Department of

Civil Engineering

Structure & Curriculum

Second Year to Final Year B.Tech.

As Per NEP 2020

With effect from 2025-26

Structure for B. Tech. Programme as per NEP 2020 for students admitted in 2024-25 onwards

(Regulations 2024)

Key Features of Curriculum:

Sanjay Bhokare Group of Institutes (SBGI) is an autonomous institute affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere (DBATU). SBGI has started implementing National Education Policy 2020 (NEP 2020) from the academic year 2024-25. NEP 2020 emphasizes holistic development, flexible curriculum, integration of technology in teaching and learning processes and multidisciplinaryapproach.UniversityGrantCommission(UGC)initsguidelinesformultipleentry andexithighlightsflexiblelearningleadingtotheawardofcertificate,diploma,anddegree.Tomeet the objectives of NEP 2020, SBGI is offering a flexible curriculum with multiple exit options in line with directives received from Higher and Technical Education Department of Government of Maharashtra.

In accordance with the mandates of NEP 2020, this curriculum adopts a learner-centric approach through a Multiple Entry and Exit Point (MEEP) system, allowing students to exit at the end of any academic year with appropriate certifications—ranging from Undergraduate Certificates to a full Degree. The academic framework is underpinned by the Academic Bank of Credits (ABC), ensuring the seamless accumulation and transfer of credits. To promote a holistic development profile, students earn formal credits for Value Education (VEC), Ability Enhancement (AEC), and Co-Curricular (CCA) activities, while completing mandatory non-credit courses to fulfill essential social and ethical learning requirements.

Students are empowered to exercise academic autonomy, choosing Open Electives (OE) and courses of interest across all disciplines to build personalized learning pathways. This includes the provision to earn Single Minors in complementary fields. For students demonstrating high academic potential, the policy provides a distinct track for a B.Tech. Honours with Research degree, requiring the successful completion of a substantive research project, thereby fostering a culture of inquiry and innovation from the undergraduate level.

A core pillar of this curriculum is the integration of Vocational and Skill Enhancement (VSE) courses alongside the Indian Knowledge System (IKS) to bridge traditional wisdom with modern professional competencies. To ensure industry readiness, a mandatory one-semester internship is required, complemented by field projects and mini-projects specifically designed to validate skills at each exit level. Furthermore, in line with the digital thrust of NEP 2020, the policy enables Blended Learning by allowing students to earn credits through recognized online platforms such as SWAYAM and NPTEL, ensuring access to high-quality global resources.

SBGI recommends a 4years multidisciplinary Bachelor's programme as the preferred option since it allows the opportunity to experience the full range of holistic and multidisciplinary education in addition to a focus on major and minor subjects as per the student's preference.

However, in case of unavoidable circumstances if students need to give up their education they can opt to exit at the end of 2nd or 4thor 6thsemeste rafter completing additional 8 credits as prescribed in this document. Students will be allowed to take the exit option after counseling by class teacher, proctor, academic coordinator and head of the department.

Students need to register in Academic Bank of Credit (ABC)for availing his option. The Academic Bank of Credits (ABC), a National-level facility provides flexibility of the curriculum framework and interdisciplinary/multidisciplinary academic mobility of students across the Higher Education Institutes (HEIs) in the country with appropriate "Credit Transfer" mechanism. It would facilitate credit accumulation through the facility created by the ABC scheme in the "Academic Bank Account" opened for students across the country to transfer and consolidate the credits earned by them by undergoing courses in any of the eligible HEIs. The ABC allows for credit redemption through the process of commuting the accrued credits in the Academic Bank Account maintained in the ABC for the purpose of fulfilling the credits requirements for the award of certificate/diploma/degree by the authorized HEIs. Upon collecting a certificate, diploma or degree, all the credits earned till then, in respect of that certificate, diploma or degree, shall stand debited and deleted from the account concerned.

Multiple Exits:

Studentswillhavetheflexibilitytoenteraprogrammeinoddsemestersandexitaprogrammeafter the successful completion of even semesters as per their future career needs the student as to earn the minimum credits as mentioned in table 1 and should not have any backlogs. The student has to submit a request for exiting the programme to the Academic Council Chairman through the BoS Chairmanwithin2weeksofdeclarationofresults.Theadditional8creditsneedtobeearnedduring the Summer Vacation (within 2 months of approval of Exit Request).

Table1
Exitoptionafter2nd or4th or6th Semester
[Ref: NEP GR, Government of Maharashtra Point 2 and Point 7]

Sr. No.	Levels and Semester Completion	Qualification Title	Regular Credit Requirement	Additional Credits to be Earned
1	Level:4.5 Semester2	One Year UG Certificate in the relevant Discipline	Minimum44 credits	8CreditsofVSEC/Internship/ Apprenticeship per the relevant programme
2	Level:5.0 Semester:4	Two Year UG Diploma in the relevant Discipline	Minimum88 credits	8 Credits of VSEC/Internship/Mini Project as per the relevant programme
3	Level 5.5 Semester:6	Three Year B.Voc/B.Scinthe relevant Discipline	Minimum 132 credits	8 Credits of VSEC/Internship/Mini Project as per the relevant programme

TheTable1isinterpretedas follows:

Students exiting the First-Year programme after securing minimum 44 credits will be awarded one-year UG Certificate in the relevant Discipline provided they secure 8 credits in work-based vocational courses or internship / Apprenticeship offered during summer vacation in addition to credits from skill-based courses earned during the first and second semester.

Students exiting the Second Year Programme after securing minimum 88 credits will be awarded TwoYearsUGDiplomaintherelevantDisciplineprovidedtheysecureadditional8creditsinskill- based vocational courses (skill-based courses, internship, mini projects etc.) offered during summer vacation after the fourth semester.

Students exiting the 3-yearUG program will be awarded Three Years B. Voc./B.Sc in the relevant Disciplineuponsecuringminimum132creditswithadditional8creditsinskill-basedvocational courses (skill-based courses, internship, Mini projects etc.) offered during summer vacation after the sixth semester.

Exit options shall be provided with Certification, Diploma and B. Vocational/ B.Sc degrees to the students at the end of the second, fourth and sixth semester, respectively, in the four-year degree programme. However, the duration of completion of UG Engineering Degree Program is 8 years from the date of admission to first year.

Institute

Vision

To be a reputed Technological and Management Institute imparting Quality Education and developing Core Human Values (H3).

(H3): Honest - Humble - Human Being

Mission

We are committed for Enrichment of the Institute by disseminating the knowledge to achieve academic excellence and develop industry ready technical manpower

Department

Vision

To be reputed Technological Civil Engineering Department imparting Advanced Engineering tools applicable for Industry & Society.

Mission

M1: To enrich Students in the Fundamentals of Civil Engineering and their Applications.
M2: To organize Training Programs on Advanced Computational Tools and Equipment during the Curriculum of Civil Engineering.
M3: To undertake Collaborative Civil Engineering Projects from Industry towards Strong Interaction with Academia.
M4: To inculcate the Core Human Values in Students

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **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.
2. **Problem analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4).
3. **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).
4. **Conduct investigations of complex problems:** Conduct investigations of complex engineering problems using research- based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
5. **Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6).
6. **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).
7. **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9).
8. **Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
9. **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.

10. **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.
11. **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).

Department of Civil Engineering

Program Specific Outcomes (PSOs)

Upon successful completion of UG course, the students will attain following Program Specific Outcomes:

PSO 1	Apply appropriate Engineering Techniques, Practical Skills, and Modern Computational Tools to analyse, design, and evaluate Civil Engineering systems in Environmental, Water Resources, Geotechnical, Structural, and Transportation disciplines.
PSO 2	Competent to design, estimate, and implement a range of Civil Engineering constructions for Industry and Society.
PSO 3	Apply appropriate Civil Engineering knowledge to develop systems and processes by integrating technical knowledge with considerations of safety, economy, environmental protection, societal needs, ethics and sustainable development.

Program Educational Objectives (PEOs)	
PEO 1	Demonstrate applications of Advanced Computational tools and fundamental concepts of Civil engineering for solving complex Civil Engineering problems.
PEO 2	Independently analyze socio-industrial problems and provide feasible solutions through critical thinking and research.
PEO 3	Have successful career in different sectors of Civil Engineering Industry through life-long learning

B.Tech. Program with one Major and one Minor (14 Credits)
Semester wise Indicative Credit Distribution

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course (BSC)	BSC/ESC	8	8							16
Engineering Science Course (ESC)		6	9							15
Programme Core Course (PCC)	ProgrammeCourses	3		16	13	9	9	7		57
Programme Elective Course (PEC)						3	3	6	4	16
Multidisciplinary Minor (MDM)	Multi-disciplinary Courses			2	2	3	3	4		14
Open Elective (OE)						3	3	2		8
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	1	2		2	2				7
Ability Enhancement Course (AEC-01), Modern Indian Language (AEC-02)	Humanities Social Science and Management (HSSM)	3		2			2			7
Entrepreneurship/Economics / Management Courses (EEM)					2					2
Indian Knowledge System (IKS)			2							2
Value Education Course (VEC)				2	2					4
Internship / OJT (Int/OJT)	Experiential Learning Courses (ELC)								12	12
Project (Proj)							2	2	4	8
Community Engagement Activity (CEA) / Field Project (FP)					1			1		2
Co-curricular & Extracurricular Activities (CCA)	Liberal Learning Course (LLC)	1	1			2				4
TotalCredits(Major)		22	22	22	22	22	22	22	20	174

Shri Ambabai Talim Sanstha's

SANJAY BHOKARE GROUP OF INSTITUTES, MIRAJ

Teaching and Evaluation Scheme

Program: B. Tech. - First Year Engineering

Class.: **First Year, B. Tech.** Semester: **SEM - I** W.E.F.: **2024-2025**

Sr. No.	Course Code	Course Title	Course Category	Teaching Scheme				Course Credits	Evaluation scheme						
				L	T	P	Contact Hrs/wk		Theory				Practical		Total
									CIE			ESE	CIE	ESE	
									CA-I	MSE	CA-II				
01	24FY101T	Engineering Chemistry	BSC	3	0	0	3	3	15	20	15	50			100
02	24FY102T	Engineering Mathematics-I	BSC	3	1	0	4	4	15	20	15	50			100
03	24FY103T	Engineering Mechanics	ESC	3	0	0	3	3	15	20	15	50			100
04	24FY116T	Computer Programming using C Language	PCC	2	0	0	2	2	15	20	15	50			100
05	24FY105T	Communication Skills	AEC	2	0	0	2	2	15	20	15	50			100
06	24FY114T	Basic Civil Engineering	ESC	2	0	0	2	2	15	20	15	50			100
07	24FY101L	Engineering Chemistry Lab	BSC	0	0	2	2	1					30	20$	50
08	24FY103L	Engineering Mechanics Lab	ESC	0	0	2	2	1					30	20*	50
09	24FY116L	Computer Programming using C Language Lab	PCC	0	0	2	2	1					30	20**	50
10	24FY105L	Communication Skills Lab	AEC	0	0	2	2	1					30	20$	50
11	24FY114L	Basic Civil Engineering Lab	VSEC	0	0	2	2	1					30	20$	50
12	24FY112L	Yoga/Sports Lab	CC	0	0	2	2	1					30	20$	50
Total				**15**	**1**	**12**	**28**	**22**	**90**	**120**	**90**	**300**	**180**	**120**	**900**

L:Lecture, **T:**Tutorial, **P:**Practical, **CA-I:** Continuous Assessment-I, **CA-II:** Continuous Assessment-II, **CIE**: Continuous in Semester Evaluation, **ESE**: End Semester Examination, **$**: Internal oral Exam.,*: External oral Exam., ** :External oral Practical Exam.

	BSC/ESC		Program Courses		Multidisciplinary Courses		Skill Courses	Humanities Social Science and Management (HSSM)				Experiential Learning Courses (ELC)			Liberal Learning Courses (LLC)	Total
Course Category	BSC	ESC	PCC	PEC	MDM	OE	VSEC	AEC-01, AEC-02	EEM	IKS	VEC	Int/OJT	Proj.	CEA/FP	CCA	
Credits	**8**	**6**	**3**				**1**	**3**							1	22
Cum.Sum	**8**	**6**	**3**				**1**	**3**							**1**	**22**

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Shri Ambabai Talim Sanstha's

SANJAY BHOKARE GROUP OF INSTITUTES, MIRAJ

Teaching and Evaluation Scheme

Program: B. Tech.- First Year Engineering

Class.: **First Year, B. Tech.** Semester: **SEM - II** W.E.F.: **2025-2026**

Sr. No.	Course Code	Course Title	Course Category	Teaching Scheme				Course Credits	Evaluation scheme						
									Theory				Practical		Total
									CIE			ESE	CIE	ESE	
				L	T	P	Contact Hrs/wk		CA-I	MSE	CA-II				
01	24FY106T	Engineering Physics	BSC	3	0	0	3	3	15	20	15	50			100
02	24FY107T	Engineering Mathematics – II	BSC	3	1	0	4	4	15	20	15	50			100
03	24FY117T	Engineering Graphics	ESC	3	0	0	3	3	15	20	15	50			100
04	24FY109T	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3	15	20	15	50			100
05	24FY115T	Basic Mechanical Engineering	ESC	2	0	0	2	2	15	20	15	50			100
06	24FY111T	Energy and Environment	IKS	2	0	0	2	2	15	20	15	50			100
07	24FY106L	Engineering Physics Lab	BSC	0	0	2	2	1					30	20$	50
08	24FY117L	Engineering Graphics Lab	ESC	0	0	2	2	1					30	20*	50
09	24FY109L	Basic Electrical and Electronics Engineering Lab	VSEC	0	0	2	2	1					60	40*	100
10	24FY115L	Workshop Practice & Basic Mechanical Engineering Lab	VSEC	0	0	2	2	1					30	20$	50
11	24FY113L	Integrated Personality Development/NSS Lab	CC	0	0	2	2	1					30	20$	50
Total				**16**	**1**	**10**	**27**	**22**	**90**	**1200**	**90**	**300**	**180**	**120**	**900**

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	BSC/ESC		Program Courses		Multidisciplinary Courses		Skill Courses	Humanities Social Science and Management (HSSM)				Experiential Learning Courses (ELC)			Liberal Learning Courses (LLC)	Total
Course Category	BSC	ESC	PCC	PEC	MDM	OE	VSEC	AEC-01, AEC-02	EEM	IKS	VEC	Int/OJT	Proj.	CEA/FP	CCA	
Credits	**8**	**9**					**2**			**2**					**1**	22
Cum.Sum	**16**	**15**	**3**				**3**	**3**		**2**					**2**	**44**

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Exit Course after SEM II
(UG Certificate in Civil Engineering)

Sr. No.	Course Code	Course Title	Course Category	Teaching Scheme				Course Credits	Evaluation scheme						
									Theory				Practical		Total
									CIE			ESE	CIE	ESE	
				L	T	P	Contact Hrs/wk		CA-I	MSE	CA-II				
01	24CV2OLT	Online Two Skill Courses at ITI Level from NSQF/ESSC/Any Other Agency providing certification/evaluation	Exit	-	-	-	-	2	25	-	25	50	-	-	100
02	24CV2OJT	2 Months Internship	Exit	-	-	-	-	6	-	-	-	-	60	40	100
Total				-	-	-	-	8	25	-	25	50	60	40	200

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SANJAY BHOKARE GROUP OF INSTITUTES, MIRAJ

Teaching and Evaluation Scheme

Program: B. Tech. Civil Engineering

Class.: **Second Year, B. Tech.** Semester: **SEM- III** W.E.F.: **2025-2026**

Sr. No.	Course Code	Course Title	Course Category	Teaching Scheme				Course Credits	Evaluation scheme						
				L	T	P	Contact Hrs/wk		Theory				Practical		Total
									CIE			ESE	CIE	ESE	
									CA-I	MSE	CA-II				
01	24CV301T	Applied Mathematics	PCC	3	-	-	3	3	15	20	15	50	-	-	100
02	24CV302T	Strength of Materials	PCC	3	-	-	3	3	15	20	15	50	-	-	100
03	24CV303T	Fluid Mechanics	PCC	3	-	-	3	3	15	20	15	50	-	-	100
04	24CV304T	Engineering Survey	PCC	3	-	-	3	3	15	20	15	50	-	-	100
05	24CV305T	MDM-I (Management in Engineering)	MDM	2	-	-	2	2	15	20	15	50	-	-	100
06	24UHV306T	Universal Human Values	VEC	2	-	-	2	2	15	20	15	50	-	-	100
07	24CV307T	Business Communication & Presentation Skills	AEC	1	1	-	-	2	50	-	-	50	-	-	100
08	24CV302L	Strength of Materials Laboratory	PCC	-	-	2	2	1	-	-	-	-	30	20*	50
09	24CV303L	Fluid Mechanics Laboratory	PCC	-	-	2	2	1	-	-	-	-	30	20*	50
10	24CV304L	Engineering Survey Laboratory	PCC	-	-	4	4	2	-	-	-	-	60	40**	100
Total				**17**	**01**	**08**	**26**	**22**	**140**	**120**	**140**	**300**	**120**	**80**	**900**

L: Lecture, **T:** Tutorial, **P:** Practical, **CA-I:** Continuous Assessment-I, **MSE**: Mid Semester Examination, **CA-II:** Continuous Assessment-II, **CIE**: Continuous in Semester Evaluation, **ESE**: End Semester Examination, *: External Oral Exam., **: External Oral Practical Exam., **$**: Internal oral Exam.

	BSC/ESC		Program Courses		Multidisciplinary Courses		Skill Courses	Humanities Social Science and Management (HSSM)				Experiential Learning Courses (ELC)			Liberal Learning Courses (LLC)	Total
Course Category	BSC	ESC	PCC	PEC	MDM	OE	VSEC	AEC-01, AEC-02	EEM	IKS	VEC	Int/OJT	Proj.	CEA/FP	CCA	
Credits			16		02			02			02					22
Cum.Sum	**16**	**15**	**19**		**02**		**03**	**05**		**02**	**02**				**02**	**66**

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Shri Ambabai Talim Sanstha's

SANJAY BHOKARE GROUP OF INSTITUTES, MIRAJ

Teaching and Evaluation Scheme

Program: B. Tech. Civil Engineering

Class.: **Second Year, B. Tech.** Semester: **SEM - IV** W.E.F.: **2025-2026**

Sr. No.	Course Code	Course Title	Course Category	Teaching Scheme				Course Credits	Evaluation scheme						
									Theory				Practical		Total
									CIE			ESE	CIE	ESE	
				L	T	P	Contact Hrs/wk		CA-I	MSE	CA-II				
01	24CV401T	Structural Mechanics	PCC	3	-	-	3	3	15	20	15	50	-	-	100
02	24CV402T	Building Planning and Drawing	PCC	2	-	-	2	2	15	20	15	50	-	-	100
03	24CV403T	Concrete Technology	PCC	2	-	-	2	2	15	20	15	50	-	-	100
04	24CV404T	Open Channel Flow and Hydraulic Machines	PCC	3	-	-	3	3	15	20	15	50	-	-	100
05	24CV407T	Hydrology & Water Resources Engineering	PCC	2	-	-	2	2	15	20	15	50	-	-	100
06	24CV405T	MDM-II (Lean Concept and Management Approach)	MDM	2	-	-	2	2	15	20	15	50	-	-	100
07	24COI406T	Constitution of India	VEC	2	-	-	2	2	25	-	25	-	-	-	50
08	24CV403L	Concrete Technology Laboratory	PCC	-	-	2	2	1	-	-	-	-	30	20*	50
09	24CV402L	Building Planning and CAD Laboratory	VSEC	-	-	4	4	2	-	-	-	-	60	40**	100
10	24CV408T	Software Applications in Civil Engineering	EEM	2	-	-	2	2	25	-	25	-	-	-	50
11	24CV409L	Seminar	CEA	-	-	2	2	1	-	-	-	-	30	20$	50
Total				18	-	8	26	22	140	120	140	300	120	80	900

L: Lecture, **T:** Tutorial, **P:** Practical, **CA-I:** Continuous Assessment-I, **MSE**: Mid Semester Examination, **CA-II:** Continuous Assessment-II, **CIE**: Continuous in Semester Evaluation, **ESE**: End Semester Examination, *: External Oral Exam., **: External Oral Practical Exam., $: Internal oral Exam.

	BSC/ESC		Program Courses		Multidisciplinary Courses		Skill Courses	Humanities Social Science and Management (HSSM)				Experiential Learning Courses (ELC)			Liberal Learning Courses (LLC)	Total
Course Category	BSC	ESC	PCC	PEC	MDM	OE	VSEC	AEC-01, AEC-02	EEM	IKS	VEC	Int/OJT	Proj.	CEA/FP	CCA	
Credits			13		02		02		02		02			01		22
Cum.Sum	**16**	**15**	**32**		**04**		**05**	**05**	**02**	**02**	**04**			**01**	**02**	**88**

Coordinator HoD Dean

Exit Course after SEM IV
(UG Diploma in Civil Engineering)

Sr. No.	Course Code	Course Title	Course Category	Teaching Scheme				Course Credits	Evaluation scheme						
									Theory				Practical		Total
									CIE			ESE	CIE	ESE	
				L	T	P	Contact Hrs/wk		CA-I	MSE	CA-II				
01	24CV4OLT	Online Two Skill Courses at Diploma Level from NSQF/ESSC/Any Other Agency providing certification/evaluation	Exit	-	-	-	-	2	25	-	25	50	-	-	100
02	24CV4OLJT	2 Months Internship	Exit	-	-	-	-	6	-	-	-	-	60	40	100
Total				-	-	-	-	8	25	-	25	50	60	40	200

Teaching and Evaluation Scheme for Minor in "Leadership and Management"

Sr. No.	Course Code	Course Title	Course Category	Teaching Scheme				Course Credits	Evaluation scheme						
				L	T	P	Contact Hrs/wk		Theory				Practical		Total
									CIE			ESE	CIE	ESE	
									CA-I	MSE	CA-II				
01	24CV305T	Management in Engineering	MDM	2	-	-	2	2	15	20	15	50	-	-	100
02	24CV405T	Lean Concept and Management Approach	MDM	2	-	-	2	2	15	20	15	50	-	-	100
03	24CV505T	Disaster Management and Mitigation Techniques	MDM	2	-	-	2	2	15	20	15	50	-	-	100
04	24CV505L	Disaster Management and Mitigation Techniques Laboratory	MDM	-	-	2	2	1	-	-	-	-	30	20$	50
05	24CV605T	Operation Research	MDM	2	-		2	2	15	20	15	50	-	-	100
06	24CV605L	Operation Research Laboratory	MDM	-	-	2	2	1	-	-	-	-	30	20$	50
07	24CV705T	Sustainable Engineering Trends	MDM	2	-		2	2	15	20	15	50	-	-	100
08	24CV705L	Capstone Project	MDM	-	-	4	4	2	-	-	-	-	30	20*	50
Total				10	-	08	18	14	75	100	75	250	90	60	650

Shri Ambabai Talim Sanstha's

SANJAY BHOKARE GROUP OF INSTITUTES, MIRAJ

Teaching and Evaluation Scheme

Program: B. Tech. Civil Engineering

Class.: **Third Year, B. Tech.** Semester: **SEM - V** W.E.F.: **2026-2027**

Sr. No.	Course Code	Course Title	Course Category	Teaching Scheme				Course Credits	Evaluation scheme						
									Theory				Practical		Total
									CIE			ESE	CIE	ESE	
				L	T	P	Contact Hrs/wk		CA-I	MSE	CA-II				
01	24CV501T	Design of Steel Structures	PCC	3	-	-	3	3	15	20	15	50	-	-	100
02	24CV502T	Geo-Technical Engineering	PCC	3	-	-	3	3	15	20	15	50	-	-	100
03	24CV503T	Environmental Engineering	PCC	3	-	-	3	3	15	20	15	50	-	-	100
04	24CV504T	PEC-I	PEC	3	-	-	3	3	15	20	15	50	-	-	100
05	24CV505T	MDM-III (Disaster Management and Mitigation Techniques)	MDM	2	-	-	2	2	15	20	15	50	-	-	100
06	24CV506T	Open Elective-I	OE	3	-	-	3	3	15	20	15	50	-	-	100
07	24CV505L	MDM-III (Disaster Management and Mitigation Techniques Laboratory)	MDM	-	-	2	2	1	-	-	-	-	30	20$	50
08	24CV502L	Geo-Technical Engineering Laboratory	VSEC	-	-	2	2	1	-	-	-	-	60	40**	100
09	24CV503L	Environmental Engineering Laboratory	VSEC	-	-	2	2	1	-	-	-	-	30	20*	50
10	24CV507T	Intellectual Property Rights for Civil Engineering	CCA	2	-	-	2	2	50	-	50	-	-	-	100
Total				**19**		**06**	**25**	**22**	**140**	**120**	**140**	**300**	**120**	**80**	**900**

L: Lecture, **T:** Tutorial, **P:** Practical, **CA-I:** Continuous Assessment-I, **MSE**: Mid Semester Examination, **CA-II:** Continuous Assessment-II, **CIE**: Continuous in Semester Evaluation, **ESE**: End Semester Examination, *: External Oral Exam., **: External Oral Practical Exam., $: Internal oral Exam.

	BSC/ESC		Program Courses		Multidisciplinary Courses		Skill Courses	Humanities Social Science and Management (HSSM)				Experiential Learning Courses (ELC)			Liberal Learning Courses (LLC)	Total
Course Category	BSC	ESC	PCC	PEC	MDM	OE	VSEC	AEC-01, AEC-02	EEM	IKS	VEC	Int/OJT	Proj.	CEA/FP	CCA	
Credits			12		03	03	02								02	22
Cum.Sum	**16**	**15**	**44**		**07**	**03**	**07**	**05**	**02**	**02**	**04**			**01**	**04**	**110**

Coordinator HoD Dean

List of Programme Elective Courses (PEC) – I

Course Code	Course Name	Domain
24CV504TA	Solid Waste Management	Environmental Engineering
24CV504TB	Advanced Surveying – Remote sensing, GIS, GPS.	Surveying
24CV504TC	Railway & Airport Engineering	Transportation Engineering
24CV504TD	Construction Practices	Construction
24CV504TE	Structural Analysis	Structures
24CV504TF	Engineering Management	Management

Shri Ambabai Talim Sanstha's

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Teaching and Evaluation Scheme

Program: B. Tech. Civil Engineering

Class.: **Third Year, B. Tech.** Semester: **SEM - VI** W.E.F.: **2026-2027**

Sr. No.	Course Code	Course Title	Course Category	Teaching Scheme				Course Credits	Evaluation scheme						
									Theory				Practical		Total
									CIE			ESE	CIE	ESE	
				L	T	P	Contact Hrs/wk		CA-I	MSE	CA-II				
01	24CV601T	Design of concrete structures- I	PCC	3	-	-	3	3	15	20	15	50	-	-	100
02	24CV602T	Infrastructure Engineering	PCC	2	-	-	2	2	15	20	15	50	-	-	100
03	24CV603T	Foundation Engineering	PCC	2	-	-	2	2	15	20	15	50	-	-	100
04	24CV604T	PEC-II	PEC	3	-	-	3	3	15	20	15	50	-	-	100
05	24CV605T	MDM-IV (Operation Research)	MDM	2	-	-	2	2	15	20	15	50	-	-	100
06	24CV606T	Open Elective -II	OE	3	-	-	3	3	15	20	15	50	-	-	100
07	24CV607T	Ethics in Profession	AEC	2	-	-	2	2	25	-	25	-	-	-	50
08	24CV602L	Infrastructure Engineering Laboratory	PCC	-	-	2	2	1					30	20*	50
09	24CV608L	DSS Laboratory	PCC	-	-	2	2	1	-	-	-	-	30	20*	50
10	24CV605L	MDM-IV (Operation Research Laboratory)	MDM	-	-	2	2	1	-	-	-	-	30	20$	50
11	24CV609L	Mini Project	Project	-	-	4	4	2	-	-	-	-	60	40*	100
Total				17	-	10	27	22	115	120	115	300	150	100	900

L: Lecture, **T:** Tutorial, **P:** Practical, **CA-I:** Continuous Assessment-I, **MSE**: Mid Semester Examination, **CA-II:** Continuous Assessment-II, **CIE**: Continuous in Semester Evaluation, **ESE**: End Semester Examination, *: External Oral Exam., **: External Oral Practical Exam., $: Internal oral Exam.

	BSC/ESC		Program Courses		Multidisciplinary Courses		Skill Courses	Humanities Social Science and Management (HSSM)				Experiential Learning Courses (ELC)			Liberal Learning Courses (LLC)	Total
Course Category	BSC	ESC	PCC	PEC	MDM	OE	VSEC	AEC-01, AEC-02	EEM	IKS	VEC	Int/OJT	Proj.	CEA/FP	CCA	
Credits			09	03	03	03		02					02			22
Cum.Sum	**16**	**15**	**53**	**03**	**10**	**06**	**07**	**07**	**02**	**02**	**04**		**02**	**01**	**04**	**132**

Coordinator HoD Dean

List of Programme Elective Courses (PEC) – II

Course Code	Course Name	Domain
24TCV604TA	Planning For Sustainable Development	Environmental Engineering
24TCV604TB	Drone Technology	Surveying
24TCV604TC	Bridge Engineering	Transportation Engineering
24TCV604TD	Safety in construction Industry	Construction
24TCV604TE	Advanced Structural Analysis	Structures
24TCV604TF	Entrepreneurship Development for Engineers	Management

Exit Course after SEM VI
(Bachelor Degree in Vocation (B.Voc) / B.Sc in Civil Engineering)

Sr. No.	Course Code	Course Title	Course Category	Teaching Scheme				Course Credits	Evaluation scheme						
									Theory				Practical		Total
									CIE			ESE	CIE	ESE	
				L	T	P	Contact Hrs/wk		CA-I	MSE	CA-II				
01	24CVOLT	Online Two Skill Courses at Degree Level from NSQF/ESSC/Any Other Agency providing certification/Evaluation	Exit	-	-	-	-	2	25	-	25	50	-	-	100
02	24CVOJT	2 Months Internship	Exit	-	-	-	-	6	-	-	-	-	60	40	100
Total				-	-	-	-	8	25	-	25	50	60	40	200

Teaching and Evaluation Scheme

Program: B. Tech. Civil Engineering

Class.: **Final Year, B. Tech.** Semester: **SEM - VII** W.E.F.: **2027-2028**

Sr. No.	Course Code	Course Title	Course Category	Teaching Scheme				Course Credits	Evaluation scheme						
									Theory				Practical		Total
									CIE			ESE	CIE	ESE	
				L	T	P	Contact Hrs/wk		CA-I	MSE	CA-II				
01	24CV701T	Design of concrete structure- II	PCC	3	-	-	3	3	15	20	15	50			100
02	24CV702T	Quantity Survey and Valuation	PCC	3	-	-	3	3	15	20	15	50			100
03	24CV703T	PEC-III	PEC	3	-	-	3	3	15	20	15	50			100
04	24CV704T	PEC-IV	PEC	3	-	-	3	3	15	20	15	50			100
05	24CV705T	MDM-V (Sustainable Engineering and Trends)	MDM	2	-	-	2	2	15	20	15	50			100
06	24CV706T	Open Elective -III	OE	2	-	-	2	2	15	20	15	50			100
07	24CV702L	Quantity Survey and Valuation Laboratory	PCC	-	-	2	2	1					30	20*	50
08	24CV708L	Structural Design and Drawing of Concrete Structures	CEA	-	-	2	2	1					60	40*	100
09	24CV705L	MDM V Capstone Project	MDM	-	-	4	4	2					30	20*	50
10	24CV709L	Project Stage-I	Project	-	-	4	4	2					60	40$	100
Total				**16**	**-**	**12**	**28**	**22**	**90**	**120**	**90**	**300**	**180**	**120**	**900**

L: Lecture, **T:** Tutorial, **P:** Practical, **CA-I:** Continuous Assessment-I, **MSE**: Mid Semester Examination, **CA-II:** Continuous Assessment-II, **CIE**: Continuous in Semester Evaluation, **ESE**: End Semester Examination, *: External Oral Exam., **: External Oral Practical Exam., $: Internal oral Exam.

	BSC/ESC		Program Courses		Multidisciplinary Courses		Skill Courses	Humanities Social Science and Management (HSSM)				Experiential Learning Courses (ELC)			Liberal Learning Courses (LLC)	Total
Course Category	BSC	ESC	PCC	PEC	MDM	OE	VSEC	AEC-01, AEC-02	EEM	IKS	VEC	Int/OJT	Proj.	CEA/FP	CCA	
Credits			07	06	04	02							02	01		22
Cum.Sum	**16**	**15**	**60**	**09**	**14**	**08**	**07**	**07**	**02**	**02**	**04**		**04**	**02**	**04**	**154**

List of Programme Elective Courses (PEC) – III

Course Code	Course Name	Domain
24TCV703TA	Environmental Impact Assessment	Environmental Engineering
24TCV703TB	BIM & Survey Data Integration	Surveying
24TCV703TC	Dock, Harbour, Tunnel Engineering	Transportation Engineering
24TCV703TD	Composite Materials	Construction
24TCV703TE	Earthquake Engineering and Structural Dynamics	Structures
24TCV703TF	Financial Management	Management

List of Programme Elective Courses (PEC) – IV

Course Code	Course Name	Domain
24TCV704TA	Integrated waste management for a smart city	Environmental Engineering
24TCV704TB	Land Surveying and Legal Aspects	Surveying
24TCV704TC	Urban Mobility Planning &Intelligent Transport	Transportation Engineering
24TCV704TD	Advanced Construction Techniques	Construction
24TCV704TE	Rehabilitation & Retrofiring of Structures	Structures
24TCV704TF	-	Management

Teaching and Evaluation Scheme

Program: B. Tech. Civil Engineering

Class.: **Final Year, B. Tech.** Semester: **SEM - VIII** W.E.F.: **2027-2028**

Sr. No.	Course Code	Course Title	Course Category	Teaching Scheme				Course Credits	Evaluation scheme						
									Theory				Practical		Total
									CIE			ESE	CIE	ESE	
				L	T	P	Contact Hrs/wk		CA-I	MSE	CA-II				
01	24CV801T	PEC-V NPTEL/SWAYAM course	PEC	2				2	15	20	15	50			100
02	24CV802T	NPTEL/SWAYAM course Research Methodology	PEC	2				2	15	20	15	50			100
03	24CV803L	Project Stage-II	Project			8		4					100	100*	200
04	24CV804L	Internship	Internship			18		12					100	100$	200
Total				4		24		20	30	40	30	100	200	200	600

L: Lecture, **T:** Tutorial, **P:** Practical, **CA-I:** Continuous Assessment-I, **MSE**: Mid Semester Examination, **CA-II:** Continuous Assessment-II, **CIE**: Continuous in Semester Evaluation, **ESE**: End Semester Examination, *: External Oral Exam., **: External Oral Practical Exam., $: Internal oral Exam.

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	BSC/ESC		Program Courses		Multidisciplinary Courses		Skill Courses	Humanities Social Science and Management (HSSM)				Experiential Learning Courses (ELC)			Liberal Learning Courses (LLC)	Total
Course Category	BSC	ESC	PCC	PEC	MDM	OE	VSEC	AEC-01, AEC-02	EEM	IKS	VEC	Int/OJT	Proj.	CEA/FP	CCA	
Credits				04								12	04			20
Cum.Sum	**16**	**15**	**60**	**13**	**14**	**08**	**07**	**07**	**02**	**02**	**04**	**12**	**08**	**02**	**04**	**174**

Coordinator HoD Dean

Track wise Programme Elective Courses (PEC)

PEC Track / Module	Sem – V PEC – I	Sem – VI PEC – II	Sem – VII PEC – III	Sem – VII PEC – IV
Environmental Engineering	Solid Waste Management	Planning For Sustainable Development	Environmental Impact Assessment	Integrated waste management for a smart city
Surveying	Advanced Surveying – Remote sensing, GIS, GPS.	Drone Technology	BIM & Survey Data Integration	Land Surveying and Legal Aspects
Transportation Engineering	Railway & Airport Engineering	Bridge Engineering	Dock, Harbour, Tunnel Engineering	Urban Mobility Planning &Intelligent Transport
Construction	Construction Practices	Safety in construction Industry	Composite Materials	Advanced Construction Techniques
Structures	Structural Analysis	Advanced Structural Analysis	Earthquake Engineering and Structural Dynamics	Rehabilitation & Retrofiring of Structures
Managenent	Engineering Management	Entrepreneurship Development for Engineers	Financial Management	-

Multidisciplinary Minor(MDM)

- Students should select any one minor, excluding those offered by their parent department, from the diverse range of minors available.
- Students should complete all courses within their selected minor in order to earn credits.

List of Multidisciplinary Minor (MDM)courses offered by Departments

MDM Name	Sr. No	Course Code	Course Name	Credits	Sem	Offered by Department	Applicable to Program/s						
							Civil	AIML	Comp.	Elect.	E&Tc	ECS	Mech.
Leadership and Management	1	24CV305T	Management in Engineering	2	III	Civil Engineering	No	Yes	Yes	Yes	Yes	Yes	Yes
	2	24CV405T	Lean Concept and Management Approach	2	IV								
	3	24CV505T	Disaster Management and Mitigation Techniques	2	V								
	4	24CV505L	Disaster Management and Mitigation Techniques Laboratory	1	V								
	5	24CV605T	Operation Research	2	VI								
	6	24CV605L	Operation Research Laboratory	1	VI								
	7	24CV705T	Sustainable Engineering Trends	2	VII								
	8	24CV705L	Capstone Project	2	VII								
Artificial Intelligence and Machine Learning	1	24AI305T	Introduction to AIML	2	III	Computer Science(AIML) Engineering	No	No	No	Yes	Yes	Yes	Yes
	2	24AI405T	Prompt Engineering	2	IV								
	3	24AI505T	Applied Machine Learning	2	V								
	4	24AI505L	Applied Machine Learning Lab	1	V								
	5	24AI605T	Deep Learning	2	VI								
	6	24AI605L	Deep Learning Lab	1	VI								
	7	24AI705T	Applications of AI	2	VII								
	8	24AI705L	Capstone Project on AI-ML	2	VII								

List of Multidisciplinary Minor (MDM)courses offered by departments

MDM Name	Sr. No	Course Code	Course Name	Credits	Sem	Offered by Department	ApplicabletoProgram/s						
							Civil	AIML	Comp.	Elect.	E&Tc	ECS	Mech.
Data Science	1	24CE305T	Principles of Data Science	2	III	Computer Engineering	Yes	Yes	No	Yes	Yes	Yes	Yes
	2	24CE405T	Mathematics for Data Science	2	IV								
	3	24CE505T	Programming in Data Science	2	V								
	4	24CE505L	Programming in Data Science Lab	1	V								
	5	24CE605T	Programming for Data Analysis	2	VI								
	6	24CE605L	Programming for Data Analysis Lab	1	VI								
	7	24CE704T	AI & IOT Data Science applications	2	VII								
	8	24CE705L	Capstone Project on Data Science Application	2	VII								
Industrial Electrical System	1	24EE305T	Renewable Energy and Cogeneration in Industry	2	III	Electrical Engineering	Yes	No	No	No	Yes	Yes	Yes
	2	24EE405T	Electrical Vehicle Technology	2	IV								
	3	24EE505T	Electrical Installation System	2	V								
	4	24EE505L	Electrical Installation System Lab	1	V								
	5	24EE605T	Electrical Switch gears and Safety	2	VI								
	6	24EE605L	Electrical Switchgears and Safety Lab	1	VI								
	7	24EE705T	Creative, Innovative and New product Development	2	VII								
	8	24EE705L	Capstone/Mini Project	2	VII								

List of Multidisciplinary Minor (MDM)courses offered by departments

MDM Name	Sr. No	Course Code	Course Name	Credits	Sem	Offered by Department	Applicable to Program/s						
							Civil	AIML	Comp.	Elect.	E&Tc	ECS	Mech.
Communication System	1	24ET305T	Fundamentals of Communication Engineering	2	III	Electronics &Telecommunication Engineering	No	Yes	Yes	Yes	No	Yes	No
	2	24ET405T	Optical Communication Network	2	IV								
	3	24ET505T	Wireless&6GTechnology	2	V								
	4	24ET505L	Wireless&6GTechnologyLab	1	V								
	5	24ET605T	Data Communication & Networking	2	VI								
	6	24ET605L	Data Communication & Networking Lab	1	VI								
	7	24ET705T	Network Simulation & Security	2	VII								
	8	24ET705L	Mini/Capstone Project	2	VII								
IoT and Applications	1	24EC305T	Fundamentals of IoT	2	III	Electronics & Computer Engineering	Yes	Yes	Yes	Yes	Yes	No	Yes
	2	24EC405T	Sensors and Wireless Sensor Network	2	IV								
	3	24EC505T	Communication Protocol & Networking for IoT tools& Platforms	2	V								
	4	24EC505L	Communication Protocol &Networking for IoT tools& Platforms Lab.	1	V								
	5	24EC605T	Security Privacy and Data Management	2	VI								
	6	24EC605L	Security Privacy and Data Management Lab.	1	VI								
	7	24EC705T	Robotics	2	VII								
	8	24EC705L	Capstone Project	2	VII								

MDM Name	Sr. No	Course Code	Course Name	Credits	Sem	Offered by Department	Applicable to Program/s						
							Civil	AIML	Comp.	Elect.	E&Tc	ECS	Mech.
Product Design and Development	1	24ME305T	Introduction to Product Design	2	III	Mechanical Engineering	Yes	Yes	Yes	Yes	Yes	Yes	No
	2	24ME405T	Materials and Manufacturing Processes for Product Design	2	IV								
	3	24ME505T	CAD and Digital Prototyping	2	V								
	4	24ME505L	CAD and Digital Prototyping Lab	1	V								
	5	24ME605T	Product Life cycle Management	2	VI								
	6	24ME605L	Product Life cycle Management Lab	1	VI								
	7	24ME705T	Creativity, Innovation and New Product Development	2	VII								
	8	24ME705L	Mini Project	2	VII								

List of Open Elective Courses (OE)-I

Course Code	Course Name	Offered by Department
24AI506T	Object Oriented Programming	Computer Science (AIML)Engineering
24CE506T	Customer Relationship Management	Computer Engineering
24CV506T	Project Management	Civil Engineering
24EE506T	E-Business and Retailing	Electrical Engineering
24EC506T	Introduction to Robotics	Electronics &Computer Engineering
24ET506T	E Waste Management	Electronics & Telecommunication Engineering
24ME506T	Design Thinking	Mechanical Engineering

List of Open Elective Courses(OE)– II

Course Code	Course Name	Offered by Department
24AI606T	Advance Excel	Computer Science(AIML)Engineering
24CE606T	Engineering Econometrics	Computer Engineering
24CV606T	Strategic Management Techniques	Civil Engineering
24EE606T	Financial Management	Electrical Engineering
24EC606T	Drone Technology	Electronics &Computer Engineering
24ET606T	Digital Marketing	Electronics &Telecommunication Engineering
24ME606T	Entrepreneurship Development	Mechanical Engineering

List of Open Elective Courses (OE)-III

Course Code	Course Name	Offered by Department
24AI706T	Operational Research	Computer Science(AIML)Engineering
24CE706T	Start up and Entrepreneurship	Computer Engineering
24CV706T	Human Resource Management in Technical Organization	Civil Engineering
24EE706T	IT Act and Cyber Laws	Electrical Engineering
24EC706T	Smart City–An Electronic Perspective	Electronics & Computer Engineering
24ET706T	Sustainable Infrastructure Planning	Electronics &Telecommunication Engineering
24ME706T	Green Technology	Mechanical Engineering

Course Code	24CV501T	Course Name	Design of Steel Structures			
Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
3	-	3	15	20	15	50

Course Prerequisites:

Strength of Materials, Structural Mechanics

Course Objective:

1. To understand the fundamentals of steel structures, including design philosophy, material properties, loads, and connection behaviour.
2. To apply design principles and IS code provisions for tension and compression members.
3. To analyse the behaviour of laterally supported and unsupported beams under various loading conditions
4. To evaluate the strength and stability of columns and their bases under axial and biaxial loading.
5. To understand the structural components and load considerations in industrial steel structures.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Analyse and design basic bolted and welded connections subjected to axial and eccentric loading conditions
CO-2	Design axially loaded tension and compression members considering different failure modes and section properties.
CO-3	Design steel beams, including built-up sections, accounting for bending, shear, and stability requirements.
CO-4	Design columns and column bases (slab base, gusseted base, and moment-resisting base) as per code provisions.
CO-5	Develop design solutions for roof trusses, purlins, and gantry girders, including member design and connections.

Course Contents

Unit-I	Introduction and Connections	Hours:13

Advantages & disadvantages of steel structures, types of steel structures, various types of standards rolled sections, Design Philosophy, types of loads and load combinations, partial safety factors for load and materials, elastic and plastic properties of sections, shape factor, stress distribution under tension, compression, bending and shear.

Connections - Types of bolts & welds, analysis and Design of axially and eccentrically loaded bolted and welded connections (subjected to bending only).

Unit-II	Tension and Compression Members	Hours:08

Tension Members: Design of axially loaded tension members, Common sections, Net area, Types of tension members, modes of failures, shear lag effect, IS code provisions and design.

Compression Members: Design of axially loaded compression members, section classifications, effective length, slenderness ratio, simple sections, built-up sections, design of lacings and battens, Single angle and double angle strut.

Unit-III	Beams	Hours:07

Laterally supported & unsupported beams, design of simple beams, built up beams using flange plates, curtailment of flange plates, web buckling & web crippling		
Unit-IV	**Columns and Column Bases**	**Hours:08**
Column subjected to Axial load and biaxial bending, built up column sections, laced and battened columns. Column bases: Design of slab base, gusseted base, moment resisting base, Anchor bolts.		
Unit-V	**Industrial Roofing**	**Hours:09**
Roof trusses: Components of an industrial shed, types of trusses, load calculations and combinations, design of purlins, design of truss members, connection of truss to column. Gantry girder: Forces acting on a gantry girder, commonly used sections, introduction to design of gantry girder as laterally unsupported beam, connection details		

Text Books:

1. Duggal S.K., "Limit state design of steel structures", Tata McGraw-Hill Publications, New Delhi, 2nd Edition, 2014.
2. Shiyekar, M. R., "Limit state design in structural steel", PHI learning Pvt.Ltd Publications 2nd Edition 2013.
3. Subramanian N., "Design of steel structures", Oxford University Press, 2010.
4. Design of Steel Structures: K.S.Sairam, Pearson

Reference Books

1. Dayaratnam, P., "Design of steel structures", S. Chand Publication, New Delhi, 2008.
2. Englekirk, Robert, "Steel structures: controlling behavior through design", John Wiley and Sons, 2003.
3. Gaylord, Edwin and Gaylord, Charles, "Design of steel structures", Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rdEdition, 2010
4. IS 800-2007 "Code of Practice for General Construction in steel", and IS 875-1987 part 1 to 5; "Code of Practice for Design Loads (other than earthquake) for building structures", Bureau of Indian Standards, New Delhi.

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

1. https://archive.nptel.ac.in/courses/105/105/105105162/
2. https://onlinecourses.nptel.ac.in/noc19_ce25/preview

Course Code	24CV502T	Course Name	Geo-Technical Engineering			
Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
3	-	3	15	20	15	50

Course Prerequisites:

1. Knowledge of different types of soil available in the field.
2. Compaction process and different types of equipment used for compaction.
3. Calculation of stress and resultant (Engineering Mechanics).
4. Knowledge of derivatives and integration (Mathematics).
5. Properties of materials (Strength of Materials).

Course Objective:

1. To introduce the **basic properties and classification of soils used in geotechnical engineering**.
2. To explain the **concepts of permeability and seepage flow through soils** and their engineering applications.
3. To develop understanding of **soil compaction and consolidation behavior** under loading conditions.
4. To study the **distribution of stresses in soil due to different loading conditions**.
5. To understand the **shear strength characteristics of soils and earth pressure theories used in the design of retaining structures**.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Identify and evaluate different soil properties and classify soils using standard soil classification systems.
CO-2	Analyze permeability and seepage characteristics of soils and apply flow net concepts.
CO-3	Explain compaction and consolidation behaviour of soils and determine consolidation parameters.
CO-4	Evaluate stress distribution in soil due to various loading conditions using theoretical approaches.
CO-5	Determine shear strength parameters of soils and apply earth pressure theories in geotechnical design.

Course Contents

Unit-I	Soil Properties	Hours:08
Soil phase systems, weight-volume relationship, index properties of soil – unit weights, water content, specific gravity, void ratio, porosity, air content, degree of saturation, their relationships and significance, particle size distribution by sieve analysis and hydrometer analysis, Atterberg's consistency limits, consistency indices, Indian Standard Soil Classification System (ISSCS), Casagrande plasticity chart		
Unit-II	**Permeability and Seepage Analysis**	**Hours:09**
Darcy's law and its validity, one dimensional permeability, factors affecting permeability of soil, determination of permeability of soil by constant head and variable head methods, seepage through soil, seepage pressure, flow net, flow net applications, uplift pressure, piping, quick sand condition, critical hydraulic gradient, concept of total stress, pore pressure and effective stress under different soil conditions.		
Unit-III	**Compaction and Consolidation**	**Hours:12**
Process of compaction, factors affecting compaction, standard proctor test and modified proctor test as per IS 2720, zero air void line and placement water content, field compaction control, field compaction equipment with their suitability in construction work, concept of consolidation, factors affecting		

consolidation, Terzaghi's piston and spring model, Terzaghi's theory of one-dimensional consolidation, lab consolidation tests to find coefficient of consolidation, coefficient of volume change, compression index, coefficient of compressibility, NCC, UCC and OCC.

Unit-IV	**Stress Distribution in soil**	**Hours:08**

Boussinesq theory – assumptions and applications for point load, strip load and circular loaded areas. Pressure distribution in soil on horizontal and vertical planes, **pressure bulbs and isobars**, use of **Newmark's influence chart**. **Westergaard's theory** – assumptions and application for uniformly loaded rectangular areas. **Contact pressure under footings** and approximate methods for stress calculation (**2V:1H method**).

Unit-V	**Shear Strength of Soil and Earth Pressure Theory**	**Hours:12**

Concept of shear stress and shear strength. Mohr–Coulomb failure theory and shear strength parameters of soils. Factors affecting shear strength of cohesive and cohesionless soils. Determination of shear strength by direct shear test, triaxial compression test and unconfined compression test.
Concept of earth pressure, earth pressure at rest, active and passive earth pressure conditions. Rankine's earth pressure theory for cohesionless soils, horizontal backfill with surcharge. Total lateral force on retaining wall and tension cracks in soil.

Text Books:

1. **"Soil Mechanics and Foundation Engineering"** – B. C. Punmia, Laxmi Publication, 18th Edition, published in 2023.
2. **"Soil Mechanics and Foundation Engineering"** – K. R. Arora, Standard Publisher, 7th Edition, 953 pages, reprint released in 2022.
3. **"Soil Mechanics and Foundation Engineering"** – V. N. S. Murthy, Marcell Dekker, 1st Edition, 2002.
4. **"Basic and Applied Soil Mechanics"** – A. S. R. Rao and Gopal Ranjan, New Age International Publication, 5th Edition, published in August 2023.
5. **"Geotechnical Testing and Instrumentation"** – Alam Singh, CBS Publisher, 2nd Edition, 2014.
6. **"Geotechnical Engineering"** – C. Venkataramaiah, New Age International Publication, 6th Edition, September 1, 2018.
7. **"Geotechnical Engineering"** – Purushottam Raj, New Age International Publication.

Reference Books

1. **K. R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers.**
2. **V. N. S. Murthy, Soil Mechanics and Foundation Engineering, CBS Publishers.**
3. **Braja M. Das, Principles of Foundation Engineering, Cengage Learning.**
4. **T. W. Lambe and R. V. Whitman, Soil Mechanics, Wiley Publications.**
5. **K. Terzaghi, R. B. Peck and G. Mesri, Soil Mechanics in Engineering Practice, Wiley.**

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

1. **Introduction to Soil Mechanics** – NPTELhttps://nptel.ac.in/courses/105106049
2. **Geotechnical Engineering, I** – NPTELhttps://nptel.ac.in/courses/105101084
3. **Soil Mechanics** – SWAYAMhttps://swayam.gov.in
4. **Geotechnical Engineering Fundamentals** – NPTELhttps://nptel.ac.in/

Course Code	24CV503T	Course Name	Environmental Engineering			
Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
3	-	3	15	20	15	50

Course Prerequisites:

Basic knowledge of Fluid Mechanics, Fundamentals of Engineering Chemistry, Basic Hydrology and Water Resources

Course Objective:

1. To introduce the importance of environmental protection and sustainable water management.
2. To understand water demand, water quality, and drinking water standards.
3. To study design principles of water treatment units.
4. To understand wastewater collection, treatment, and disposal systems.
5. To introduce concepts of solid waste management and air pollution control.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Explain environmental components, water demand, and water quality standards.
CO-2	Describe and design basic water treatment units.
CO-3	Analyze water distribution systems and water supply methods.
CO-4	Explain wastewater characteristics and treatment processes.
CO-5	Understand solid waste management and air pollution control techniques.

Course Contents

Unit-I	Introduction to Environmental Engineering	Hours:09

Environment and its components, importance of environmental protection, role of environmental engineer in sustainable development, Water resources and sources of water supply: surface water and groundwater sources, Water demand: types of demand, design period, design population forecasting methods, per capita demand, factors affecting water consumption, Variation in demand: seasonal, daily and hourly variations, peak demand factors, Design capacity for water supply components, Quality of water: Physical characteristics , Chemical characteristics

Unit-II	Treatment of Water	Hours:12

Necessity of water treatment and flow diagram of water treatment plant, Intake Structures Types of intake structures and design considerations.

Aeration: Purpose of aeration, removal of taste and odour, aeration methods, design of aeration fountain.

Sedimentation: Theory of sedimentation, settling velocity, types of sedimentation tanks, surface loading rate, detention time, inlet and outlet arrangements.

Coagulation and Flocculation: Need for coagulation, types of coagulants, coagulant dosage, optimum pH, rapid mixing devices, flocculation process, mean velocity gradient.

Clarification: Clari-flocculator, plate settlers, tube settlers.

Filtration: Theory of filtration, filter media, types of filters (slow sand filter and rapid sand filter), components, working and cleaning of filters.

Disinfection: Theory of chlorination, factors affecting disinfection, breakpoint chlorination, chlorine demand, bleaching powder estimation.

Water Softening: Lime-soda process, ion exchange process, demineralization.

Unit-III	Water Conveyance and Distribution System	Hours:08

Conveyance of raw water: canals and pipelines, Hydraulics of conduits flowing full and partially full, Pipe materials and pipe joints, Laying and testing of pipelines, Design of rising main, Valves and fittings used in water supply system, Types of pumps used in water supply

Water distribution systems: Continuous and intermittent supply, Types of distribution networks, Layout of distribution systems, Methods of water supply: gravity, pumping, combined system, Hydraulic

analysis of distribution systems

Unit-IV	Wastewater Engineering	Hours:10

Sources of wastewater and wastewater flow characteristics, Components of wastewater: physical, chemical, and biological constituents, Characteristics of municipal wastewater, Concepts of sewage, sullage, and storm water.
Sewerage systems: separate system, combined system, partially separate system.
Necessity of wastewater treatment.

Wastewater Treatment Processes

Preliminary treatment: screening, grit removal, skimming.
Primary treatment: sedimentation tanks.
Secondary treatment: Activated sludge process, Trickling filters, Oxidation ponds
Introduction to tertiary or advanced treatment.
Fundamentals of anaerobic treatment.
Industrial wastewater and sewage of common origin.

Unit-V	Pollution	Hours:06

Water Pollution

Definition and sources of water pollution, Types of water pollutants: Physical, Chemical, and Biological Water quality parameters: pH, Turbidity, DO, BOD, COD, TDS, Effects of water pollution on human health and aquatic ecosystems, Prevention and control measures

Air Pollution

Definition and sources of air pollution, Types of air pollutants, Meteorological parameters affecting air pollution, Atmospheric stability, mixing height, plume behaviour, Effects of air pollution on health and environment, Air pollution control measures.

Noise Pollution

Definition and sources of noise pollution, Noise characteristics and measurement units (dB), Effects of noise pollution on human health and environment, Noise standards and regulations, Noise monitoring and assessment methods, Noise control measures at source, transmission path, and receiver

Text Books:

1. **Water Supply Engineering Vol I Garg,S.K Khanna publication.**
2. **Water Supply Engineering Vol I Modi, P.N. Standard Book House.**
3. **Water Supply Engineering Punmia,B.C. Laxmi Pub, N Delhi**
4. **Water Supply & Sanitary Engineering Birdie,G.S.Dhanpat Rai Pub. N Delhi.**
5. **Water & Waste Water Technology Hammer,M.J.PHI Learning.**

Reference Books

1. **Environmental Engineering Peavy, Howard S. MacGraw Hill Pvt.Ltd**
2. **Waste Water Treatment Rao,M.Noxforde IBH Pub**
3. **Environmental Pollution Control Engineering Rao C.S. New Age Int,N.Delhi**

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

1. **Water and waste water treatment By Prof. Bhanu Prakash Vellanki | IIT Roorkee**

Course Code	24CV504TA	Course Name	Solid Waste Management

Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
3	-	3	15	20	15	50

Course Prerequisites:

Students should have basic knowledge of:

1. Environmental Engineering
2. Environmental Studies
3. Engineering Chemistry

Course Objective:

1. Familiarize students regarding sources, types, characteristics, and environmental impacts of solid waste and the need for effective solid waste management systems.
2. Develop knowledge of waste storage, segregation, collection, transfer, and transportation methods used in municipal solid waste management.
3. Impart the knowledge of principles and applications of various solid waste processing and treatment technologies, including biological, mechanical, and thermal treatment methods.
4. Train the students regarding the planning, design, operation, and environmental aspects of sanitary landfill systems for safe disposal of solid waste.
5. Develop knowledge of resource recovery, waste-to-energy technologies, waste management regulations, and emerging sustainable practices for integrated solid waste management.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Identify and characterize different types of solid waste and estimate waste generation rates.
CO-2	Plan efficient systems for waste storage, collection, transfer, and transportation.
CO-3	Analyze and select suitable waste processing and treatment technologies.
CO-4	Design and evaluate sanitary landfill systems including leachate and gas management.
CO-5	Apply principles of recycling, resource recovery, waste-to-energy technologies, and environmental regulations.

Course Contents

Unit-I	**Fundamentals of Solid Waste Management**	**Hours:09**
Definition and classification of solid waste, Sources of solid waste, Municipal, industrial, biomedical, hazardous, e-waste and C&D waste, Functional elements of SWM, Factors affecting waste generation Waste generation rates and future projections, Physical, chemical and biological characteristics, Sampling and characterization techniques, Public health and environmental impacts of improper waste disposal		
Unit-II	**Storage, Collection and Transportation**	**Hours:09**
Waste minimization hierarchy, Source reduction, reuse and recycling, Segregation at source, Storage methods and containers, Primary and secondary collection systems, Collection routes and route optimization, Collection equipment and vehicles, Transfer stations, Transportation methods and logistics		
Unit-III	**Processing and Treatment of Solid Waste**	**Hours:09**
Biological Treatment: Composting principles, Aerobic and anaerobic composting, Indore and Bangalore methods, Vermicomposting, Bio methanation **Thermal Treatment:** Incineration, Pyrolysis, Gasification, Refuse Derived Fuel (RDF) **Mechanical Processing:** Screening, Shredding, Baling, Material Recovery Facilities (MRFs)		
Unit-IV	**Sanitary Landfills and Disposal Systems**	**Hours:10**
Open dumping and controlled dumping, Sanitary landfill concept, Site selection criteria, Landfill planning and layout, Components of sanitary landfill, Landfill operation and management, Leachate generation and control, Landfill gas generation and management, Environmental monitoring and closure plans		
Unit-V	**Resource Recovery, Legislation and Smart Waste Management**	**Hours:10**
Resource Recovery and Sustainable SWM: Recycling and material recovery, Waste-to-energy technologies, Circular economy concepts, Integrated Solid Waste Management (ISWM) **Legislation and Policies:** Solid Waste Management Rules, 2016, Plastic Waste Management Rules, E-Waste Management Rules, Biomedical Waste Management Rules, Construction & Demolition Waste Rules **Case Studies:** Indore Municipal Corporation SWM Model, Pune Waste Management System, Smart City Waste Management Practices **Emerging Trends:** IoT-based smart bins, GIS in waste management, Artificial Intelligence in waste collection planning		
Text Books:		
1. Integrated Solid Waste Management – George Tchobanoglous, Hilary Theisen and Samuel Vigil, McGraw Hill. 2. Handbook of Solid Waste Management, McGraw Hill. 3. Solid Waste Technology and Management, Wiley Publications. 4. Environmental Engineering, McGraw Hill. 5. CPHEEO Manual on Municipal Solid Waste Management, Government of India		
Reference Books		

1. Michael D. LaGrega, Buckingham and Evans – Hazardous Waste Management.
2. Vesilind, Worrell and Reinhart – Solid Waste Engineering.
3. Sincero and Sincero – Environmental Engineering.
4. Manual on Municipal Solid Waste Management, Ministry of Housing and Urban Affairs, Government of India.

Online Video Resources (NPTEL & Open Learning)

NPTEL Course: Municipal Solid Waste Management
NPTEL Municipal Solid Waste Management Course
NPTEL SWM Lecture Series
NPTEL Video Lectures on Solid Waste Management
SWAYAM Platform
SWAYAM Courses Portal
Ministry of Housing and Urban Affairs (MoHUA)
Swachh Bharat Mission Urban Resources
Central Pollution Control Board
CPCB Waste Management Guidelines

Course Code	24CV504TB	Course Name	Advanced Surveying – Remote sensing, GIS, GPS

Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
3	-	3	15	20	15	50

Course Prerequisites:

Basic knowledge of geography and earth sciences, Fundamentals of mathematics and coordinate systems, Basic computer skills and data handling, Introductory knowledge of Surveying

Course Objective:

1. Introduce principles and applications of Remote Sensing, GIS, and GPS
2. Develop understanding of spatial data acquisition and analysis
3. Enable use of GIS tools for mapping and decision-making
4. Understand satellite systems and positioning technologies
5. Apply geospatial techniques in engineering and environmental problems

Course Outcome: After successful completion of the course, students will be able to

CO-1	Explain principles of remote sensing, GIS, and GPS
CO-2	Interpret satellite imagery and spatial data
CO-3	Apply GIS tools for spatial analysis and mapping
CO-4	Understand GPS technology and its engineering applications
CO-5	Integrate geospatial technologies for real-world problem solving

Course Contents

Unit-I	Fundamentals of Remote Sensing	Hours:09

Introduction to Remote Sensing, Electromagnetic Radiation and Spectrum, Energy interactions with atmosphere and earth surface, Platforms and Sensors, Types of Remote Sensing (Passive & Active) Resolution concepts: Spatial, Spectral, Radiometric, Temporal, Image characteristics and interpretation elements

Unit-II	Satellite Systems and Image Processing	Hours:09

Satellite orbits and types, Earth observation satellites (Indian and global), Data acquisition systems Image preprocessing: geometric and radiometric corrections, Image enhancement techniques, Image classification: supervised and unsupervised, Accuracy assessment

Unit-III	Geographic Information System (GIS)	Hours:09

Introduction to GIS and components, Spatial data models: Raster and Vector, Data input and editing,

Database management systems (DBMS), Coordinate systems and map projections, Spatial analysis: overlay, buffering, network analysis, GIS applications in engineering		
Unit-IV	**Global Positioning System (GPS)**	**Hours:09**
Introduction to GPS and GNSS, Segments of GPS: Space, Control, User, Working principle of GPS, Types of GPS signals and receivers, Errors in GPS and correction techniques, Differential GPS (DGPS), Applications in surveying, navigation, and engineering		
Unit-V	**Applications and Integration of RS-GIS-GPS**	**Hours:09**
Integration of Remote Sensing, GIS, and GPS, Urban planning and smart cities, Water resources and watershed management, Disaster management (floods, earthquakes, landslides), Environmental monitoring and impact assessment, Agriculture and precision farming, Transportation and infrastructure planning, Case studies (Indian context)		

Text Books:

1. Lillesand, Kiefer & Chipman – Remote Sensing and Image Interpretation, Wiley.
2. B.C. Punmia, A.K. Jain & A.K. Jain – Surveying and Geomatics, Laxmi Publications.
3. Satheesh Gopi, Rashmi Sakar & S. Kumar Madhu – Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson.
4. Peter A. Burrough & Rachael A. McDonnell – Principles of Geographical Information Systems, Oxford University Press.
5. Dan Doberstein – Fundamentals of GPS Receivers: A Hardware Approach, Springer.

Reference Books

1. **B. Bhatta – Remote Sensing and GIS, Oxford University Press.**
2. **Paul A. Longley et al. – Geographic Information Systems and Science, Wiley.**
3. **Pratap Misra & Per Enge – Global Positioning System: Signals, Measurements and Performance, Ganga-Jamuna Press.**
4. **C.P. Lo & Albert K.W. Yeung – Concepts and Techniques of Geographic Information Systems, Pearson.**

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

1. NPTEL Remote Sensing – https://nptel.ac.in/courses/105108077
2. NPTEL GIS – https://nptel.ac.in/courses/105107155
3. NPTEL Satellite Navigation Systems (GPS/GNSS) – https://nptel.ac.in/courses/101104090
4. NPTEL Geoinformatics Engineering – https://nptel.ac.in/courses/105107208
5. QGIS Tutorials – https://www.qgistutorials.com/en/

Course Code	24CV504TC	Course Name	Railway and Airport Engineering			
Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
3	-	3	15	20	15	50

Course Prerequisites:

Students should have basic knowledge of transportation engineering, engineering mechanics, and surveying.

Course Objective:

1. To understand the basic components and construction of railway tracks.
2. To study geometric design and operational aspects of railway systems.
3. To learn railway infrastructure such as stations, yards, and signaling systems.
4. To understand airport planning and site selection criteria.
5. To study runway design and airport components.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Explain components and terminology used in railway engineering.
CO-2	Analyze permanent way components and geometric design of railway tracks.
CO-3	Understand railway operations such as stations, yards, and signaling systems.
CO-4	Apply principles of airport planning and site selection.
CO-5	Explain runway design, airport layout, and airport facilities.

Course Contents

Unit-I	Railway Engineering: Introduction and Permanent Way	Hours:10
Introduction to railway engineering. Permanent way: definition and components. Rails: types, functions, and rail sections. **Sleepers**: types (wooden, steel, cast iron, concrete) and functions. **Ballast**: functions and requirements of good ballast. **Subgrade and formation**. **Rail fixtures and fastenings**. Coning of wheels.		
Unit-II	**Geometric Design of Railway Tracks**	**Hours:10**
Geometric design of railway tracks: Horizontal alignment and vertical alignment. Gradients in railways and types of gradients. Horizontal curves and super elevation. Cant and cant deficiency. Problems based on gradients and curves. **Points and Crossings**: Terms used in points and crossings. Standard types of points and crossings. Design of simple turnout. Types of track junctions.		
Unit-III	**Railway Operations and Modern Trends**	**Hours:10**
Stations and yards: purpose, location, and site selection. Types and general layouts of terminus and junction stations. **Signalling and interlocking**: introduction and importance. **Construction and maintenance of railway tracks**: Track laying methods. Tools and plants used for track laying. Materials required per km of track. Maintenance of track. Modern trends in railways and safety in railways. Introduction to Mass Rapid Transit Systems (MRTS) and metro rail.		
Unit-IV	**Airport Engineering: Introduction and Airport Planning**	**Hours: 07**

Introduction to airport engineering. Terminology used in airport engineering. Components of aircraft and aircraft characteristics. **Airport planning**: need and importance. Airport surveys. Airport site selection factors. Obstructions to air navigation.		
Unit-V	**Runway Design and Airport Layout**	**Hours:08**
Runway orientation and wind rose diagram. Basic runway length and corrections for elevation, temperature, and gradient. Geometric design of runways. Airport capacity and runway patterns. Taxiways: layout and design considerations. Terminal buildings: functions and planning considerations.		

Text Books:

1. **Saxena S.C. and Arora S.P., Railway Engineering, Dhanpat Rai Publications.**
2. **Rangawala S. C. (2012) "Airport Engineering", Charotar Publishing House Pvt. Limited, Anand**

Reference Books

1. **Khanna S.K., Justo C.E.G., Veeraragavan A., Highway Engineering, Nem Chand & Bros (Airport chapters).**
2. **Khanna S. K. and Arora N. L. (1999), "Airport Engineering" Nemchand& Bros., Roorkee**

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

1. NPTEL – Transportation Engineering (Railways) – IIT Roorkee https://nptel.ac.in
2. NPTEL – Airport Planning and Design – IIT Kharagpur

Course Code	**24TCV504TD**		**Course Name**	**Construction Practices**			
Teaching Scheme				**Evaluation Scheme**			
L	**T**	**Credits**		**CA-I**	**MSE**	**CA-II**	**ESE**
3	-	3		15	20	15	50

Course Prerequisites:

Students should have basic knowledge of: Students should have basic knowledge of:

- Building Materials and Construction
- Concrete Technology
- Surveying
- Construction Drawing and Detailing

Course Objective:

1. Explain construction methods, materials, and equipment used in civil engineering projects.
2. Apply standard construction practices for buildings and infrastructure works.
3. Analyze construction planning, execution, and quality control procedures.
4. Evaluate safety, sustainability, and productivity aspects in construction projects.

5. Develop technical knowledge related to modern construction techniques and project execution.	
Course Outcome: After successful completion of the course, students will be able to:	
CO-1	Describe construction methods, materials, and site operations used in civil engineering.
CO-2	Apply appropriate construction techniques for foundations, buildings, and infrastructure works.
CO-3	Analyze construction planning, scheduling, and resource utilization.
CO-4	Evaluate quality assurance, safety practices, and sustainability measures in construction projects.
CO-5	Recommend modern construction technologies and management practices for improved project performance.

Course Contents

Unit-I	**Introduction to Construction Practices and Site Preparation**	**Hours:09**
Introduction to construction industry and project lifecycle, Construction organization and site management, Site investigation and site layout, Site clearance and preparation methods, Temporary works and site facilities, Construction documentation and records		
Unit-II	**Construction Practices for Foundations and Substructure**	**Hours:09**
Excavation and earthwork operations, Dewatering techniques, Construction of shallow foundations Construction of deep foundations (pile foundations), Retaining structures and basement construction, Quality control in foundation works		
Unit-III	**Construction Practices for Superstructure**	**Hours:09**
Masonry construction practices, Formwork and scaffolding systems, Reinforcement placement and concreting methods, Construction of RCC framed structures, Steel structure erection practices Precast and prefabricated construction methods		
Unit-IV	**Construction Equipment, Planning and Safety**	**Hours:09**
Selection and use of construction equipment, Material handling systems, Construction planning and scheduling, Resource allocation and productivity, Construction safety regulations and practices Occupational health and risk management		
Unit-V	**Modern Construction Practices and Sustainability**	**Hours:09**
Mechanized and automated construction methods, green construction and sustainable practices Lean construction principles, Building Information Modelling (BIM) fundamentals, Construction waste management, Case studies of modern construction projects		
Text Books:		
1. Building Construction — B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain — Laxmi Publications 2. Building Construction — Sushil Kumar — Standard Publishers		

3. Construction Planning and Management — P.S. Gahlot, B.M. Dhir — New Age International

Reference Books

5. Construction Technology — R. Chudley, Roger Greeno — Routledge
6. Building Construction Handbook — Roy Chudley, Roger Greeno — Routledge
7. Construction Project Management — K.K. Chitkara — Tata McGraw Hill
8. Principles of Construction Management — Roy Pilcher — McGraw Hill

Online Video Resources (NPTEL & Open Learning)

1. **NPTEL – Principles of Construction Management (IIT Kanpur)**
   Topics: Planning, scheduling, estimation, quality control, contracts, and construction safety.
2. **NPTEL – Project Planning and Control (IIT Madras)**
   Topics: Construction planning, CPM, PERT, monitoring and project control.
3. **NPTEL – Construction Planning and Management Video Library**
   Topics: Construction management fundamentals and execution practices.
4. **NPTEL YouTube – Construction Management Sessions**
   Topics: Construction planning, project execution, resource management, and scheduling.
5. **NPTEL – Project Management Planning, Execution, Evaluation and Control (IIT Kharagpur)**
   Topics: Project lifecycle, planning, execution, monitoring, and control.
6. **NPTEL – Construction Methods and Equipment Management (IIT Guwahati)**
   Topics: Construction methods, equipment selection, execution techniques, construction operations.

Course Code	24CV504TE	Course Name	Structural Analysis			
Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
3	-	3	15	20	15	50

Course Prerequisites:

Students are able to know the fundamentals of statics, equilibrium, shear force and bending moment diagrams, and basic structural mechanics

Course Objective:

a. Aware the students to concept of static and kinematic determinacy and indeterminacy.
b. Impart different solution techniques to a problem.
c. Analyze indeterminate structures by using different methods.
d. Evaluate the suitable method of analysis for statically and kinematically indeterminate structure.

Course Outcome: After successful completion of the course, students will be able to

CO-1	To determine the static and *kinematic indeterminacy* of the structure
CO-2	Analyze continuous beams using Clapeyron's Theorem of Three Moments considering different support conditions and varying moments of inertia.
CO-3	Solve beams and portal frames using Kani's Method.
CO-4	Develop stiffness matrices for simple structural systems and analyze indeterminate structures using the Stiffness Matrix Method
CO-5	Develop flexibility matrices for simple structural systems and analyze indeterminate structures using the Flexibility Matrix Method

Course Contents

Unit-I	Concept of determinacy and indeterminacy	Hours:07
Types of Indeterminacies, Degree of redundancy (D.O.R.), Degrees of freedom (D. O. F.), Methods of Analysis. Comparison between the force methods and displacement methods. Numerical on static and kinematic indeterminacy		
Unit-II	**Clapeyron's theorem of three moments**	**Hours:08**
Continuous beams with single or double redundancy, propped cantilever beams, fixed beams		
Unit-III	**Kani's method**	**Hours:10**
Applications to beams and portal frames without sway		
Unit-IV	**Stiffness Method**	**Hours:10**
Stiffness coefficients, development of stiffness matrix up to 4 x 4. Analysis of beams and portals by stiffness matrix method, Degree of S.I. < 2		
Unit-V	**Flexibility Method**	**Hours:10**
Flexibility coefficients, development of flexibility matrix up to 4 x4. Analysis of beams and portals by flexibility matrix method, Degree of K.I. < 2		

Text Books:

1. Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill,3rd edition 2010
2. Wang C.K., "Statically Indeterminate Structures", McGraw Hill
3. Vazirani V.N., Ratwani M.M, "Analysis of Structures - Vol. I & II"

4. S.S.Bhavikatti, "Structural Analysis", Vikas Publishing House Pvt, ltd
5. Pandit & Gupta, "Structural Analysis- Matrix approach"

Reference Books:

1. Timoshenko and Young, "Theory of structures", McGraw Hill
2. Kinney J. S., "Indeterminate Structural Analysis", Oxford and IBH
3. Hibbler R. C., "Structural Analysis", Pearson Publications, 9th Edition
4. Gere & Weaver, "Matrix analysis of structures"

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

https://onlinecourses.nptel.ac.in/noc25_ce54/preview

Course Code	24CV504TF	Course Name	Engineering Management

Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
3	-	3	15	20	15	50

Course Prerequisites:

- Basic understanding of engineering processes, industrial systems, and organizational structure.
- Fundamental knowledge of mathematics (algebra, basic statistics) and problem-solving techniques.

Course Objective:

1. Understand fundamental principles and evolution of management in engineering context.
2. Apply planning, organizing, and decision-making techniques in engineering systems.
3. Analyze productivity, work study, and industrial engineering concepts for performance improvement.
4. Develop project management skills using CPM and PERT techniques.
5. Understand modern management practices for improving efficiency, quality, and sustainability.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Explain management concepts, functions, and evolution of management thought.
CO-2	Apply planning, organizing, and decision-making tools in engineering scenarios.
CO-3	Analyze productivity, work study, and industrial engineering techniques for system improvement.
CO-4	Solve project scheduling problems using CPM and PERT methods.

CO-5	Evaluate modern management approaches such as systems, contingency, and quality practices

Course Contents

Unit-I	**Introduction to Management & Evolution**	**Hours:08**
Definition, nature, and scope of management, Functions of management, Evolution of management thought: Frederick Winslow Taylor, Henry Fayol, Max Weber, Elton Mayo, Types of Charts, Systems and Contingency approach		
Unit-II	**Planning, Organizing & Decision-Making**	**Hours:08**
Planning: types, steps, forecasting, Decision-making: process and tools, Organizational structures, Authority, responsibility, delegation, Centralization vs decentralization		
Unit-III	**Industrial Engineering & Productivity**	**Hours:09**
Productivity: definition, measurement, and improvement techniques, Work Study: Method Study and Time Study, Ergonomics: concept and applications, Plant layout: types and selection, Material handling systems, Introduction to Quality Control (basic concepts)		
Unit-IV	**Network Analysis**	**Hours:10**
Introduction to project management, Network diagrams and representation, Critical Path Method (CPM): Forward pass and backward pass, Critical path identification, Float and slack calculations Program Evaluation Review Technique (PERT): Three-time estimates (optimistic, most likely, pessimistic), Expected time calculation, Variance and probability analysis, Comparison between CPM and PERT		
Unit-V	**Modern Management Practices**	**Hours:10**
Material management – purchasing principles, stores, coding system function, responsibilities, record and accounting. Inventory control – an introduction, inventory cost, EOQ analysis, ABC analysis, safety stocks, Systems approach (concept and elements), Contingency approach, Total Quality Management (TQM), Lean manufacturing and Just-In-Time (JIT), Entrepreneurship and innovation, Ethics and social responsibility		

Text Books:

- Deshpande S. H., 1976, "Operation Research", S Chand Delhi.
- Deshpande A. S., "A Text book of Management"
- Gopal Krishnan, 2015, "Material Management", Sudeshan.
- Taha, 1971, "Operation Research", Pearson.
- Banga and Sharma, 2017, "Engineering Management", Khanna publishing
- Khanna O.P., "Work Study",Dhanpatrai publication

Reference Books

- Stoner, 2018, "Engineering Management", Pearson education.
- Davar, 1980, "Principles of Management", Progressive corporation Pvt. Limited.
- Koontz, Dounell and Weigrick, 2015, "Essentials of Management", McGraw Hill publishers.
- Kast and Rosinweig, 1973, "Management and Organization", Tata McGraw Hill Publication.
- Wagner, "Operation Research", Wikey Easter Ltd., New Delhi
- Zhamb L.C.,1999, "Quantitative Techniques in Management", Vol. I,
- Miller and Stars, 1960, "Executive Decisions & Operation Research", Prentice Hall of India

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

1. **Engineering Management** – NPTEL, IIT Kharagpur
   Covers management principles, decision making, operations research, and material management
   https://nptel.ac.in/courses/110/104/110104111/
2. **Principles of Management** – University of London (Coursera)
   Covers planning, organization, leadership, decision-making, and motivation
   https://www.coursera.org/learn/principles-of-management
3. **Operations Research: An Introduction** – NPTEL, IIT Madras
   Covers linear programming, simplex method, transportation/assignment models, simulation
   https://nptel.ac.in/courses/111/104/111104021/
4. **Supply Chain and Material Management** – Alison
   Covers purchasing, inventory management, EOQ, ABC analysis, safety stocks
   https://alison.com/course/diploma-in-supply-chain-management

Supplementary Readings

- *Engineering Management* – S. P. Goyal
- *Principles of Management* – Stephen P. Robbins & Mary Coulter
- *Operations Research: An Introduction* – Hamdy A. Taha
- *Material Management: Principles and Practice* – Gopalakrishnan & Sundaresan

3. Videos

1. **Evolution of Management Thought** – NPTEL YouTube Playlist
   https://www.youtube.com/playlist?list=PLbMVogVj5nJS-O1xB4J9q6OJ9pXhD5XJu
2. **Decision Making and Game Theory** – YouTube by LearnPM
   https://www.youtube.com/watch?v=bl0t0Cfz4lQ
3. **Linear Programming and Simplex Method Explained** – NPTEL
   https://www.youtube.com/watch?v=9r2rkK9JcHI
4. **Material Management and Inventory Control** – YouTube
   https://www.youtube.com/watch?v=UeRqzQL2jSk

Course Code	24CV505T	Course Name	MDM-III -Disaster Management and Mitigation Techniques			
Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
2	-	2	15	20	15	50

Course Prerequisites:

Basic understanding of Environmental Engineering and Geography, Fundamental knowledge of natural hazards and environmental systems.

Course Objective:

6. To introduce the concepts of disasters, hazards, vulnerability, and risk assessment.
7. To understand different types of natural and man-made disasters and their impacts.
8. To study disaster preparedness, prevention, and mitigation techniques.
9. To develop knowledge about disaster management planning and risk reduction strategies.
10. To equip students with knowledge of disaster-resilient planning and sustainable mitigation strategies for infrastructure systems.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Explain the concepts of disaster, hazard, vulnerability, and risk.
CO-2	Identify different types of natural and man-made disasters and their impacts.
CO-3	Understand disaster preparedness, response, and recovery strategies.
CO-4	Apply mitigation techniques in planning and design of infrastructure.
CO-5	Analyze disaster management policies and community-based disaster risk reduction.

Course Contents

Unit-I	Introduction to Disaster Management	Hours:06

Concept of disaster, hazard, vulnerability, and risk, Types of disasters: natural and man-made disasters, Disaster management cycle: prevention, mitigation, preparedness, response, and recovery, Disaster management policies and institutional framework in India, Role of government agencies and organizations in disaster management.

Unit-II	Natural Disasters	Hours:08

Earthquakes: causes, seismic zones in India, effects on structures, earthquake-resistant construction principles, Floods: causes, flood forecasting, flood control measures, Cyclones and storms: causes, effects, mitigation measures, Landslides: causes, effects, prevention techniques, Drought: causes, impacts, drought mitigation strategies

Unit-III	Man-Made Disasters	Hours:06

Industrial hazards and accidents, Chemical and nuclear disasters, Fire hazards in buildings and industries,Transportation accidents, Environmental pollution disasters, Safety management and emergency response planning.

Unit-IV	Disaster Mitigation and Preparedness	Hours:06

Risk assessment and vulnerability analysis, Structural and non-structural mitigation measures, Disaster-resistant infrastructure planning, Early warning systems, Community-based disaster management, Role of GIS, remote sensing, and information technology in disaster management.

Unit-V	Disaster Response and Recovery	Hours:04

Emergency management and rescue operations, Relief operations and rehabilitation, Post-

disasterdamage assessment, Sustainable reconstruction and resilience planning, Role of NGOs and international agencies.
Text Books:
1. K.K. Singh – Disaster Management **2. Rajib Shaw – Disaster Management and Risk Reduction** **3. Satish Modh – Introduction to Disaster Management**
Reference Books
1. Pradeep Sahni – Disaster Risk Reduction in South Asia **2. NDMA Guidelines – National Disaster Management Authority Publications** **3. Alexander David – Natural Disasters**
MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:
• **NPTEL Course: Disaster Management** • **NPTEL Course: Natural Hazards and Disaster Mitigation**

Course Code	**24CV506T**		**Course Name**	**Project Management**			
Teaching Scheme				**Evaluation Scheme**			
L	**T**	**Credits**		**CA-I**	**MSE**	**CA-II**	**ESE**
3	-	3		15	20	15	50

Course Prerequisites:

- Basic understanding of engineering systems, construction/production processes, and organizational structure.
- Knowledge of mathematics including algebra, basic probability, and statistics.

Course Objective:

1. Understand concepts, phases, and importance of project management.
2. Apply project planning, scheduling, and resource optimization techniques.
3. Analyze project networks using CPM and PERT methods.
4. Evaluate uncertainty, cost, and time trade-offs in projects.
5. Develop skills in monitoring, control, and risk management.

Course Outcome: After successful completion of the course, students will be able to	
CO-1	Explain project management concepts, life cycle, and organizational structures.
CO-2	Apply planning, scheduling, and resource allocation techniques.
CO-3	Analyze project networks using CPM and PERT techniques.
CO-4	Evaluate project performance using probabilistic and cost analysis tools.
CO-5	Apply monitoring, control, and risk management techniques in real projects.

Course Contents

Unit-I	**Introduction to Project Management**	**Hours:09**
Definition, characteristics, and objectives of projects, Project vs operations, Project life cycle (initiation, planning, execution, monitoring, closure), Project stakeholders and their roles, Role, responsibilities, and skills of project manager, Project organizational structures: Functional, Matrix,		

Projectized, Project selection methods (NPV, IRR – basic idea), Overview of project management knowledge areas		
Unit-II	**Project Planning and Scheduling**	**Hours:09**
Project planning process, Work Breakdown Structure (WBS) – concept and preparation, Activity definition and sequencing, Precedence relationships (FS, SS, FF, SF), Time estimation techniques, Resource planning and allocation, Resource levelling and smoothing (concept), Introduction to scheduling tools (Gantt charts), Basics of project documentation		
Unit-III	**Network Techniques – CPM & PERT**	**Hours:11**
Critical Path Method (CPM): Network construction (AOA and AON),. Rules for network diagram, Forward pass and backward pass, Critical path identification, Float analysis (total, free, independent float), Time-cost trade-off (crashing), Practical numerical Program Evaluation Review Technique (PERT): Concept of uncertainty in projects, Three-time estimates: optimistic, most likely, pessimistic, Expected time calculation, Variance and standard deviation, Probability of project completion, Numericals Comparison of CPM and PERT: Deterministic vs probabilistic models, Advantages, limitations, and applications		
Unit-IV	**Project Monitoring, Control & Performance Evaluation**	**Hours:10**
Need and importance of monitoring and control, Project control cycle, Progress tracking methods, Milestone analysis and reporting, Earned Value Management (EVM):,Planned Value (PV), Earned Value (EV), Actual Cost (AC), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Forecasting techniques: Estimate at Completion (EAC),Variance at Completion (VAC), Time, cost, and resource control techniques, Change management in projects, Project reporting and communication systems, Introduction to project management software (MS Project/Excel)		
Unit-V	**Project Risk Management & Modern Practices**	**Hours:06**
Risk management process, Risk identification techniques, Qualitative and quantitative risk analysis (basic idea), Risk response and mitigation strategies, Project uncertainty management, Introduction to modern practices: Agile project management (basic concept), Sustainability in projects, Ethics and social responsibility in project management		

Text Books:

- Gupta R.C. "Statistical Quality Control", khanna publishers 9th edition
- Roy Pilcher, "Project Cost Control in Construction",Sheridon House Inc.(Feb1988)
- Layland Blank and Torquin, "Engineering Economics",Mc-Graw-Hill Edition
- Naik B. M. "Project Management",Stosius Inc./Advent Book division
- Srinath L. S. "CPM PERT", Affiliated East-West Press (Pvt) ltd

Reference Books

- Antill and Woodhead, "C.P.M. in Construction Practice", Wiley-Interscience 4th edition 1990
- Taylor. G.A., "Management and Engineering Economics", Mc-Graw Hill 4th edition
- Roy Pilcher, "Principles of Construction Management" Mc-Graw Hill Higher Education 2rd revision

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

1. Project Management Principles and Practices Specialization – University of California, Irvine (Coursera)

- Covers: Project management fundamentals, scheduling, CPM, PERT, resource allocation
- URL: https://www.coursera.org/specializations/project-management

2. NPTEL – Project Management (Civil Engineering) – Prof. D. P. Aggarwal, IIT Kharagpur

- Covers: Introduction, Bar charts, milestone charts, CPM/PERT, network analysis, resource allocation, time estimates
- URL: https://nptel.ac.in/courses/105/105/105105112/

3. Introduction to Project Management – University of Adelaide (edX)

- Covers: Project planning, project scheduling, network diagrams, critical path method, project completion probability
- URL: https://www.edx.org/course/introduction-to-project-management

Course Code	**24CV505L**	**Course Name**	**Disaster Management and Mitigation Techniques Laboratory**	
Teaching Scheme			**Evaluation Scheme**	
P	**Credits**		**CIE**	**ESE**
2	1		30	20

Course Prerequisites:

Basic knowledge of **Engineering Chemistry** related to water quality parameters.

Familiarity with **laboratory safety practices and basic measurement techniques**.

Basic knowledge of **chemical analysis and titration methods**.

Course Objective:

1. To provide practical exposure to disaster risk assessment and hazard identification techniques.
2. To develop the ability to analyze disaster-prone areas using maps, case studies, and basic tools.
3. To understand disaster preparedness, mitigation, and emergency planning practices.
4. To familiarize students with disaster management strategies used by authorities and organizations.
5. To develop skills for preparing disaster preparedness and mitigation plans for communities or institutions.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Identify different types of hazards and evaluate disaster risks in a given region.

CO-2	Perform basic analysis of disaster-prone areas using maps, case studies, and available data.
CO-3	Apply disaster preparedness and emergency response strategies for real-life situations.
CO-4	Prepare disaster mitigation and evacuation plans for buildings or communities.
CO-5	Analyze case studies of major disasters and suggest suitable risk reduction measures.

Course Contents

Exp. No.	Experiment Title	CO
1	Study of disaster management cycle using case studies.	1
2	Identification of disaster-prone areas using maps or GIS tools	1
3	Preparation of risk assessment report for a selected region.	2
4	Simulation exercise for emergency evacuation planning.	2
5	Preparation of disaster preparedness plan for a community or campus.	3
6	Study of early warning systems used in flood and cyclone prediction.	4
7	Case study analysis of major disasters in India (earthquake, floods, cyclone, etc.).	4
8	Visit to live case study in vicinity	5

Course Code	**24CV502L**	**Course Name**	**Geo Technical engineering Laboratory**	
Teaching Scheme			**Evaluation Scheme**	
P	**Credits**		**CIE**	**ESE**
2	1		60	40

Course Prerequisites:

1. Basic knowledge of **Soil Mechanics** and **Engineering Mechanics**.
2. Understanding of **soil properties, soil classification, and basic geotechnical concepts**.
3. Basic knowledge of **laboratory measurements and data analysis**.

Course Objective:

1. To familiarize students with standard laboratory tests on soils used in geotechnical engineering.
2. To determine physical and engineering properties of soils such as specific gravity, particle size distribution, consistency limits, permeability, shear strength, and compressibility.
3. To develop the ability to conduct soil tests, record observations, and interpret results for engineering applications.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Determine the basic physical properties of soils such as specific gravity and particle size distribution.
CO-2	Evaluate the consistency limits and compaction characteristics of soils.
CO-3	Determine the permeability and field density of soil for engineering applications.
CO-4	Analyze the shear strength parameters of soils using direct shear, triaxial, and unconfined compression tests.
CO-5	Determine the compressibility and consolidation characteristics of soils and interpret their behavior in foundation engineering.

Course Contents

Exp. No.	Experiment Title(Any 8)	CO
1	Specific gravity determination of coarse- and fine-grained soil	CO 1
2	Particle size distribution-Mechanical sieve analysis, wet sieve analysis	CO 1
3	Determination of Atterberg' s consistency limit	CO 2
4	Permeability- Determination of coefficient of permeability	CO 3
5	Field density determination	CO 3
6	Direct shear box test	CO 4
7	Procter compaction test	CO 2
8	Tri-axial test	CO 4
9	Unconfined compression test	CO 4
10	One-dimensional consolidation test	CO 5

Course Code	**24CV503L**	**Course Name**	**Environmental Engineering Laboratory**	
Teaching Scheme			**Evaluation Scheme**	
P	**Credits**		**CIE**	**ESE**
2	1		30	20

Course Prerequisites:

Basic knowledge of **Engineering Chemistry** related to water quality parameters.
Familiarity with **laboratory safety practices and basic measurement techniques**.
Basic knowledge of **chemical analysis and titration methods**.

Course Objective:

6. To develop practical skills in analysis of water and wastewater quality parameters.
7. To understand the importance of physical, chemical, and biological characteristics of water.
8. To perform laboratory experiments related to drinking water quality assessment.
9. To provide hands-on experience in testing procedures used in water and wastewater treatment plants.
10. To enable students to interpret experimental results and relate them to environmental standards and treatment processes.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Perform laboratory tests to determine physical and chemical characteristics of water and wastewater.
CO-2	Analyze water quality parameters such as pH, turbidity, hardness, alkalinity, chlorides, DO, BOD, and COD.
CO-3	Evaluate the suitability of water for drinking purposes based on standard specifications.
CO-4	Apply experimental methods like jar test and residual chlorine test for water treatment processes.
CO-5	Interpret laboratory results and relate them to design and operation of water and wastewater treatment systems.

Course Contents

Exp. No.	Experiment Title (Any 08 experiments)	CO
1	Determination of pH of water sample	1
2	Determination of turbidity of water	1
3	Determination of total dissolved solids (TDS)	2
4	Determination of total hardness of water	2
5	Determination of chloride content of water	2
6	Determination of alkalinity of water	2
7	Determination of dissolved oxygen (DO)	2
8	Determination of biochemical oxygen demand (BOD)	2
9	Determination of chemical oxygen demand (COD)	2
10	Determination of residual chlorine	4
11	Jar test for coagulation and flocculation	4
12	Visit to Water Treatment Plant	2
13	Visit to Sewage Treatment Plant	3

Course Code	**24CV601T**		**Course Name**	**Design of concrete Structures- I**			
Teaching Scheme				**Evaluation Scheme**			
L	**T**	**Credits**		**CA-I**	**MSE**	**CA-II**	**ESE**
3	-	3		15	20	15	50

Course Prerequisites:

Strength of materials and Concrete Technology

Course Objective:

1. To understand the concept of influence lines and their application in structural analysis.
2. To study the analysis of indeterminate trusses considering different effects such as temperature and lack of fit.
3. To understand the behaviour and analysis of arches under different loading conditions.
4. To analyze cable and suspension bridge systems.
5. To study the approximate analysis methods for multistorey frames subjected to gravity and lateral loads.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Understand the design philosophies of RCC Design by limit state and working stress methods
CO-2	Design Reinforced Concrete beams using limit state and working stress methods
CO-3	Design the Shear reinforcement
CO-4	Design Reinforced Concrete slabs & staircases
CO-5	Design Reinforced Concrete columns and footings

Course Contents

Unit-I	**Introduction** and **Methods of design:**	**Hours:8**
Introduction: Review of Concrete making materials- Structural concrete- Grades properties of Concrete- Modulus of elasticity-flexural strength-Characteristic and Design values-Partial safety factor. **Methods of design:** Aims of design- RCC- Limit State method- Assumptions- Stress-Strain behavior of Steel and Concrete- Stress block parameters- Working stress method comparison of design process.as per IS 456:2000		
Unit-II	**Analysis and Design of Singly and Doubly Reinforced Beams**	**Hours:9**
Analysis and Design of Singly Reinforced Beams: Analysis of Singly Reinforced RC Section - Neutral axis-Balanced-Under Reinforced-Over Reinforced Sections- Moment of Resistance- Design parameters- Design examples. **Analysis and Design of Doubly Reinforced Beams:** Necessity of Doubly Reinforced Sections - Analysis of Doubly Reinforced RC Section-Moment of Resistance- Design parameters- Design.		
Unit-III	**Shear and Bond design of RCC**	**Hours:9**
Shear and Bond design of RCC: Shear forces in RC-Shear Resistance of RC- Truss analogy- design of Vertical stirrups-Bent-up bars- Limitation- Bond failure in RC- Check for bond resistance-Development length-Design for shear and bond.		
Unit-IV	**Design of RCC Slabs and Staircses**	**Hours:9**
Design of RCC Slabs: Concept of yield line theory - Design of One and Two way slabs- Effect of edge conditions- Moment of resistance-Torsion reinforcement at corners- Design examples. Design of Stair cases – Types and design		
Unit-V	**Design of RC Columns and Footing**	**Hours:10**
Design of RC Columns: Design principles of RC columns- Assumptions- Rectangular and Circular columns- Helical reinforcement- Minimum eccentricity-Use of Interaction diagrams for Axial load and Moment. **Design of RC Footings**: RC footings-Minimum depth of footing- Safe bearing capacity- Design for Bending-Shear in One way and Shear in Two way- Transfer of load at base of column.		
Text Books:		
1. Limit State Design of Reinforced Concrete Structures, B.C.Punmia, Ashok.K.Jain and Arun.K.Jain, Laxmi Pub. Pvt Ltd, 2016. 2. IS-456-2000, BIS Publication		

3. Design Of Reinforced Concrete Structures, IS:456-2000, N.Krishnaraju, CBS Publications, 2019, 4th Edition.
Reference Books
1. Reinforced Concrete Design, Devdas Menon , S. Pillai, Tata McGraw Hill Pub., 2017, 3rd Edition. 2. Reinforced Cement Concrete Structures, R. Park and T. Paulay, MISL-WILEY Series, Wiley India Pvt. Ltd, 2009. 3. Design of Reinforced Concrete Structures, N.Subramanian, Oxford Pub Pvt Ltd, 2013. 4. Reinforced Concrete Design - Unnikrishnan & Pillai, McGraw Hill Pub, 2009.
MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:
1. https://nptel.ac.in/courses/105/105/105105105/

Course Code	**24CV602T**		**Course Name**	**Infrastructure Engineering**			
Teaching Scheme				**Evaluation Scheme**			
L	**T**	**Credits**		**CA-I**	**MSE**	**CA-II**	**ESE**
2	-	2		15	20	15	50

Course Prerequisites:

Students should have basic knowledge of transportation engineering concepts, engineering mechanics, and basic civil engineering materials.

Course Objective:

11. To understand the planning, classification, and development of highways in India.
12. To study geometric design elements such as sight distance, curves, and gradients.
13. To understand the properties and testing of pavement materials used in highway construction.
14. To learn the principles of flexible and rigid pavement design according to IRC guidelines.
15. To understand highway construction methods and traffic engineering concepts.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Explain highway planning, classification of roads, and development programs in India.
CO-2	Apply geometric design principles such as sight distance, super elevation, and highway alignment.
CO-3	Identify and evaluate pavement materials and their properties for highway construction.
CO-4	Analyze the basic concepts of flexible and rigid pavement design as per IRC guidelines.
CO-5	Understand traffic engineering concepts, highway construction methods, and drainage systems.

Course Contents

Unit-I	**Highway Planning and Development**	**Hours:06**

Highway planning: Classification of roads – National highways, state highways, major district roads, other district roads and village roads. **Brief history of road development in India** – Nagpur Road Plan

(1943), Bombay Road Plan (1961), Lucknow Road Plan (1981). Present status of roads in India. **Organizations involved in highway development**: National Highways Authority of India (NHAI), National Highways Development Project (NHDP), Pradhan Mantri Gram Sadak Yojana (PMGSY), Maharashtra State Road Development Corporation (MSRDC). **Highway cross-section elements**: Right of way, carriageway, camber, shoulders, medians, and side slopes.

Unit-II	**Geometric Design of Highways**	**Hours:07**

Terrain classification and design speed. Vehicular characteristics affecting highway design. **Sightdistance**: Reaction time, braking distance, stopping sight distance (SSD), overtaking sight distance (OSD), intersection sight distance. **Designofhorizontalalignment**: Horizontal curves, super elevation and its provision, radius of horizontal curves, widening of pavement on curves, transition curves. **Designofverticalalignment**: Types of gradients, grade compensation on curves, summit curves, valley curves. **Road Arboriculture**

Unit-III	**Pavement Materials**	**Hours:06**

Stone aggregates: Desirable properties, sources, and requirements for pavement construction. **Tests on aggregates** – crushing value test, impact value test, abrasion test, flakiness and elongation index tests. specific gravity, water absorption. **Bituminous materials**: Types of bitumen, desirable properties. **Tests on bitumen** – Specific Gravity Test, penetration test, ductility test, softening point test, viscosity test, flash and fire point **Bituminous mix design**: Basic principles and modified binders.

Unit-IV	**Pavement Design**	**Hours: 06**

Types of pavements – flexible pavements and rigid pavements. **Functions of pavement components** – subgrade, sub-base, base course, surface course. **Pavement design factors** – wheel load, axle load, traffic repetitions, climatic effects. **Design of flexible pavement** using CBR method as per IRC 37. **Design of rigid pavements** as per IRC 58. Stresses in rigid pavements. Joints in rigid pavements – transverse joints, longitudinal joints, sealers and fillers.

Unit-V	**Traffic Engineering, Highway Construction and Drainage**	**Hours:06**

Traffic characteristics – speed, volume, density. **Traffic studies** – traffic volume study and speed study. **Highway construction methods** – Water Bound Macadam (WBM), Bituminous Bound Macadam (BBM), Semi Dense Bituminous Concrete (SDBC), Dry Lean Concrete (DLC), Pavement Quality Concrete (PQC). **Highway drainage** – necessity of drainage, surface drainage, sub-surface drainage systems.**Road Accidents and Safety**: Classification, Causes, Mitigation and Control Measures, Aspects of Safety in Usage of Roads, Type and Design of anti-crash barriers, Introduction to Intelligent Transport Systems (ITS).

Text Books:

6. **Khanna S.K., Justo C.E.G., Veeraragavan A., Highway Engineering, Nem Chand & Bros.**
7. **Arora N. L., "Transportation Engineering"**
8. **Bindra and Arora, "Highway Engineering", Standard Publishers**

Reference Books

4. **Garber, N.J. and Hoel, L.A., "Traffic and Highway Engineering", West Publishing Company, New York Jones, J.H.,**
5. **IRC 37 – Guidelines for Design of Flexible Pavements.**
6. **IRC 58 – Guidelines for Design of Rigid Pavements.**
7. **IRC SP 41 – Guidelines for Road Drainage.**

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

- NPTEL – Transportation Engineering (IIT Kharagpur) https://nptel.ac.in/courses/105105107
- NPTEL – Pavement Materials and Design (IIT Bombay) https://nptel.ac.in/courses/105101087

Course Code	24CV603T	Course Name	Foundation Engineering			
Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
2	-	2	15	20	15	50

Course Prerequisites:

1. Basic understanding of **Soil Mechanics** (soil properties, shear strength, consolidation, permeability).
2. Knowledge of **Engineering Mechanics and Strength of Materials**.
3. Basic understanding of **Geology relevant to Civil Engineering**.

Course Objective:

1. To introduce the **principles of engineering geology and site investigation** for foundation design.
2. To understand the **bearing capacity and settlement behavior of soils**.
3. To study the **design concepts of shallow and deep foundations**.
4. To understand foundation problems associated with **problematic soils and ground improvement methods**.
5. To familiarize students with **special foundations and slope stability concepts** used in geotechnical engineering practice.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Explain engineering geology concepts and methods of site investigation used for foundation design.
CO-2	Analyze soil bearing capacity and determine safe bearing capacity for shallow foundations.
CO-3	Evaluate settlement behavior of soils and identify foundation solutions for problematic soils.
CO-4	Explain design principles and applications of shallow and deep foundations.
CO-5	Describe special foundations and analyze basic slope stability problems.

Course Contents

Unit-I	Engineering Geology and Site Investigation	Hours:05

Role of engineering geology in foundation engineering, types of rocks and their engineering properties, geological structures (faults, folds, joints) affecting foundations, weathering and groundwater conditions.
Site investigation: objectives and planning, methods of soil exploration, soil sampling techniques, field tests used in foundation design (SPT, plate load test), interpretation of site investigation data.

Unit-II	Bearing Capacity of Foundations	Hours:07

Types of foundations and performance requirements, modes of shear failure in soils, Terzaghi's bearing capacity theory for shallow foundations, factors affecting bearing capacity (water table, shape and depth of footing, load eccentricity), safe bearing capacity and allowable bearing pressure.
Introduction to IS code provisions for foundation design.

Unit-III	Settlement and Foundations on Problematic Soils	Hours:06

Types of settlement: immediate, consolidation and differential settlement, permissible settlement for

structures.
Foundations on problematic soils: expansive soils, collapsible soils and weak soils, effects on structures and preventive measures.
Ground improvement techniques: compaction, drainage, stabilization and other commonly used methods.

Unit-IV	**Design of Shallow and Deep Foundations**	**Hours:06**

Shallow foundations: types and design principles of isolated footing, combined footing, strap footing and raft foundation.
Deep foundations: pile foundations – classification, pile installation methods, load carrying capacity of piles, pile load tests, group action of piles, under-reamed piles and their applications.

Unit-V	**Special Foundations and Slope Stability**	**Hours:06**

Caisson foundations: types and applications in bridge and marine structures.
Sheet piles and cofferdams: types and basic design concepts.
Slope stability: types of slope failures, factor of safety, stability of infinite slopes and basic methods of slope stability analysis.

Text Books:

1. **K. R. Arora** – *Soil Mechanics and Foundation Engineering*, Standard Publishers.
2. **B. C. Punmia, A. K. Jain & A. K. Jain** – *Soil Mechanics and Foundations*, Laxmi Publications.
3. **V. N. S. Murthy** – *Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering*, CRC Press.
4. **C. Venkatramaiah** – *Geotechnical Engineering*, New Age International Publishers.

Reference Books

1. **Braja M. Das** – *Principles of Foundation Engineering*, Cengage Learning.
2. **H. J. Bowles** – *Foundation Analysis and Design*, McGraw Hill.
3. **Tomlinson & Woodward** – *Pile Design and Construction Practice*, CRC Press.
4. **Donald P. Coduto** – *Foundation Design: Principles and Practices*, Pearson Education.
5. **Joseph E. Bowles** – *Foundation Analysis and Design*, McGraw Hill.
6. **Peck, Hanson & Thornburn** – *Foundation Engineering*, Wiley.
7. **K. K. Chugh** – *Engineering Geology*, CBS Publishers (useful for geology part of syllabus).
8. **P. K. Jain & K. S. Jain** – *Engineering Geology*, Dhanpat Rai Publications.

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

MOOCs Courses

1. **NPTEL – Foundation Engineering**
   https://nptel.ac.in/courses/105106176
2. **NPTEL – Soil Mechanics and Foundation Engineering**
   https://nptel.ac.in/courses/105106049
3. **NPTEL – Introduction to Geotechnical Engineering**
   https://nptel.ac.in/courses/105106051

- Relevant **IS Codes for Foundation Design**
  - IS 6403: Code of Practice for Determination of Bearing Capacity of Shallow Foundations
  - IS 1904: Code of Practice for Design and Construction of Foundations
  - IS 2911: Design and Construction of Pile Foundations

Course Code	24TCV604TA	Course Name	Planning For Sustainable Development

Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
3	-	3	15	20	15	50

Course Prerequisites:

Students should have basic knowledge of: Students should have basic knowledge of:

- Environmental Engineering
- Urban and Regional Planning concepts
- Surveying

Course Objective:

6. Explain the principles and concepts of sustainable development and their application in civil engineering.
7. Analyze environmental, social, and economic dimensions involved in development planning.
8. Apply planning tools and techniques for sustainable land use and infrastructure development.
9. Evaluate sustainable practices for urban and rural development projects.
10. Develop integrated and resilient planning approaches for future infrastructure systems.

Course Outcome: After successful completion of the course, students will be able to:

CO-1	Describe concepts, indicators, and frameworks of sustainable development.
CO-2	Analyze the interaction between environment, society, and economic growth in planning processes.
CO-3	Apply planning methods for sustainable land use and infrastructure development.
CO-4	Evaluate sustainable urban and rural development strategies using case studies.
CO-5	Propose integrated planning solutions considering resilience and sustainability principles.

Course Contents

Unit-I	Introduction to Sustainable Development and Planning	Hours:09
Concept and evolution of sustainable development, Need and importance of sustainability in civil engineering, Principles of sustainable development, Pillars of sustainability: Environmental, Economic, and Social dimensions, Sustainable Development Goals (SDGs) and national policies, Indicators and assessment methods for sustainability		
Unit-II	**Environmental Planning and Resource Management**	**Hours:09**
Natural resource planning and conservation, Environmental impact assessment (EIA), Carrying capacity		

analysis, Climate change and adaptation strategies, Water resource planning and sustainable management, Energy-efficient infrastructure planning		
Unit-III	**Land Use Planning and Sustainable Infrastructure**	**Hours:09**
Concepts of land use planning, Land capability and suitability analysis, Sustainable transportation planning, Green infrastructure and low-impact development, Smart growth and compact city concepts Infrastructure planning for sustainability		
Unit-IV	**Urban and Rural Sustainable Development**	**Hours:10**
Urbanization and sustainability challenges, Sustainable urban planning approaches, Rural development planning principles, Affordable housing and community participation, Waste management planning Case studies on sustainable city and village development		
Unit-V	**Integrated Sustainable Planning and Future Trends**	**Hours:10**
Integrated development planning framework, Disaster resilience and climate-resilient infrastructure, Circular economy principles in civil engineering, GIS and remote sensing applications in planning Sustainable infrastructure rating systems, Preparation of a sustainable development plan (Mini Project/Case Study)		

Text Books:

4. Planning for Sustainability — Stephen M. Wheeler — Routledge Publications
5. An Introduction to Sustainable Development — Peter P. Rogers, Kazi F. Jalal, John A. Boyd — Earthscan Publications Ltd.
6. Engineering for Sustainable Development: Theory and Practice — Wahidul K. Biswas, Michele John — John Wiley & Sons
7. Sustainable Civil Engineering: Principles and Applications — Varinder S. Kanwar, Sanjay Kumar Shukla, Siby John, Harpreet Singh Kandra — CRC Press (Taylor & Francis)

Reference Books

1. Handbook of Sustainable Development Planning — M.A. Quaddus, M.A.B. Siddique (Editors) — Edward Elgar Publishing
2. Sustainability Issues in Civil Engineering — G.L. Sivakumar Babu, Sireesh Saride, B. Munwar Basha (Editors) — Springer Singapore
3. Regenerative Design for Sustainable Development — John Tillman Lyle — John Wiley & Sons
4. Civil and Environmental Engineering for the Sustainable Development Goals — Manuela Antonelli, Gabriele Della Vecchia (Editors) — Springer Cham
5. Geotechnical Engineering and Sustainable Construction — Mahdi O. Karkush, Deepankar Choudhury (Editors) — Springer Singapore

Online Video Resources (NPTEL & Open Learning)

NPTEL – Sustainable Development Course

SWAYAM – Environmental and Sustainable Planning

MIT Open Course Ware – Sustainable Urban Development

IIT Kharagpur NPTEL Lectures

Course Code	**24TCV604TB**	**Course Name**	**Drone Technology**			
Teaching Scheme			**Evaluation Scheme**			
L	**T**	**Credits**	**CA-I**	**MSE**	**CA-II**	**ESE**
3	-	3	15	20	15	50

Course Prerequisites:

Students should have basic knowledge of: Students should have basic knowledge of:

- Engineering Physics
- Engineering Mathematics
- Basic Electronics and Electrical Engineering
- Computer Programming Fundamentals
- Engineering Mechanics

Course Objective:

1. Introduce the fundamentals, classifications, and applications of drone technology.
2. Interpret the aerodynamic principles and design considerations of UAV systems.
3. Illustrate the architecture and operation of drone hardware, sensors, and communication systems.
4. Prepare students for flight planning, navigation, and control techniques for drone operations.
5. Enable students to drone applications, regulations, safety requirements, and emerging trends in various engineering sectors.

Course Outcome: After successful completion of the course, students will be able to:

CO-1	Explain the principles, components, and classifications of UAVs and drones.
CO-2	Analyze aerodynamic forces and design parameters affecting drone performance.
CO-3	Identify and integrate drone subsystems such as sensors, flight controllers, communication modules, and payloads.
CO-4	Demonstrate knowledge of drone navigation, mission planning, and autonomous flight operations.

CO-5	Evaluate drone applications, DGCA regulations, safety practices, and future developments in drone technology

Course Contents

Unit-I	**Introduction to Drone Technology**	**Hours:09**
Introduction to UAVs and Drone Technology, History and Evolution of Drones, Drone Terminology and Concepts, Classification of Drones, Fixed Wing, Rotary Wing, Hybrid UAVs, Components of UAV Systems, Advantages and Limitations, Drone Ecosystem and Industry, Applications of Drones, Future Scope of Drone Technology		
Unit-II	**Drone Design and Aerodynamics**	**Hours:09**
Basics of Flight Mechanics, Forces Acting on Drones, Lift, Drag, Thrust and Weight, Airfoil Concepts, Propellers and Propulsion Systems, Drone Frame Design, Materials Used in UAV Construction, Battery Technologies and Power Systems, Performance Parameters and Payload Capacity		
Unit-III	**Drone Hardware and Communication Systems**	**Hours:09**
Flight Controllers, Autopilot Systems, Electronic Speed Controllers (ESC), Sensors: GPS, IMU, Accelerometer, Gyroscope, Magnetometer, Communication Systems, Telemetry Systems, Ground Control Stations, Radio Frequency Communication, Payload Integration and Data Acquisition		
Unit-IV	**Navigation, Control and Autonomous Flight**	**Hours:10**
Principles of Drone Navigation, GPS-Based Navigation, Waypoint Navigation, Path Planning Techniques, PID Control Concepts, Flight Modes and Stabilization, Mission Planning Software Autonomous Flight Operations, Flight Testing and Troubleshooting		
Unit-V	**Drone Applications, Regulations and Future Trends**	**Hours:10**
Drone Applications in Civil Engineering, Surveying and Mapping, Precision Agriculture, Disaster Management and Monitoring, Infrastructure Inspection, Logistics and Delivery Systems, DGCA Regulations and Drone Rules (India), Safety, Ethics and Privacy Issues, Emerging Technologies: AI in Drones, Swarm Drones, Autonomous UAV Systems		
Text Books:		
8. Reg Austin, *Unmanned Aircraft Systems: UAV Design, Development and Deployment*, Wiley, 2010. 9. Paul G. Fahlstrom and Thomas J. Gleason, *Introduction to UAV Systems*, Wiley. 10. Kimon P. Valavanis, *Advances in Unmanned Aerial Vehicles*, Springer. 11. Robert C. Nelson, *Flight Stability and Automatic Control*, McGraw-Hill. 12. Armand J. Chaput, *Design of Unmanned Air Vehicle Systems*.		
Reference Books		
9. Rafael Yanushevsky, *Unmanned Aircraft Systems: Design, Development and Deployment*.		

10. ICAO Manual on Remotely Piloted Aircraft Systems.
11. DGCA India Drone Rules and Operational Guidelines.

Online Video Resources (NPTEL & Open Learning)

NPTEL

- Drone Technology and Applications
  NPTEL Courses

SWAYAM

- UAV and Emerging Technologies Courses
  SWAYAM Platform

DGCA India

- Drone Regulations and Certification
  DGCA India

Drone Federation of India

Industry Resources and Guidelines

Video Lectures

Introduction to Drones

MIT OpenCourseWare Aerospace Videos

UAV Fundamentals

NASA Aeronautics YouTube Channel

Flight Controllers and ArduPilot

ArduPilot Documentation and Videos

PX4 Autopilot Tutorials

PX4 Official Tutorials

Drone Assembly and Testing

IIT Drone Training Resources

- Drone Federation of India

Course Code	24TCV604TC	Course Name	Bridge Engineering			
Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
3	-	3	15	20	15	50

Course Prerequisites:

Students should have basic knowledge of: Students should have basic knowledge of:

- Fluid Mechanics and Hydrology
- Geotechnical Engineering

- Reinforced Concrete Design
- Steel Structures

Course Objective:

11. Introduce the students classification, components, planning, and site investigations of bridges.
12. Interpret IRC provisions and loading standards applicable to bridge design.
13. Enhance knowledge of bridge superstructures subjected to dead, live, wind, seismic, and impact loads.
14. Design basic bridge components such as slab bridges, T-beam bridges, piers, and abutments.
15. Evaluate bridge construction, maintenance, rehabilitation, and inspection techniques.

Course Outcome: After successful completion of the course, students will be able to:

CO-1	Describe bridge types, components, surveys, and site selection criteria.
CO-2	Apply IRC loading standards and determine forces acting on bridge structures.
CO-3	Analyze and design RCC slab and T-beam bridge decks.
CO-4	Design bridge substructures including piers, abutments, and foundations.
CO-5	Assess bridge construction methods, maintenance practices, and rehabilitation measures.

Course Contents

Unit-I	**Introduction, Planning and Hydrological Investigations**	**Hours:09**
Historical development of bridges, Components and classification of bridges, Site selection and planning of bridges, Preliminary and detailed surveys, Bridge hydrology, Design discharge estimation Linear waterway and afflux, Scour depth determination, Economic span, Selection of bridge type		
Unit-II	**Loads and Design Standards**	**Hours:09**
IRC and IRS bridge specifications, Dead load and superimposed dead load\, IRC Class A, Class AA, and 70R loading, Impact factor, Wind load, Longitudinal forces, Centrifugal forces, Water current forces, Buoyancy effects, Earth pressure, Temperature effects, Seismic forces, Load combinations		
Unit-III	**Design of Bridge Superstructures**	**Hours:09**
Culverts: Pipe, Slab and Box Culverts, RCC Slab Bridges, Effective Width Method, Load distribution methods, T-Beam Bridges, Courbon's Method, Introduction to PSC Bridges, Box Girder Bridges, Steel and Composite Bridges, Introduction to Arch, Cable-Stayed and Suspension Bridges		
Unit-IV	**Bridge Substructures and Foundations**	**Hours:10**
Bridge piers and abutments, Types of wing walls and return walls, Forces acting on substructures, Open foundations, Well foundations, Pile foundations, Design considerations for substructures Bearings: Fixed bearings, Expansion bearings, Elastomeric bearings, Expansion joints		

Unit-V	**Construction, Maintenance and Rehabilitation of Bridges**	**Hours:10**

Bridge construction methods, Construction sequence of RCC and PSC bridges, Construction stage analysis, Quality control during construction, Inspection and condition assessment, Bridge health monitoring, Maintenance and repair techniques, Strengthening and retrofitting methods, Causes of bridge failures, Case studies of bridge failures and rehabilitation

Text Books:

13. D. J. Victor, Essentials of Bridge Engineering, Oxford & IBH Publications.
14. N. Krishna Raju, Design of Bridges, Oxford & IBH Publications.
15. S. Ponnuswamy, Bridge Engineering, Tata McGraw-Hill.

Reference Books

12. V. K. Raina, Concrete Bridge Practice.
13. N. Rajagopalan, Bridge Superstructure.
14. IRC Codes and Standards.

Online Video Resources (NPTEL & Open Learning)

NPTEL Courses

1. **Bridge Engineering**
   - https://nptel.ac.in
2. **Design of Reinforced Concrete Structures**
   - https://nptel.ac.in
3. **Prestressed Concrete Structures**
   - https://nptel.ac.in

YouTube Resources

1. IIT Madras – Bridge Engineering Lectures
   - https://www.youtube.com/results?search_query=bridge+engineering+iit+madras
2. NPTEL Bridge Engineering Playlist
   - https://www.youtube.com/results?search_query=nptel+bridge+engineering
3. Bridge Design and Construction
   - https://www.youtube.com/results?search_query=bridge+design+and+construction

Course Code	24CV604TD	Course Name	Safety in Construction Industry

Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
3	-	3	15	20	15	50

Course Prerequisites:

Students should have basic knowledge of construction activities and site operations. Basic awareness of safety practices and building construction will help in understanding construction safety concepts.

Course Objective:

1. Aware the importance of safety culture and safety management in construction.
2. Describe the hazards risk and safety devices.
3. Interpret and implement safety rules, safety systems, and modern safety technologies.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Explain the basic concepts and importance of safety in the construction industry.
CO-2	Identify and assess hazards and risks at construction sites.
CO-3	Explain and select appropriate PPE and demonstrate safe practices on site.
CO-4	Apply safety measures during various construction activities.
CO-5	Describe and interpret modern safety rules and technologies used in construction projects.

Course Contents

Unit-I	Introduction to Construction Safety	Hours:08

Importance of safety in construction industry, Safety culture and safe work practices, Causes and types of construction accidents, Accident statistics and case studies, Roles and responsibilities of employer, engineer and worker, Role of safety officer and safety committee, Safety training and awareness programs, Introduction to national and international safety standards

Unit-II	Hazard Identification and Risk Assessment	Hours:08

Types of hazards in construction sites, Physical, chemical, electrical and mechanical hazards, Hazard identification techniques, Job Safety Analysis (JSA), Risk assessment concepts, Risk probability and severity analysis, Safety inspections and safety checklists, Accident investigation and preventive

measures

Unit-III	Personal Protective Equipment (PPE) and Safety Devices	Hours:08

Importance and need of PPE in construction, Types of PPE – helmet, gloves, goggles, safety shoes, Respiratory protection and hearing protection, Safety harness, lifelines and fall protection systems, Safety nets and guard rails, Selection and maintenance of PPE, Safety signs, symbols and signals, Emergency safety equipment and first aid

Unit-IV	Safety in Construction Operations	Hours:09

Safety in excavation and trenching work, Shoring and trench protection methods, Scaffolding safety practices, Formwork safety, Safety during concreting operations, Demolition safety, Safety in material handling, Crane and lifting equipment safety, Electrical safety and fire safety at construction sites

Unit-V	Construction Safety Management and Modern Practices	Hours:09

Construction safety rules and regulations, Legal safety requirements in construction, Safety audits and safety inspections, Safety documentation and reporting system, Toolbox meetings and safety communication, Safety management systems in construction projects, Use of modern technology in safety (drones, sensors, AI monitoring)

Text Books:

1. **K. K. Chitkara –** *Construction Safety Management*, Tata McGraw Hill.
2. **Jimmie Hinze –** *Construction Safety*, Prentice Hall.

Reference Books

1. **V. J. Davies and K. Tomasin –** *Construction Safety Handbook*, Thomas Telford Publishing.
2. **Phil Hughes and Ed Ferrett –** *Introduction to Health and Safety in Construction*, Routledge.
3. **National Safety Council –** *Accident Prevention Manual for Construction*.
4. **B. L. Gupta and Amit Gupta –** *Construction Management and Safety*, Standard Publishers.

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

Course Code	24CV604TE	Course Name	Advanced Structural Analysis

Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
3	-	3	15	20	15	50

Course Prerequisites:

Engineering Mechanics, Strength of Materials and analysis of determinate structures

Course Objective:

1. To understand the influence line concepts for indeterminate structures
2. To understand the methods of analysis of intermediate trusses for external Loads, lack of fit and thermal effect
3. To study behaviour of arches and their methods of analysis
4. To know the concept and analysis of cable stayed bridge
5. To study the multi storey frames subjected to gravity loads and lateral loads

Course Outcome: After successful completion of the course, students will be able to

CO-1	Demonstrate the concepts of qualitative influence line diagram for continuous beams and frames.
CO-2	Apply the methods of indeterminate truss analysis.
CO-3	Demonstrate the behaviour of arches and their methods of analysis.
CO-4	Analyse cable suspension bridges.
CO-5	Analyse multistorey frames subjected to gravity loads and lateral loads.

Course Contents

Unit-I	Influence lines	Hours:10

Influence lines - Maxwell Betti's theorem - Muller Breslau's principle and its application. Influence lines for continuous beams ,Moving loads -single load - two point loads - several points loads - maximum bending moment and maximum shear force - equivalent u.d.l. - absolute maximum bending moment. Enveloping curves for maximum bending moment and maximum shear force and determination of equivalent UDL, ILD for shear, moment and reactions for beams and trusses - Reversal of stresses under live load.

Unit-II	Analysis of plane truss	Hours:9

Analysis of plane truss with one or two redundant - trusses with lack of fit - Thermal stresses - Settlement of supports - Trussed beams.

Unit-III	**Theory of arches**	**Hours:9**
Theory of arches - Analysis of three hinged, two hinged and fixed arches - influence lines, rib shortening, settlement and temperature effects.		
Unit-IV	**Analysis of cables**	**Hours:9**
Analysis of cables - Suspension bridges with three and two hinged stiffening girders - influence lines.		
Unit-V	**Analysis of multistorey frames**	**Hours:8**
Analysis of multistorey frames for gravity and lateral loads by approximate methods - Substitute frame - Portal and Cantilever methods		

Text Books:

1. Theory of Structures (Vol. 1), G. Pandit, S. Gupta, Rajesh Gupta, Tata McGraw Hill Pub., 2017.
2. Theory and Problems in Structural Analysis, L.S. Negi, Tata McGraw Hill Pub., 1997.
3. Mechanics of Structures Vol 1 & Vol.2, Junnarkar. S. B and Shah H.J, Charotar Publishers, 2008, 32nd Edition.

Reference Books

1. Intermediate Structural Analysis, Chu-Kia Wang, Tata McGraw Hill Publishers, 2017.
2. Structural Analysis, R C Hibbeler, Pearson, 2017.
3. Analysis Of Structures (Analysis, Design and Details of Structures) - Vol.1, V. N. Vazirani, M. M. Ratwani, S. K. Duggal, Khanna Publishers, 1999
4. Basic Structural Analysis, C S Reddy, Tata McGraw Hill Publishers, 2017

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

https://nptel.ac.in/courses/105/105/105105166

Course Code	24TCV604TF	Course Name	Entrepreneurship Development for Engineers			
Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
3	-	3	15	20	15	50

Course Prerequisites:

Basic understanding of engineering problem-solving, Fundamental knowledge of economics/management, Interest in innovation, startups, and business development

Course Objective:

6. To introduce students to the concepts of entrepreneurship and innovation.
7. To develop entrepreneurial mindset and opportunity recognition skills.
8. To equip students with knowledge of startup formation, funding, and management.
9. To familiarize students with legal, financial, and marketing aspects of startups.
10. To enable students to prepare and present a viable business plan.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Understand entrepreneurship concepts, traits, and ecosystem.
CO-2	Identify and evaluate business opportunities and market needs.
CO-3	Apply business model development tools for startups
CO-4	Analyze financial, legal, and operational requirements of ventures.
CO-5	Develop and present a comprehensive business plan.

Course Contents

Unit-I	Introduction to Entrepreneurship	Hours:09

Definition and importance of entrepreneurship, Evolution of entrepreneurship in India and globally, Types of entrepreneurs (tech, social, women, rural), Entrepreneurial traits and competencies, Role of engineers in entrepreneurship, Startup ecosystem: Incubators, accelerators, government initiatives (Startup
India), Case studies of successful startups

Unit-II	Opportunity Identification & Innovation	Hours:09

Idea generation techniques (brainstorming, design thinking), Problem identification and opportunity recognition Innovation vs invention, Design Thinking process (Empathize, Define, Ideate, Prototype, Test), Market research and feasibility analysis, SWOC analysis, Intellectual Property Rights (IPR): Patents, trademarks, copyrights

Unit-III	Business Models & Startup Formation	Hours:09
Business model concepts (BMC – Business Model Canvas), Value proposition design, Customer segments and channels, Lean startup methodology, Steps in starting a venture, Company formation procedures (India context),Team building and leadership, Entrepreneurial ethics		
Unit-IV	**Financial & Legal Aspects of Entrepreneurship**	**Hours:09**
Basics of startup finance, Costing, pricing, and revenue models, Break-even analysis, Funding sources: Bootstrapping, angel investors, venture capital, crowdfunding, Financial statements , Legal structures: Sole proprietorship, partnership, LLP, private limited, Government policies and support schemes, Risk management		
Unit-V	**Marketing, Growth & Business Plan**	**Hours:09**
Marketing strategies for startups, Digital marketing and branding, Customer acquisition and retention, Scaling and growth strategies, Pitching to investors, Business plan preparation: Executive summary, Market analysis, Financial projections, Final project: Business plan presentation		

Text Books:

1. Vasant Desai – *Entrepreneurship Development*, Himalaya Publishing House.
2. Robert D. Hisrich, Michael P. Peters & Dean A. Shepherd – *Entrepreneurship*, McGraw-Hill Education.
3. S.S. Khanka – *Entrepreneurial Development*, S. Chand Publications.
4. Peter F. Drucker – *Innovation and Entrepreneurship*, Harper Business.

Reference Books

1. Barringer & Ireland – *Entrepreneurship: Successfully Launching New Ventures*, Pearson.
2. Alexander Osterwalder & Yves Pigneur – *Business Model Generation*, Wiley.
3. Ash Maurya – *Running Lean*, O'Reilly Media.

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

1. NPTEL – Entrepreneurship Essentials: NPTEL Entrepreneurship Essentials
2. NPTEL – Innovation, Business Models and Entrepreneurship: NPTEL Innovation and Entrepreneurship
3. NPTEL – Developing Soft Skills and Personality for Entrepreneurs: NPTEL Soft Skills and Entrepreneurship
4. Startup India Learning Program: Startup India Learning Program

Course Code	24CV605T	Course Name	Operation Research			
Teaching Scheme			Evaluation Scheme			
L	T	Credits	CA-I	MSE	CA-II	ESE
2	-	2	15	20	15	50

Course Prerequisites:

6. Engineering Mathematics (Linear Algebra, Probability)
7. Basic Programming Knowledge (Excel / Python preferred)

Course Objective:

6. To understand the fundamental concepts and scope of Operations Research in engineering applications
7. To formulate real-world problems into mathematical models for optimization
8. To apply Linear Programming techniques to solve decision-making problems
9. To analyze transportation, assignment, inventory, and queuing models
10. To apply decision theory and simulation techniques under conditions of uncertainty

Course Outcome: After successful completion of the course, students will be able to

CO-1	Explain fundamental concepts and methodologies of Operations Research
CO-2	Formulate and solve Linear Programming Problems using graphical and simplex methods
CO-3	Apply transportation and assignment techniques for optimal resource utilization
CO-4	Analyze inventory and queuing systems for improving system performance
CO-5	Apply decision-making and simulation techniques to solve real-life problems

Course Contents

Unit-I	Introduction to Operations Research	Hours:04
Definition, scope, and applications of Operations Research, OR methodology and types of models, Advantages and limitations of OR, Formulation of Linear Programming Problem (LPP)		
Unit-II	**Linear Programming Problem (LPP)**	**Hours:08**
Mathematical formulation of LPP, Graphical solution method, Simplex method, Big-M method, Duality concept and economic interpretation		
Unit-III	**Transportation and Assignment Models**	**Hours:05**

Transportation problem formulation, Initial basic feasible solutions: North-West Corner Method, Least Cost Method, Vogel's Approximation Method (VAM), Optimality test using MODI method Assignment problem, Maximization cases

Unit-IV	**Inventory Models**	**Hours:04**

Inventory concepts and types of costs, EOQ model (basic and with shortages), Production inventory model, ABC analysis

Unit-V	**Queuing Theory & Decision Theory with Simulation**	**Hours:09**

Queue characteristics and structure, Single server model (M/M/1), Multi-server model (M/M/c), Performance measures, Decision-making under certainty, risk, and uncertainty Payoff table and decision criteria: Maximax, Maximin, Minimax regret, Laplace criterion Introduction to simulation, Monte Carlo simulation basics

Text Books:

1. **Operations Research: An Introduction Hamdy** A. Taha Pearson Education **Edition:** Latest (10th or above recommended)
2. **Operations Research** Kanti Swarup, P.K. Gupta, Man Mohan Sultan Chand & Sons **Edition:** 20th Revised Edition (or latest)
3. **Operations Research: Theory and Applications** J.K. Sharma Macmillan Publishers India

Reference Books

1. **Introduction to Operations Research** Frederick S. Hillier, Gerald J. Lieberman McGraw Hill Education
2. **Operations Research** R. Panneerselvam PHI Learning
3. **Introduction to Management Science Frederick** S. Hillier McGraw Hill Education

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

Course Code	24CV606T	Course Name	Strategic Management Techniques

Teaching Scheme				Evaluation Scheme			
L	T	Credits		CA-I	MSE	CA-II	ESE
3	-	3		15	20	15	50

Course Prerequisites:

Basic understanding of management principles
Fundamentals of economics and business environment
Analytical and problem-solving skills
Basic knowledge of engineering systems and industrial processes

Course Objective:

11. Introduce concepts, frameworks, and techniques of strategic management
12. Develop ability to analyze internal and external business environments
13. Enable formulation of competitive and corporate strategies
14. Understand strategy implementation and control mechanisms
15. Apply strategic tools in engineering, technology, and business contexts

Course Outcome: After successful completion of the course, students will be able to

CO-1	Explain strategic management concepts and processes
CO-2	Analyze external and internal environments using strategic tools
CO-3	Formulate business and corporate strategies
CO-4	Apply implementation techniques for effective execution
CO-5	Evaluate strategies using financial and non-financial methods

Course Contents

Unit-I	Introduction to Strategic Management	Hours:08

Concept and evolution of strategic management, Levels of strategy: Corporate, Business, Functional, Vision, Mission, Goals, Objectives, Strategic management process, Role of leadership in strategy.

Ethics and corporate governance		
Unit-II	**Environmental and Internal Analysis**	**Hours:08**
External environment analysis (PESTLE), Industry analysis using Porter's Five Forces, Internal analysis: Resources, capabilities, core competencies, Value chain analysis. SWOC analysis, Benchmarking, Competitive intelligence		
Unit-III	**Strategy Formulation**	**Hours:08**
Generic strategies: Cost leadership, differentiation, focus, Corporate strategies: Growth, stability, retrenchment, Diversification strategies, Business models and strategic choices, Blue Ocean Strategy, Innovation and digital strategies		
Unit-IV	**Strategy Implementation**	**Hours:09**
Strategy implementation process, Organizational structure and strategy, Resource allocation, Change management, Leadership in execution, Balanced Scorecard, Role of technology in implementation		
Unit-V	**Strategy Evaluation & Contemporary Issues**	**Hours:12**
Importance and process of evaluation, Evaluation criteria: consistency, feasibility, advantage, performance Financial Methods: ROI, EPS, NPV, IRR, Cost-benefit analysis, Non-Financial Methods: Customer satisfaction, Market share, Employee performance, Innovation metrics, Balanced Scorecard Approach: Financial perspective, Customer perspective, Internal process perspective, Learning and growth perspective, Benchmarking: Internal, competitive, functional, Strategic Audit, Gap Analysis, Value Chain Analysis, Case Studies: Engineering industries, IT sector, Startups		
Text Books:		
9. Fred R. David & Forest R. David – Strategic Management: A Competitive Advantage Approach **10. Michael E. Porter – Competitive Strategy** **11. Azhar Kazmi – Strategic Management and Business Policy**		
Reference Books		
8. W. Chan Kim & Renée Mauborgne – Blue Ocean Strategy **9. Thompson, Strickland & Gamble – Crafting and Executing Strategy**		
MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:		

Course Code	24CV607T	Course Name	Ethics in Profession				
Teaching Scheme				Evaluation Scheme			
L	T	Credits			CIE		ESE
2	-	2		-	50	-	-

Course Prerequisites:

Students should have basic awareness of professional responsibilities and workplace behavior. A general understanding of social values, technology use, and environmental responsibility will help in understanding ethical issues in professional practice.

Course Objective:

1. Interpret and implement professional ethics, responsibilities and values.
2. Implement environmental ethics and social responsibility.
3. Evaluate real-life situations and make ethical decisions using proper principles.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Explain the fundamental concepts of ethics, values, and morals and their role in responsible decision-making and professional behaviour.
CO-2	Describe and demonstrate the duties and ethical responsibilities of professionals in workplace and society.
CO-3	Identify and analyse ethical issues related to technology, data privacy, and responsible use of digital systems.
CO-4	Apply principles of environmental ethics for sustainable development and public safety.
CO-5	Analyse and evaluate ethical problems to make responsible decisions in professional situations.

Course Contents

Unit-I	Introduction to Professional Ethics	Hours:06
Meaning, definition and importance of ethics in professional life, Values, morals and ethics – concept and relationship, Need for professional ethics in engineering, management and technical fields, Role of ethics in decision making and responsible professional behavior, Overview of ethical theories – utilitarianism, duty ethics, virtue ethics.		
Unit-II	**Ethical Responsibilities of Professionals**	**Hours:06**

Duties and responsibilities of professionals toward society, Professional integrity, honesty, accountability and transparency, Ethical issues in workplace such as corruption, bribery and conflict of interest, Professional codes of ethics and conduct. Role of professional bodies and regulatory organizations.		
Unit-III	**Ethics in Technology and Digital Environment**	**Hours:06**
Ethical issues related to modern technology, Data privacy, cybersecurity and responsible data handling, Ethical concerns related to Artificial Intelligence and automation, Digital communication ethics and responsible use of social media. Intellectual property rights, plagiarism and copyright issues.		
Unit-IV	**Environmental and Social Ethics**	**Hours:06**
Concept of environmental ethics and sustainable development, Responsibility of professionals toward environmental protection, Ethics in resource utilization and waste management, Corporate social responsibility and community welfare, Ethical practices in infrastructure development and public safety.		
Unit-V	**Case Studies and Ethical Decision Making**	**Hours:06**
Approaches to ethical decision making, Analysis of real-life professional ethical dilemmas, Importance of leadership and ethical culture in organizations, Whistleblowing – meaning, importance and protection, Case studies related to professional ethics in construction, industry and public projects.		

Text Books:

1. **Mike W. Martin and Roland Schinzinger –** *Ethics in Engineering*, McGraw Hill Education**.**
2. **Govindarajan M., Natarajan S., Senthil Kumar V.S. –** *Professional Ethics and Human Values*, PHI Learning.

Reference Books

1. Charles E. Harris Jr., Michael S. Pritchard and Michael J. Rabins – *Engineering Ethics: Concepts and Cases*, Cengage Learning.

2. Caroline Whitbeck – *Ethics in Engineering Practice and Research*, Cambridge University Press**.**

3. Charles B. Fleddermann – *Engineering Ethics*, Pearson Education.

4. National Society of Professional Engineers (NSPE) – *Code of Ethics for Engineers***.**

MOOCs Course (Course name and Weblink) / Supplementary Readings / Videos:

Course Code	24CV602L	Course Name	Infrastructure Engineering Laboratory	
Teaching Scheme			Evaluation Scheme	
P	Credits		CIE	ESE
2	1		30	20

Course Prerequisites:

Students should have basic knowledge of pavement materials, aggregates, and bituminous materials used in highway construction.

Course Objective:

11. To perform laboratory tests on aggregates and bituminous materials used in highway construction.
12. To evaluate engineering properties of pavement materials as per standard specifications.
13. To understand the suitability of materials for flexible pavement construction.
14. To relate laboratory results with field performance of pavement materials.
15. To gain practical exposure to pavement design and highway construction practices.

Course Outcome: After successful completion of the course, students will be able to

CO-1	Determine physical properties of road aggregates using standard laboratory tests.
CO-2	Evaluate strength characteristics of aggregates used in pavement construction.
CO-3	Determine engineering properties of bituminous materials through laboratory testing.
CO-4	Analyze suitability of aggregates and bitumen for pavement construction as per IRC standards.
CO-5	Interpret laboratory test results and understand practical aspects of pavement design and construction.

Course Contents

Exp. No.	Experiment Title	CO
a) Tests on Aggregates		
1.	Specific Gravity and Water Absorption Test	1
2.	Shape Test: Determination of Flakiness Index and Elongation Index of Aggregates	1
3.	Determination of Aggregate Impact Value	2
4.	Determination of Abrasion Value of Aggregates (Los Angeles Abrasion Test)	2
5.	Stripping Value Test	4
b) Test on Bituminous Materials		
6.	Specific Gravity Test	3
7.	Penetration Test	3
8.	Softening Point Test	4
9.	Flash and Fire Point Test	3
10.	Ductility Test	3
11.	Viscosity Test	3
12.	Pavement design exercise based on flexible pavement consisting of bituminous concrete.	5
13.	Visit to Road construction site for studying different construction equipment's	5

Course Code	24CV608L	Course Name	Design of Steel Structures Laboratory	
Teaching Scheme			Evaluation Scheme	
P	Credits		CIE	ESE
2	1		30	20

Course Prerequisites:

1. Students should have basic knowledge of **Strength of Materials and Structural Analysis**, including stress, strain, shear force, and bending moment concepts.
2. Students should be familiar with **Engineering Drawing and fundamental design principles** related to structural elements.

Course Objective:

1. To develop the ability to **analyze and design steel structural components** such as beams, columns, trusses, and girders.
2. To understand **load calculation and load transfer mechanisms** in buildings, industrial sheds, and bridges.
3. To design and detail **structural connections** including bolted and welded joints.
4. To enhance skills in **structural drafting and preparation of detailed drawings**.
5. To apply relevant **IS codes and standard practices** in real-life structural design problems.

Course Outcome:

CO-1	Analyze structural systems such as trusses, beams, and girders under various loading conditions.
CO-2	Design steel structural components including **roof trusses, gantry girders, beams, and columns**.
CO-3	Design and detail **structural connections** such as beam-to-beam and column-beam joints.
CO-4	Apply concepts of **influence lines and structural behavior** in bridge structures like footbridges and plate girders
CO-5	Prepare **detailed structural drawings** and apply IS codes to solve practical engineering design problems.

Course Contents

Term work shall consist of detailed analytical report for structural design and drawing of any one of the following steel structures from Group A and B. Use IS 800: 2007.

SR.	DESCRIPTION	CO

NO.		
1	**Group A.** **Industrial Shed** a. Roof truss, purlin, and connections. b. Gantry girder. c. Columns and column bases **OR** **G + 3 Building Structure** a. Secondary and main beams b. Column and column bases c. Beam- to- beam connection d. Column- beam connection.	1,2,5
2	**Group B** **Foot Bridge** a. Influence lines b. Cross beam c. Main truss d. Raker e. Joint details f. Support details **OR** **Plate Girder** a. Stiffeners b. Curtailment of Flange plates	3,4,5

Course Code	24CV605L	Course Name	Operation Research Laboratory	
Teaching Scheme			Evaluation Scheme	
P	Credits		CIE	ESE
2	1		30	20

Course Prerequisites:

Engineering Mathematics (Linear Algebra, Matrices, Probability, and Statistics) , Basic concepts of calculus and algebra , Fundamentals of computer applications (MS Excel / basic programming)

Course Objective:

1. To introduce fundamental concepts, scope, and applications of Operations Research in engineering
2. To develop the ability to formulate real-world problems into mathematical models
3. To apply Linear Programming techniques for optimal decision-making
4. To analyze transportation, assignment, inventory, and queuing models
5. To apply decision-making and simulation techniques under uncertain conditions

Course Outcome: After successful completion of the course, students will be able to

CO-1	Explain fundamental concepts and methodologies of Operations Research
CO-2	Formulate and solve Linear Programming Problems using graphical and simplex methods
CO-3	Apply transportation and assignment models for optimal resource allocation
CO-4	Analyze inventory and queuing systems for improved system performance
CO-5	Apply decision theory and simulation techniques to solve real-world problems

Course Contents

Exp. No.	Experiment Title(Any 10)	CO
1	Solve LPP using Graphical Method	CO 1
2	Solve LPP using Simplex Method (Excel Solver)	CO 1
3	Solve LPP using Big-M Method	CO 2
4	Transportation Problem using NW Corner & Least Cost Method	CO 3
5	Transportation Problem using VAM	CO 3

6	Optimal solution using MODI Method	CO 4
7	Assignment Problem using Hungarian Method	CO 2
8	EOQ Model computation and analysis	CO 4
9	Queuing Model (M/M/1) performance analysis	CO 4
10	Decision-making using payoff matrix	CO 5
11	Monte Carlo simulation using Excel/Python	CO 5
12	Mini Project on real-life OR application	CO 5

Course Code	**24CV609L**			**Course Name**	**Mini Project**		
Teaching Scheme					**Evaluation Scheme Practical**		
L	**T**	**P**	**Credits**		**CIE**	**ESE**	**Total**
-	-	4	2		60	40	100

Mini Project

The Mini Project course provides third year civil engineering students an opportunity to apply theoretical knowledge to practical engineering problems. Students will identify a relevant problem in areas such as structural, transportation, environmental, geotechnical engineering, or construction management. The project may include literature review, data collection, analysis, design calculations, or modelling under the guidance of a faculty supervisor. Students will develop skills in problem identification, technical analysis, use of engineering tools, and report writing. At the end of the semester, students will submit a project report and give a presentation. Evaluation will be based on problem definition, methodology, report quality, and presentation.