Converse-Labarre formula etc. 3.4 Concept of negative skin friction and its estimation, settlement in pile foundation, estimation of load on single pile in a group of pile etc. 3.5 Calculation of group capacity of pile in cohesive soil, under reamed pile –its application and installation techniques	**CO3**	**(06)**
Unit 4	**Machine Foundations** 4.1 Introduction to machine foundation, types of machine foundations, terms related to dynamic loadings, static and dynamic design criteria etc. 4.2Permissible amplitude of vibrations for different types of machines, calculation of probable amplitude, amplitude ratio & maximum amplitude, criteria for design of machine foundations, 4.3 Design criteria for foundations of reciprocating machines (IS2974-Part-I), design criteria for foundations of impact type machines (IS2974Part-II) 4.4 Vibration Isolation & Its methods, vibration effects on soil etc.	**CO4**	**(08)**
Unit 5	**Sheet Piles** 5.1 Introduction to sheet piles, types and uses of sheet piles 5.2 Analysis & design of cantilever sheet pile walls in cohesive &cohesion less(granular) soils, 5.3 Anchored bulkhead, free earth support and fixed earth support method 5.4 Introduction to coffer dams, different types of coffer dam, uses of cofferdams, construction techniques of cofferdams etc	**CO5**	**(06)**
Unit 6	**Foundations in difficult soils and soil stabilization** 6.1 Introduction to difficult or weak soils, foundations in expansive soils, foundations in soft & compressible soils 6.2 Problems associated with foundation installation- ground water lowering and drainage, shoring and underpinning, different methods, damage and vibrations due to constructional operations. 6.3 Introduction to soil stabilization, methods of stabilization & their applications - mechanical stabilization, cement stabilization, lime stabilization, bituminous stabilization, chemical stabilization &stabilization by grouting	**CO6**	**(06)**

Text Books

Foundation Engineering", by P. C. Varghese, Prentice Hall India Learning Private Limited

"Raft Foundation Design and Analysis with a Practical Approach", by Sharat Chandra Gupta, New age Publisher 1997

“Pile foundation Design & Construction”, by Satyendra Mittal, CBS Publishers &Distributers Pvt. Ltd.
Reference Books
Principles of Foundation Engineering”, by Braja. M. Das, Cengage India Private Limited
“Foundation Analysis & Design”, by Joseph Bowles, McGraw-Hill Education; 5thedition March 2001
“Foundation Design “, by W. C. Teng, Prentice Hall of India PVT. LTD, New Delhi

Shivaji University, Kolhapur

Third Year (Sem- VI) B.Tech. Civil Engineering

CE0264 Program Elective 02: Airport Engineering

Teaching Scheme			Examination Scheme	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	---		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: NIL

Course Objectives:

1	To understand the fundamentals of Airport Engineering
2	To determine the runway orientation, design of runway and airport facilities
3	To plan geometric design, and construction of various facilities of the Airport
4	To know the operational management of the various facilities of the Airport.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Explain Airport Engineering in the Context of Regional Mass Transportation Systems
CO2	Apply design principles of planning to Airport Infrastructure
CO3	Evaluate Parking Configurations and Apron Facilities.
CO4	Design Runways, Taxiways, Aprons, and Cargo Facilities.

Course Contents		COs	Hours
Unit 1	History of Air transportation, policy of air transportation, air transport activities. Airport Engineering- Aircraft characteristics and their influence on airport planning.	**CO1**	**(06)**
Unit 2	Airport planning: topographical and geographical features, air traffic characteristics, and development of new airports, factors affecting airport site selection Airport obstruction: Zoning laws, classification of obstruction, imaginary surfaces, approach zones, turning zones.	**CO2**	**(06)**
Unit 3	Runway orientation, wind rose diagrams, and basic runway length. Correction of runway length, airport classification, geometric design, airport capacity, run way configuration, taxiway design, geometric standards	**CO3**	**(06)**
Unit 4	Exit taxiways, holding aprons, location of terminal buildings, aircraft hangers and parking. Airport marking and lighting: marking and lighting of runways, taxiways and approach areas.	**CO4**	**(08)**
Unit 5	Terminal area, planning of terminal building, Apron: size of the gate position, number of gate position, Aircraft parking system; Hanger: general planning considerations, blast considerations.	**CO5**	**(06)**
Unit 6	Air traffic control: Air traffic control aids, Enroute aids, landing aids. Airport Drainage: requirement of airport drainage, design data, surface drainage design, subsurface drainage design.	**CO6**	**(06)**

Text Books

Airport Engineering by G.V. Rao. Rao, Tata McGraw Hill
Airport Planning & Design, by Khanna and Arora, Nemchand Bros, Roorkee
Reference Books
Airport Planning & Design by Khanna &Arrora.

Shivaji University, Kolhapur

Third Year (Sem- VI) B.Tech. Civil Engineering

CE0265 Program Elective 03: Design of Bridges

Teaching Scheme			Examination Scheme	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	---		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: NIL

Course Objectives:

1	To understand the types of bridges and its suitability.
2	To understand the design concept of bridges i.e. Superstructure and substructure.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Classify the types of bridges and its components.
CO2	Assess the different kinds of loading on the bridge.
CO3	Design the different types bridges.
CO4	Analyze the substructures of the bridges.

	Course Contents	COs	Hours
Unit 1	Introduction & Brief History of bridges, Classification, Importance of bridges, Components of bridges: Substructure-superstructure, Investigation for Bridges.	**CO1**	**(06)**
Unit 2	Standard specification for Road Bridges. I.R.C. bridge code, width of carriage way, clearances, loads to be considered i.e. D.L., L.L., Impact load, wind load, Earthquake load, Longitudinal force, Centrifugal force, buoyancy, Earth pressure, water current force, thermal force etc.	**CO2**	**(06)**
Unit 3	General design considerations. For R.C.C. & P.S.C. bridges. Traffic aspects for highway bridges. Aesthetics of bridge design, Relative costs of bridge components. Design of reinforced concrete, deck slab, Pigeaud's theory, beam and slab and T – beam, Courbon's theory.	**CO3**	**(06)**
Unit 4	Construction Techniques – Construction of sub structure footing, piles, caissons, construction of reinforced earth retaining wall and reinforced earth abutments, super structure – erection method for bridge deck construction by cantilever method, Repair, Strengthening, and Rehabilitation of Existing Bridges.	**CO4**	**(08)**
Unit 5	Design of sub structure–Abutments, Piers, Approach slab. (Numerical on Abutments, Pier)	**CO1**	**(06)**
Unit 6	Different types of bridge Bearing and expansion joints, forces on bearings, Types of bearings, design of unreinforced elastomeric bearings, expansion joints. (Numerical on	**CO2**	**(06)**

	Bearings)		
Text Books			
Design of Bridge Structures, -T.RJagadeesh and M.A.Jayaram, PHI Publications.			
Bridge Enginnering – Rangwala, Charotar Publications.			
Principles and practice of Bridge Engineering, S.P. Bindra ,Dhanapat Rai Publications.			
Reference Books			
Reinforced Concrete Structures – Vol. II by Dr. B. C. Punmia, Ashok Kumar Jain, ArunKumar Jain, Laxmi Publications.			
Concrete Bridge Practice, Analysis, Design and Economics by Dr. V. K. RAINA, TataMcGraw- Hills Publishing Company Limited.			
Bridge Engineering by S. Ponnuswamy, Tata McGraw-Hills Publishing Company Limited.			

Shivaji University, Kolhapur

Third Year (Sem- VI) B.Tech. Civil Engineering

CE0265 Program Elective-III:-Open Channel Hydraulics

Teaching Scheme			**Examination Scheme**	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	---		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: NIL

Course Objectives:

1	To Study the fundamental principles governing open channel hydraulics required to the design of engineering systems
2	To study various types of open channel flow and their analysis
3	To study and understand the techniques, skills and modern mathematical tools to applied to the river engineering problems

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Apply knowledge of open channel flow for designing most efficient channel section and computations of flow parameters
CO2	Analyze the Gradually varied, rapidly varied and spatially varied flow and apply to complex field problems
CO3	Design erodible channels by applying the knowledge of sediment transportation.
CO4	Collect, analyses the data and apply similitude to river models

	Course Contents	**COs**	**Hours**
Unit 1	Basic Fluid Flow Concepts: Basic equations (Continuity, Energy, Momentum) applied to OCF, Energy and Momentum correction factors, First and Second hydraulic exponent, Uniform flow computations by using section factor curve ,Determination of Rugosity coefficient 'n', Flow in channel transitions, Measurement of velocity of channel flow and sediment concentration in the flow by various methods. River Gauging by different methods.	**CO1**	**(06)**
Unit 2	Non-Uniform Flow in Open Channel: Computation of GVF in prismatic channels and Natural channels by different methods, Hydraulic jump in rectangular and nonrectangular channels, Location of Jump, Jump on sloping floor , Use of jump as Energy Dissipater (recommended by USBR and IS),Spatially-Varied Flow, Side weir, Bottom racks	**CO2**	**(06)**
Unit 3	Flow in Non-linear alignment and Non prismatic Channels: Nature of Flow, Spiral Flow, Energy Loss, Super elevation, Cross Waves, Design Considerations for Subcritical and Super critical flow, Standing wave flume, Venturi flume, Flow between bridge piers, Flow through culvert, Flow through Trash Racks.	**CO3**	**(06)**

Unit 4	Unsteady Flow in Open Channels: Gradually Varied Unsteady Flow, Flood routing, Rapidly Varied Flow, Waves and their classification, Celerity of a wave, Positive and negative Surges, SDam-break problem, Introduction to HEC RAS software	**CO4**	**(08)**
Unit 5	a) Dispersion in Open Channels: Diffusion and dispersion, Some classical solutions of the diffusion equation, Discharge measurement using tracer techniques b) Hydraulics of Mobile Bed Channels: Initiation of motion of sediment, Bed forms, Sediment Load, design of Erodible Channels, Regime Theory for Alluvial Channels	**CO1**	**(06)**
Unit 6	Hydraulic Models: Fixed bed river models (Distorted and Undistorted), Moveable bed Models, Model materials and construction, Physical model calibration and verification, Special-Purpose models	**CO2**	**(06)**

Text Books

Open Channel Hydraulics: By, Richard H. French, McGraw-Hill International Student Edition

Flow Through Open Channels: By, K. G. RangaRaju, Tata McGraw Hill Publsh. Co. Ltd.

Flow in Open Channels: By, K. Subramanyam, Tata McGraw Hill Publsh. Co. Ltd.

Reference Books

Open-Channel Flow: By, M. Hanif Chaudhary, Prentice-Hall International Publications

Mays, L. W., Water Resources Engineering, John Wiley and Sons, New York, 2001.

Rajesh Srivastava., Flow Through Open Channels, Oxford University Press, 2008.

Shivaji University, Kolhapur

Third Year (Sem- VI) B.Tech. Civil Engineering

CE0265 Program Elective 03:-Smart City, Green Building

Teaching Scheme			Examination Scheme	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	---		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: NIL

Course Objectives:

1	To understand the definition, concept & objectives of the green building and to imbibe basics of green design.
2	To understand planning specifications of green building.
3	To understand the definition, concept & objectives of the smart city.
4	To understand the policies of smart city.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Demonstrate green concept skills and apply tools of green building assessment.
CO2	Select appropriate green building material and technique.
CO3	Acquaint knowledge on smart cities planning and development.
CO4	Develop work break down structure, scheduling and project management of smart cities.

	Course Contents	COs	Hours
Unit 1	**Concept of Green Buildings** a) Definition of Green Buildings, typical features of green buildings, Necessity, Initiatives, Green buildings in India, Green building Assessment- Green Building Rating Systems(BREEAM, USGBC,LEED, IGBC, TERI-GRIHA, GREEN STAR), Criteria for rating, Energy efficient criteria, environmental benefits economic benefits, health and social benefits, Major energy efficiency areas for building, Life cycle cost of buildings, Codes and Certification Program b) 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)	**CO1**	**(06)**
Unit 2	**Green Building Materials,** Green Building Materials: Sustainably managed Materials, depleting natural resources of building materials; renewable and recyclable resources; energy efficient materials; Embodied Energy of Materials, Green cement, Biodegradable materials, Smart materials, Manufactured Materials, Volatile Organic Compounds (VOC's), Natural Non-Petroleum Based Materials, Recycled materials, Renewable and Indigenous Building Materials,	**CO2**	**(06)**

	Engineering evaluation of these materials.		
Unit 3	**Green Building Planning and Specifications** Green Building Planning and Specifications: Environment friendly and cost-effective Building Technologies, Integrated Life cycle design of Materials and Structures, Green Strategies for Building Systems, Alternative Construction Methods, Energy Conservation Measures in Buildings, Waste & Water management and Recycling in Sustainable Facilities, Heating, Ventilation and Air Conditioning, Passive Solar & Daylight, Plumbing and its Effect on Energy Consumption.	**CO3**	**(06)**
Unit 4	**Introduction to Smart cities** a) Introduction of Smart City, Concept of smart city, Objective for smart cities, History of Smart city world and India. Need to develop smart city. Introduction to city planning, Concept, principle stakeholders, key trends in smart cities developments. b) Intelligent transport systems: Smart vehicles and fuels, GIS, GPS, Navigation system, traffic safety management, mobility services, E-ticketing	**CO4**	**(08)**
Unit 5	**Project management and Policies in Smart Cities** a) Project management: Phases, Stages of project and work break down Structure, Project organization structure, Planning, Scheduling and CPM, Project cost analysis, resource allocation &leveling, Line of balancing technique, Project monitoring and control, Project risk management. Storage and conveyance system of water, sustainable water and	**CO1**	**(06)**
Unit 6	**Policies in Smart Cities** Sanitation, sewerage system, flood management, conservation system. Policy for Smart City: Integrated infrastructure management systems for smart city, Infrastructure management system applications for existing smart city. Worldwide policies for smart city Government of India policy for smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city.	**CO2**	**(06)**

Text Books

Alternative Building Materials and Technologies - By K S Jagadeesh, B V Venkata Rama Reddy & K S Nanjunda Rao - New Age International Publishers

Integrated Life Cycle Design of Structures - By AskoSarja - SPON Press

Green Buildings (McGraw hill publication): by Gevorkian

Reference Books

Smart City on Future Life - Scientific Planning and Construction by Xianyi Li

The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) by Nicos Komninos

Alternative Building Materials and Technologies - By K S Jagadeesh, B V Venkata Rama Reddy & K S Nanjunda Rao - New Age International Publishers

Shivaji University, Kolhapur

Third Year (Sem- VI) B.Tech. Civil Engineering

CE0265 Program Elective 03: Traffic Engineering

Teaching Scheme			Examination Scheme	
Lectures	3Hrs/Week		MSE	30 Marks
Tutorials	---		ISE/CA	10 Marks
Total Credits	3		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: NIL

Course Objectives:

1	Provide an insight on traffic and its components, factors affecting road traffic.
2	Provide an insight on traffic movements and speed studies.
3	Provides clear understanding on conducting various types of traffic surveys, data collection, analysis, inference and presentation.
4	To identify the role of various modes of Mass Transportation like Bus and Rail and its Planning and Management
5	Learn the objectives, benefits in ITS and functional areas in ITS.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Acquire and apply knowledge of traffic, its components, and factors affecting road traffic.
CO2	Analyze traffic speed study data and its presentation.
CO3	Apply the knowledge of sampling data in conducting various surveys and analysis
CO4	Understand various modes of mass transit system.
CO5	Use the advantages of ITS and suggest the appropriate technologies for field conditions

Course Contents		COs	Hours
Unit 1	Introduction: Infrastructure &its role in developing society; Transport sector in India – policy framework; Development plans –Airports, Highways –National highway development program (NHDP); JNNURM, Asian highways network (AH).	**CO1**	**(06)**
Unit 2	Traffic characteristics: Traffic characteristics – Road user characteristics, General human characteristics, Physical characteristics. Vision eye –movement peripheral vision, Visual attention, Visual sensitivity to light and colour, glare vision and recovery perception of space. Hearing, Stability sensation, Time factor in response, Theory of PIEV modifying factors, conditional responses; Vehicular Characteristics – types, dimensions, resistance, power requirement for different resistance, change in direction – minimum turning radius, off tracking, slip angle.	**CO2**	**(06)**
Unit 3	a) Traffic Engineering & Speed Analysis: Introduction, Speed studies, journey time and	**CO3**	**(06)**

	delay studies, Sampling in traffic studies &application, Traffic surveys-types of volume count Planning, Problems on PCU, moving observer method and spot speed. b) Traffic operation and management. Traffic systems management and Travel demand management - Congestion management-Cost effective management measures, Traffic control aids, and Street furniture, Road Arboriculture–Traffic Regulation, Traffic Sign and Road Markings.		
Unit 4	Trip generation and distribution: Factors governing trip generation and attraction – Application of Regression Analysis- Methods of trip distribution; Growth and Synthetic Models Calibration and Application of gravity model.- Category analysis.	**CO4**	**(08)**
Unit 5	a) Introduction to intelligent transportation systems (ITS) – Definition, Objectives, Historical Background, Benefits of ITS -ITS Data collection techniques –Detectors, Automatic vehicle location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS),Video data collection. b) ITS functional areas – Advanced traffic management systems(ATMS), Advanced traveller information Systems (ATIS), Commercial vehicle operations (CVO), Advanced vehicle control systems (AVCS),Advanced Public transportation systems (APTS), Advanced rural transportation systems (ARTS).	**CO1**	**(06)**
Unit 6	Specialized traffic studies: Parking Studies: Parking inventory, statistics, parking surveys; in out, license palate, on-street and off-street parking. Accident Studies: Accident data collection, statistics, safety audit, safety measures. Fuel consumption and emission studies: Consumption models, pollutants, air quality models, mitigation measures. Toll operation: Design and configuration, queuing theory, operation and maintenance issues.	**CO2**	**(06)**

Text Books

Kadiyali L.R. and N.B. Lal (2004): Principles and Practice of HighwayEngineeringIncluding Expressways and Airport Engineering), Khanna Publishers, New Delhi.

Kadiyali L.R. (1994): Traffic Engineering and Transport Planning, Khanna Publishers, NewDelhi.

ParthaChakroborty and Animesh Das (2003): Principles of Transportation Engineering,Prentice-Hall India, New Delhi.

Reference Books

Black John (1981): Urban Transportation Planning. Croom Helm Ltd. London.

BPR (1970): Urban Transportation Planning: General Information and Introduction to System

Bureau of Public Roads, Washington D.C.

Shivaji University, Kolhapur

Third Year (Sem- VI) B.Tech. Civil Engineering

CE0266: Multi-Disciplinary Minor- 04 (Concrete Technology)

Teaching Scheme			Examination Scheme	
Lectures	2 Hrs/Week		MSE	30 Marks
Tutorials	---		ISE/CA	10 Marks
Total Credits	2		ESE	60 Marks
			Total Marks	100 Marks

Prerequisites: NIL

Course Objectives:

1	To understand process of concrete manufacturing and to study properties of fresh concrete.
2	To study mix design of concrete by using IS code method and ACI method
3	To study different Non Destructive Tests (NDT).
4	To study different types of special concrete and their manufacturing.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Explain the fundamentals of process of making good quality concrete and its elastic properties.
CO2	Understand the fresh and hardened properties of concrete.
CO3	Design the concrete mix proportion as per Indian standard code of practice.
CO4	Demonstrate Non Destructive Testing (NDT) and evaluate quality of existing concrete.
CO5	Understand different types of special concrete and their applications.

	Course Contents	COs	Hours
Unit 1	**Ingredients of Concrete: Cement:** Manufacturing process of cement, chemical composition, grades of cement, hydration, types of cement, Tests for cement: fineness, Standard consistency, setting time, soundness and compressive strength. **Aggregates**: classification, requirements, Tests for coarse aggregates: specific gravity, grading of aggregate, Flakiness index, Elongation Index, Impact value, abrasion value, crushing value. Tests for fine aggregates: specific gravity, sieve analysis, fineness modulus. Alkali aggregate reaction, bulking of sand, Artificial and Recycled aggregate. **Water**: general requirements, quality of water.	**CO1**	**(06)**
Unit 2	**Fresh Concrete:** Workability: factors affecting, different tests for measurement of workability. Segregation, bleeding. Manufacturing process of concrete: batching, mixing, transportation, compaction, curing of concrete, curing methods.	**CO2**	**(06)**
Unit 3	**Admixtures in concrete:** a) Chemical Admixtures: Plasticizers, Super plasticizers, Retarders, Air entraining agents, IS 9103Specifications b) Mineral Admixtures: Fly ash, Silica Fume, GGBS, Rice husk ash, metakaolin	**CO3**	**(06)**

Unit 4	**Concrete Mix Design:** Objectives of mix design, different methods of mix design, factors affecting mix proportions, quality control of concrete, statistical methods, acceptance criteria, Numerical on mix design by ACI 211.1-1991, IS 10262- 2009andIS 456 -2000. Mix design of fly ash concrete by IS 10262 – 2009.	**CO4**	**(08)**
Unit 5	**Hardened concrete:** Strength of concrete: w/c ratio, gel/space ratio, gain of strength with age, maturity concept of concrete, effect of maximum size of aggregate on strength. Test on hardened concrete: compressive strength, comparison of compressive strength between cube test and cylinder test, flexural strength. Relation between compressive and tensile strength. Elastic constants, factors affecting modulus of elasticity, definition and factors affecting creep and shrinkage. Nondestructive testing: Schmidt's rebound hammer, Ultrasonic pulse velocity method.	**CO1**	**(06)**
Unit 6	**Special Concretes and Durability of concrete:** a. Special Concretes: Light weight concrete, Polymer modified concrete, concept of fibre reinforced concrete, High performance concrete, Pumpable concrete, Roller compacted concrete, Self compacting concrete. b. Durability of concrete: Significance, Permeability and Durability, Chemical Attack, Sulphate attack, Attack by Seawater, Acid attack, Chloride attack, Carbonation of concrete and its determination.	**CO2**	**(06)**

Text Books

Concrete Technology – M. S. Shetty, S. Chand Publications.

Concrete Technology – M. L. Gambhir, Tata McGraw-Hill.

Concrete Technology – A. R. Santhakumar, Oxford University Press.

Reference Books

Properties of Concrete – A. M. Neville, Pearson Education India.

Concrete Technology – R. S. Varshney, Oxford & IBH Publishing.

Microstructure and Properties of Concrete – P. Kumar Mehta, Prentice Hall.

IS Codes

IS 10262:2019 – Concrete Mix Proportioning – Guidelines. *(Latest revision; replaces IS 10262:2009.)*

IS 456:2000 – Plain and Reinforced Concrete – Code of Practice.

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

PCC-CE0267: Structural Design and Drawing-I Laboratory

Teaching Scheme			Examination Scheme	
Practical	02 Hrs/Week		MSE	----
Tutorials	-		ISE/CA	50 Marks
Total Credits	1		ESE	25 Marks
			Total Marks	75 Marks

Prerequisites: NIL

Course Objectives:

1	To apply a holistic approach to the planning, analysis, segmentation, and design of RCC buildings.
2	To develop an understanding of the codal provisions of IS 456:2000 and SP:16 for the design of reinforced concrete structures.
3	To understand the reinforcement detailing requirements of various RCC structural elements as per SP: 34.
4	To provide exposure to the analysis and design of RCC structures using industry-standard structural design software.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Translate structural concepts and functional requirements into workable RCC building plans.
CO2	Identify and classify the various structural components of RCC buildings.
CO3	Design individual structural members and integrate them into the design of a complete RCC building.
CO4	Prepare structural drawings and reinforcement detailing suitable for execution at the construction site.
CO5	Interpret and understand structural drawings and apply them effectively during on-site execution and supervision.

Term Work /List of Experiments/ List of Assignments

Any 8 Experiments based on following list

Expt. No	Name of Experiment	CO
1	**Project Work** **Group Project (4–6 Students)** • **Planning, analysis, design, and detailing of a two-storied residential RCC building** (minimum **60 m² built-up area per floor**). • The structural drawings shall include **ductile detailing** in accordance with the provisions of **IS 13920**. **Individual Project (Any ONE of the following)** • Design of a **Retaining Wall** (Cantilever or Counterfort type). • Design of **Foundations** (Raft Foundation or Pile Foundation).	**CO1, CO2, CO3, CO4, CO5**

	• **Analysis and Design of an RCC Framed Structure** using industry-standard structural analysis and design software (e.g., STAAD.Pro, ETABS, or SAP2000).	

Text Books
Reinforced Concrete Design – S. Unnikrishna Pillai and Devdas Menon, 3rd Edition, Tata McGraw-Hill.
Design of Reinforced Concrete Structures – N. Subramanian, Oxford University Press.
Limit State Design of Reinforced Concrete – P. C. Varghese, PHI Learning.
Reference Books
Detailed Reinforced Concrete Design – S. Ramamrutham, Dhanpat Rai Publications.
Design of Reinforced Concrete and Detailing – M. L. Gambhir, McGraw-Hill Education.
Ductile Detailing of Reinforced Concrete Structures (Based on IS 13920) – S. K. Duggal, McGraw-Hill Education.
IS Codes
IS 456:2000 – Plain and Reinforced Concrete – Code of Practice.
IS 1893 (Part 1):2016 – Criteria for Earthquake Resistant Design of Structures.

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

CE0268: TRAFFIC ENGINEERING LABORATORY

Teaching Scheme			**Examination Scheme**	
Practical	02Hrs/Week		MSE	----
Tutorials	-		ISE/CA	25 Marks
Total Credits	1		ESE	25 Marks
			Total Marks	50 Marks

Prerequisites: NIL

Course Objectives:

1	To develop the ability to perform laboratory experiments on highway construction materials in accordance with relevant IS and IRC standards.
2	To enable students to evaluate the engineering properties of bitumen, aggregates, and bituminous mixes through standard laboratory testing procedures.
3	To develop practical skills in analyzing test results and applying them to the design, construction, and quality control of pavement materials.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Perform standard laboratory tests on bitumen and interpret the results to assess its suitability for pavement construction as per IS and IRC standards.
CO2	Evaluate the physical and mechanical properties of aggregates using standard IS test methods and compare the results with IRC specifications.
CO3	Design bituminous mixes and conduct performance tests to assess the characteristics and quality of bituminous pavements as per IS and IRC guidelines.
CO4	Analyze laboratory test results and recommend suitable highway construction materials for different pavement applications.

Term Work /List of Experiments/ List of Assignments

Any 8 Experiments based on following list

Expt. No	Name of Experiment	CO
1	To determine the specific gravity of bituminous binder.	**CO1**
2	To determine the penetration value of bitumen.	**CO2**
3	To determine the softening point of bitumen.	**CO3**
4	To determine the flash point and fire point of bitumen.	**CO4**
5	To determine the ductility of bitumen.	**CO4**
6	To determine the viscosity of bitumen.	**CO1**
7	To determine the stripping value of aggregates.	**CO2**

8	To determine the California Bearing Ratio (CBR) of soil.	**CO3**
9	Any Two of the Following:	
10	To conduct traffic volume study on a selected roadway.	**CO4**
11	To conduct a parking study in a selected area.	**CO1**
12	To conduct an accident study for traffic safety analysis.	**CO2**

Text Books

Highway Engineering – S. K. Khanna and C. E. G. Justo, Nem Chand & Bros., Roorkee.

Highway Engineering – L. R. Kadiyali, Khanna Publishers, New Delhi.

A Course in Railway Engineering – Subhash C. Saxena and Satya Pal Arora, Dhanpat Rai & Sons, New Delhi.

Reference Books

Principles, Practice and Design of Highway Engineering – S. K. Sharma, S. Chand Publishing, New Delhi.

Principles of Transportation Engineering – Partha Chakraborty and Animesh Das, Prentice Hall.

Transportation Engineering – K. P. Subramanyam, Scitech Publications, Chennai.

Highway Engineering – S. K. Khanna and C. E. G. Justo, Nem Chand & Bros., Roorkee.

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

CE0269: Industrial Training

Teaching Scheme		Examination Scheme	
Practical	04 Hrs/Week	MSE	----
Tutorials	-	ISE/CA	50 Marks
Total Credits	2	ESE	
		Total Marks	50 Marks

Prerequisites: NIL

Course Objectives:

1	Expose students to real industrial working environments and professional practices in civil engineering and allied industries.
2	Bridge the gap between theoretical knowledge and practical application through hands-on experience in industry.
3	Develop professional skills**,** including communication, teamwork, discipline, and work ethics.
4	Familiarize students with industrial safety practices, project management, and resource utilization.
5	Enhance students' ability to observe, analyze, and document engineering activities performed in the industry.

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Demonstrate awareness of industrial safety practices, time management, and resource utilization in the workplace.
CO2	Understand and describe industrial processes, construction practices, and operational procedures used in civil engineering industries.
CO3	Apply professional communication, teamwork, and workplace etiquette while interacting with industry professionals.
CO4	Prepare a comprehensive industrial training report describing activities performed, observations, and learning outcomes during the internship.

Term Work /List of Experiments/ List of Assignments

Any 8 Experiments based on following list

Expt. No	Name of Experiment	CO
1	**I. RATIONALE** Globalization has prompted organizations to encourage a skilled and innovative workforce. Internships are educational and career development opportunities that provide practical and hands-on experience in a particular field or discipline. Industrial training provides students an opportunity to become familiar with modern industry practices and apply the knowledge and skills acquired in the classroom to real-world situations. It also enables students to understand the working environment of industries before entering the professional world. Keeping this in view, **industrial training is incorporated in all diploma programmes** as it helps students develop **practical skills, soft skills, and life skills**, thereby preparing them	**CO1, CO2, CO3, CO4**

for professional careers.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student attain the following **industry-identified competency** through various teaching-learning experiences:

Apply skills and practices to industrial processes.

V. GENERAL GUIDELINES FOR ORGANIZING INDUSTRIAL TRAINING

The industry/organization selected for industrial training/internship may include:

- Government organizations
- Public Limited companies
- Private Limited companies
- Startups
- Centers of Excellence
- Skill Centers / Skill Parks

1. Duration of Training

- **4 Weeks (1 Month)**

2. Period / Time Slot

- Internship shall be conducted **between the 5th and 6th semester**.
- It shall **commence immediately after completion of the 5th semester examinations**.

3. Industry Area

Students may undergo training in:

- Engineering programme allied industries
- Large, medium, or small-scale industries
- Government / Semi-Government sectors

VI. ROLE(S) OF DEPARTMENT AT THE INSTITUTE

The concerned department at the institute shall perform the following activities:

Activity	Timeline
Progressive assessment of industrial training by mentor	Each week during training period
Assessment of training by institutional mentor and industry mentor	During 6th Semester

Suggestions

1. The department may take help from **alumni or parents of students** having contacts in industries for securing placements.
2. Students will normally be placed as per their preferences. In case of higher demand for a particular industry, allocation will be based on students' potential. Preference will be given to students who arrange placement through parents or relatives.
3. **Principal/HOD/Faculty** should brief students about **industrial safety norms, rules, and discipline** before sending them for training.
4. Faculty members should monitor the progress of students during training through **industry visits or online interaction**, reviewing attendance, discipline, and report preparation each week.

	VII. ROLES AND RESPONSIBILITIES OF STUDENTS 1. Students may consult their mentor to identify suitable industries for training. If they have contacts through parents or relatives, they may use them to secure placements. 2. Students must submit the **required forms and training letters**, duly signed by institutional authorities, to the industry mentor on the **first day of training**. 3. Students must carry their **Institute Identity Card** during the training period. Students must follow the **industrial dress code**. If no specific protocol is given, **college uniform must be worn compulsorily**	

Text Books

Industrial Training and Internship Manual for Engineering Students – AICTE, New Delhi.

Professional Ethics and Human Values – R. S. Naagarazan, New Age International Publishers.

Soft Skills: Know Yourself and Know the World – Dr. Alex K., S. Chand Publishing.

Reference Books

The Unwritten Laws of Engineering – W. J. King and James G. Skakoon, ASME Press.

Project Management: A Systems Approach to Planning, Scheduling, and Controlling – Harold Kerzner, Wiley.

Engineering Your Future: The Professional Practice of Engineering – Stuart G. Walesh, Wiley.

Shivaji University, Kolhapur

Third Year (Sem- V) B.Tech. Civil Engineering

PCC-CE0270: Concrete Technology Laboratory

Teaching Scheme			Examination Scheme	
Practical	02Hrs/Week		MSE	----
Tutorials	-		ISE/CA	25 Marks
Total Credits	1		ESE	25 Marks
			Total Marks	50 Marks

Prerequisites: NIL

Course Objectives:

1	To impart skills to perform laboratory experiments for determination of index and engineering properties of soil
2	To interpret the experiment results and draw valid conclusions

Course Outcomes (CO's): At the end of this course, student will be able to

CO1	Demonstrate skill to conduct laboratory experiments as per standard procedure to determine soil properties.
CO2	Analyze soil properties and describe soil performance

Term Work /List of Experiments/ List of Assignments

Any 8 Experiments based on following list

Expt. No	Name of Experiment	CO
1.	To determine fineness of cement by Sieve analysis and/or Blaine's air permeability method.	**CO1**
2.	To determine the standard consistency of cement using Vicat's apparatus.	**CO2**
3.	To determine initial and final setting time of cement.	**CO1**
4.	Determination of soundness of cement by Le-Chatelier's apparatus and/or Auto Clave test.	**CO2**
5.	To determine the compressive strength of cement.	**CO1**
6.	Determination of particle size distribution of fine, coarse and all in aggregate by sieve analysis (grading of aggregate).	**CO2**
7.	Determination of specific gravity of fine aggregates.	**CO1**
8.	Determination of specific gravity and water absorption of coarse aggregates.	**CO2**
9.	To determine flakiness and elongation index of coarse aggregates.	**CO1**
10.	To determine workability of fresh concrete by using slump cone.	**CO2**
11.	To determine compaction factor for workability of fresh concrete	**CO1**
12.	To determine workability of fresh concrete by using Vee Bee Consitometer.	**CO1**

13.	Nondestructive test on concrete by: Rebound Hammer Test, Ultrasonic Pulse Velocity Test.	**CO2**
14.	Tests for compressive strength of concrete cubes for M20 or M30 (ACI 211.1-91, IS 10262-2009 and IS 456 2000).	**CO1**

Text Books
Concrete Technology – M. S. Shetty, S. Chand Publications.
Concrete Technology – M. L. Gambhir, Tata McGraw-Hill.
Concrete Technology – A. R. Santhakumar, Oxford University Press.
Reference Books
Properties of Concrete – A. M. Neville, Pearson Education India.
Concrete Technology – R. S. Varshney, Oxford & IBH Publishing.
Microstructure and Properties of Concrete – P. Kumar Mehta, Prentice Hall.
IS Codes
IS 10262:2019 – Concrete Mix Proportioning – Guidelines. *(Latest revision; replaces IS 10262:2009.)*
IS 456:2000 – Plain and Reinforced Concrete – Code of Practice.