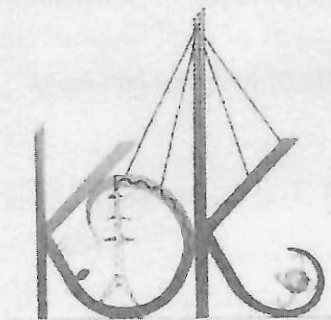




KDK College of Engineering, Nagpur 440024

Scheme and Syllabus for
Bachelor of Technology (Civil Engineering)

Submitted by
Board of Studies in Civil Engineering

2026-27

K D K College of Engineering, Nagpur
(An Autonomous Institute affiliated to RTM Nagpur University)
Department of Civil Engineering
Board of Studies Meeting

Institution Vision

Transforming Society through excellence in Education, Innovation and Research.

Institution Mission

- M1- To deliver quality, outcome-based education that provides strong technical knowledge and lifelong learning.
- M2- To promote innovation and impactful research addressing real-world and societal challenges.
- M3- To develop competent, ethical and socially responsible professionals through industry interaction and holistic development.

Department Vision

A center for Civil Engineering education focusing on Competence, Innovation & Research for Societal Transformation.

Department Mission

- M1- To develop competent Civil Engineers through quality technical and skill-based education.
- M2- To enhance employability and professional skills through industry interaction for sustainable infrastructure development.
- M3- To promote lifelong learning with ethics and leadership qualities.


Head
Department of Civil Engineering
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Program Outcomes (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering 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)

PO6: The Engineer and The World: Analyse and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)



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Program Specific Outcomes (PSOs)

PPSO1- Students shall apply civil engineering knowledge to solve real-world problems related to sustainable civil infrastructure projects.

PSO2- Students shall use the emerging tools & technologies in executing complex civil engineering projects of societal application.



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Course Competencies: Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behaviour and conduct. Acquire the knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes



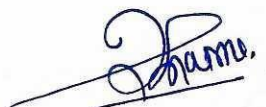
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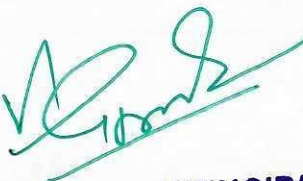
K D K College of Engineering, Nagpur
Department of Civil Engineering

List of Programme Core Courses offered

Groups	List of Programme Core Courses (PCC)	Sem
Structural Engineering	Strength of Materials	3rd
	Concrete Technology	3rd
	Structural Analysis	4th
	Design of Steel Structures	6th
	Design of Reinforced Concrete Structures	5th
	Retrofitting & Rehabilitation of Structures	8th
	Forensic Civil Engineering	7th
	Engineering Mechanics	1st
Geotechnical Engineering	Geotechnical Engineering	4th
Transportation Engineering	Transportation Engineering	5th
Water Resources Engineering	Hydrology	5th
	Fluid Mechanics	6th
	Irrigation Engineering	7th
Environmental Engineering	Environment Engineering	5th
Surveying	Surveying	6th
General Engineering	Building Materials & Construction	2nd
	Building Design and Drawing	3rd
	Estimating & Costing	7th
	Construction Economics & Finance	7 th
	Construction Workshop Practices	2nd


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Dr. N. R. Dhamge
 Dean (Academic)
 K.D.K. College Engineering
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List of Skill Enhancement Courses offered

S.N.	Semester	Course Code	Course Name
1	1 st Sem	1BSE01P	Application of Python in Civil Engineering
2	2 nd Sem	2BSE02P	Technical Communication & Report Writing
3	4 th Sem	4BSE03P	Basics of Building Drawing using AutoCAD Lab
4	6 th Sem	6BSE04P	Field Surveying

List of Value Education Courses offered

S.N.	Semester	Course Code	Course Name
1	3 rd Sem	3BVEC01T	Environmental Studies
2	4 th Sem	4BVEC02T	Constitution of India

List of Ability Enhancement Courses offered

S.N.	Semester	Course Code	Course Name
1	4 th Sem	4BAEC01T	Technical Report Writing


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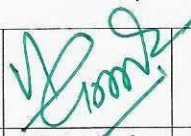

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List of Multidisciplinary Minor (MDM) Courses offered to the Civil Engineering Students

Sr. No.	Sem	Name of Subject aligned with CSE/IT domain	No. of Credit
1	3 rd	Scientific Programming with Python	3
2		Introduction to Internet of Things	3
3		Fundamentals of Computer Network	3
4		Fundamentals of Data Structures	3
5		Fundamentals of Computer Network	3
6	4 th	Smart Mobility Systems & Transportation Analytics	2
7		Sensors and Actuators for Industrial Applications	2
8		Introduction to Data Structure	2
9		Introduction to Artificial Intelligence	2
10		Introduction to Data Structure	2
11	5 th	Geospatial Information Systems & Spatial Data Analytics	3
12	6 th	Construction Data Analytics & Digital Cost Engineering	2
13	7 th	Smart Renewable Energy Systems & Energy Informatics	4

Sr. No.	Sem	Name of Subject aligned with CSE/IT domain	No. of Credit
1	3 rd	Computational Environmental Health & Safety Systems	3
2	4 th	Digital ESG Analytics & Sustainability Informatics	2
3	5 th	IoT Architectures & Smart Infrastructure Systems	3
4	6 th	Digital Project Management & Responsive Systems	2
5	7 th	Computational Climate Data Analytics	4

			June 2026	1.0	Applicable from AY 2026-27 Onwards
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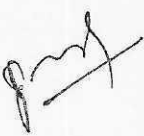
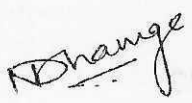
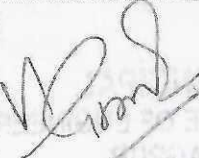
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K.D.K. College of Engineering, Nagpur
Faculty of Engineering and Technology

Courses offered by Applied Science and Humanities Board

Open Elective Courses for V Sem. B. Tech.

Sr. No.	Semester	Course Code	Subjects	Credits
1	V	5BOE03T - A	Principles of Management	3
2	V	5BOE03T - B	Professional Practices & Ethics	3
3	V	5BOE03T - C	Insurance & Banking Management	3
4	V	5BOE03T - D	Total Quality Management	3
5	V	5BOE03T - E	Campus Sustainability	3
6	V	5BOE03T - F	Indian Stock Market	3
7	V	5BOE03T - G	Climate Change	3

			June 2026	1.00	Applicable for AY 2026-27 onwards
BoS Chairman	Dean (Acad.)	Principal	Date of release	Version	

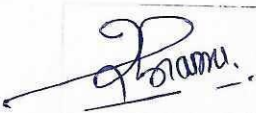
K D K College of Engineering, Nagpur
Faculty of Science & Technology
Department of Civil Engineering
For Students Migrating from RTMNU Affiliated Scheme to Autonomous Scheme
ABSORPTION SCHEME

SEMESTER – I

RTMNU Affiliated Scheme		Autonomous Scheme	
Code No.	Name of Subject	Code No.	Name of Subject
BSE1-1T	Mathematics – I	1BCV01T	Applied Mathematics – I
BSE1-2T	Applied Physics	1BCV02T	Applied Physics
BSE1-2P	Applied Physics Lab	1BCV02P	Applied Physics Lab
BSE1-3T	Energy & Environment	4BVE02T	Environment Science
BSE1-3P	Energy & Environment Lab	4BVE02T	Environment Science
BSE1-4T	Communication Skills	1BAE01T	Refer AEC Basket
BSE1-4P	Communication Skills Lab		
BSE1-5T	Engineering Graphics	1BCV03T	Engineering Graphics
BSE1-5P	Engineering Graphics Lab	1BCV03P	Engineering Graphics Lab
BSE1-6T	Basics of Civil & Mechanical Engineering	1BSE01P	Refer VSEC-1 Basket

SEMESTER – II

RTMNU Affiliated Scheme		Autonomous Scheme	
Code No.	Name of Subject	Code No.	Name of Subject
BSE2-1T	Mathematic - II	2BCV01T	Applied Mathematics - II
BSE2-2T	Advanced Engineering Materials	1BCV04T	Construction Materials and Practices
BSE2-2P	Advanced Engineering Materials Lab	1BCV04P	Construction Materials and Practices Lab
BSE2-3T	Applied Chemistry	2BCV02T	Applied Chemistry
BSE2-3P	Applied Chemistry Lab	2BCV02P	Applied Chemistry Lab
BSE2-4T	Computational Skills	-----	-----
BSE2-4P	Computational Skills Lab	-----	-----
BSE2-6T	Basics of Electrical Engineering	-----	-----
BSE2-7T	Engineering Mechanics	2BCV03T	Engineering Mechanics
BSE2-8T	Indian Culture & Constitution	2BIK01T	Refer IKS Basket
BSE2-5P	Workshop Practices	2BCV04T	Construction Workshop Practices
		2BSE01P	Refer VSEC-II Basket
		2BCC01P	Refer CC Basket

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K D K College of Engineering, Nagpur
Proposed Scheme

Bachelor of Technology (Civil Engineering)

Bachelor of Technology (Civil Engineering)															
Semester: Fourth				Teaching Scheme				Total Credit	Examination Scheme						
Sr. No.	Course Category	Course Code	Name of Course	BoS	Theory	Tutorial	Practical		Theory Exam Hrs	CA	MSE	ESE	Practical		
													CA	ESE	
1	PCC-IV	4BCV01T	Structural Analysis	Civil	3	-	-	3	20	30	50	-	-		
2	PCC-IV	4BCV01P	Structural Analysis Lab	Civil	-	-	2	1	-	-	-	25	25		
3	PCC-V	4BCV02T	Geotechnical Engineering	Civil	3	-	-	3	20	30	50	-	-		
4	PCC-V	4BCV02P	Geotechnical Engineering Lab	Civil	-	-	2	1	-	-	-	25	25		
5	MDM-II	4BCVMD2T	Refer MDM Basket	Civil	2	-	-	2	10	15	25	-	-		
6	OE-II	4BOE02T	Refer OE Basket	Civil	2	-	-	2	10	15	25	-	-		
	VSEC	4BCV03P	Basics of Building Drawing using AutoCAD Lab	Civil	-	-	4	2	-	-	-	50	50		
8	AEC	4BAF02T	Refer AEC Basket	ASH	2	-	-	2	10	15	25	-	-		
9	Entrepreneurship/Economics/Management Courses	4BEM02T	Refer EEM Basket	ASH	2	-	-	2	10	15	25	-	-		
10	VEC	4BVE02T	Refer VEC Basket	ASH	2	-	-	2	10	15	25	-	-		
Total					16	0	08	20	90	135	225	100	100		
								Total Marks	650						

Exit Option: Candidates may exit with UG Diploma after successfully completing the Second Year (after four semesters) of the Undergraduate Programme with a minimum of 80 credits, followed by additional exit 8 credits.

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Department of Civil Engineering
K. D. K. College of Engineering
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K D K College of Engineering, Nagpur
Bachelor of Technology (Civil Engineering)
EXIT SCHEME

After Fourth Semester			BoS	Teaching Scheme			Total Credit	Examination Scheme				
Sr. No.	Course Category	Course Code		Name of Course	Theory	Tutorial	Practical	Theory	CA	MSE	ESE	Practical
1	Exit Course	CVEXT01P	Civil	Environment Engineering	-	-	2	-	-	-	-	25
2	Exit Course	CVEXT02P	Civil	Surveying Practical	-	-	2	-	-	-	-	25
3	Exit Course	CVEXT03P	Civil	Minor Project	-	-	12	-	-	-	-	200
				Total			16					50
								Total Marks	250			

			June 2025	1.0	Applicable from AY 2025-26 Onwards
Chairman BoS in CE	Dean (Academics)	Principal	Date of Release	Version	

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K D K. College of Engineering
Nagpur - 24

Principal
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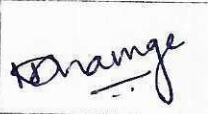
K D K College of Engineering, Nagpur
Faculty of Science & Technology
Department of Civil Engineering
For Students Migrating from RTMNU Affiliated Scheme to Autonomous Scheme
ABSORPTION SCHEME

SEMESTER – III

RTMNU Affiliated Scheme		Autonomous Scheme	
Code No.	Name of Subject	Code No.	Name of Subject
BTCVL301T	Mathematics - III	-----	-----
BTCVL302T	Fluid Mechanics	-----	-----
BTCVE302P	Fluid Mechanics (Practical)	-----	-----
BTCVE303T	Solid Mechanics	3BCV01T	Strength of Materials
BTCVL303P	Solid Mechanics (Practical)	3BCV01P	Strength of Materials Lab
BTCVL304T	Geotechnical Engineering	4BCV02T	Geotechnical Engineering
BTCVL304P	Geotechnical Engineering (Practical)	4BCV02P	Geotechnical Engineering Lab
BTCVL305T	Building Construction & Elementary Building Drawing	4BSE03P	Basics of Building Drawing using AutoCAD Lab
BTCVE305P	Building Construction & Elementary Building Drawing (Practical)		
BTCVE306T	Effective Technical Communication	-----	-----
		3BEM01T	Refer EEM - I Basket
		3BVE01T	Refer VEC-I Basket
		3BOE01T	Refer OE-I Basket

SEMESTER – IV

RTMNU Affiliated Scheme		Autonomous Scheme	
Code No.	Name of Subject	Code No.	Name of Subject
BTCVL401T	Concrete Technology	3BCV02T	Concrete Technology
BTCVL402T	Structural Analysis	4BCV01T	Structural Analysis
BTCVL402P	Structural Analysis (Practical)	4BCV01P	Structural Analysis Lab
BTCVL403T	Environmental Engineering	-----	-----
BTCVE403P	Environmental Engineering (Practical)	-----	-----
BTCVL404T	Transportation Engineering	-----	-----
BTCVE404P	Transportation Engineering (Practical)	-----	-----
BTCVL405T	Surveying & Geomatics	-----	-----
BTCVL405P	Surveying & Geomatics (Practical)	-----	-----
BTCVL406T	Mini Project (Practical)	3BCV03P	Mini Project
		4BOE02T	Refer OE-II Basket
		4BEM02T	Refer EEM - II Basket
		4BVE02T	Refer VEC-II Basket
		4BAE02T	Refer AEC-II Basket

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**Syllabus of 5th Semester B. Tech.
Civil Engineering**

K D K College of Engineering, Nagpur

Proposed Scheme (2026-27)

Bachelor of Technology (Civil Engineering)

Semester: Fifth

Bachelor of Technology (Civil Engineering)														
Semester: Fifth				Teaching Scheme				Total Credit	Examination Scheme					
Sr. No.	Course Category	Course Code	Name of Course	BoS	Theory	Tutorial	Practical		Exam Hrs	Theory				Practical
										CA	MSE	ESE	CA	
1	PCC-VI	5BCV01T	Design of RCC Structures	Civil	2	-	-	2	2	10	15	25	-	-
2	PCC-VI	5BCV01P	Design of RCC Structures Lab	Civil	-	-	2	1	-	-	-	-	25	25
3	PCC-VII	5BCV02T	Transportation Engineering	Civil	2	-	-	2	2	10	15	25	-	-
4	PCC-VIII	5BCV03T	Environmental Engineering	Civil	2	-	-	2	2	10	15	25	-	-
5	PCC-VIII	5BCV03P	Environmental Engineering Lab	Civil	-	-	2	1	-	-	-	-	25	25
6	PCC-IX	5BCV04T	Hydrology	Civil	2	-	-	2	2	10	15	25	-	-
7	PEC-I	5BCV05T	Refer PEC Basket	Civil	3	-	-	3	3	20	30	50	-	-
8	PEC-I	5BCV05P	Refer PEC Basket	Civil	-	-	2	1	-	-	-	-	25	25
9	MDM-III	5BCVMD03T	Refer MDM Basket	Civil	3	-	-	3	3	20	30	50	-	-
10	OE-I	5BOE03T	Refer OE Basket	BSH	3	-	-	3	3	20	30	50	-	-
			Total	17	0	6	20	17	100	150	250	75	75	75
Total Marks								650						

	Chairman BoS in CE Head			June 2026	1.0	Applicable from AY 2026-27 Onwards
	Dean (Academics)					

Department of Civil Engineering
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Dr. N. R. Dhangre
Dean (Academics)
K.D.K. College Engineering
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K D K College of Engineering, Nagpur
(An Autonomous Institute affiliated to RTM Nagpur University)
Department of Civil Engineering
Curriculum for B. Tech. Programme in Civil Engineering
(Scheme: 2026-27)
FIFTH SEMESTER

Semester V	Subject Code 5BCV01T	Name of Subject Design of RCC Structures		
Total Hours Distribution per week				
Total Credit: 02	Lecture (L): 02 Hours		Tutorial (T):	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
15 Marks	10 Marks	25 Marks	50 Marks	2.0 Hours

Course Objectives: During teaching, the students will be

1. Made to Understand phenomena of design concepts and learn various codes related to RCC design.
2. Explained the structural behavior of steel and concrete.
3. Imparted the knowledge of conventional methods for designing structural components of building
4. Explained the design procedure of slabs

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

COs	Course Outcome
CO1	Explain working stress method principles & compute moment of resistance using IS 456-2000.
CO2	Analyze RCC sections for limit state of collapse in flexure, shear, and bond.
CO3	Evaluate compression member behavior & explain isolated footing design concepts
CO4	Design simply supported one-way and two-way slabs as per IS 456-2000

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Explain principles of Working Stress Method and compute moment of resistance of RCC sections as per Bureau of Indian Standards code IS 456:2000.
2	Analyze RCC sections for limit state of collapse in flexure, shear, and bond according to limit state design principles.
3	Evaluate the behavior and design concepts of compression members and explain the fundamentals of isolated footing design.
4	Design simply supported one-way and two-way RCC slabs as per IS 456:2000 provisions.

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(An Autonomous Institute affiliated to RTM Nagpur University)
Department of Civil Engineering
Curriculum for B. Tech. Programme in Civil Engineering
(Scheme: 2026-27)
FIFTH SEMESTER

CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	2	1	2	2	3	1	—	—	3	3	3
CO2	3	2	2	1	2	2	3	1	—	—	3	3	3
CO3	3	2	2	1	2	2	3	1	—	—	3	3	3
CO4	3	2	2	1	2	2	3	1	—	—	3	3	3

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
1	Introduction to WSM Basic concept in design for flexure, assumptions, design constants. Analysis of the rectangular section for Balanced, under-reinforced and over-reinforced sections. Design for flexure: Analysis and design of singly reinforced rectangular section.	8	CO1
2	Introduction to Limit State Design: Concept of limit state design and philosophy. Characteristic values, partial safety factors, stress strain relationship stress block parameters, failure criteria, types and properties of reinforcement, limit state of Serviceability and limit state of collapse. Limit states of durability Limit state of collapse in flexure: Analysis and design of singly reinforced rectangular section. Analysis & design of the Tee beam section. Limit state of Collapse in Shear & Bond: Design of beam for shear, shear span, post cracking resistance, shear mechanism approach, shear failure modes and collapse loads, interaction of shear, flexure and axial force, Check for bond.	8	CO2
3	Limit state of collapse in compression: Analysis & design of short axially loaded columns. Columns subjected to uniaxial bending, use of interaction curves.	7	CO3
4	Design of one –way, simply supported, single span and cantilever slabs and continuous slab / beam with IS coefficients, Design of Simply supported Two-way slab	7	CO4

Suggested Activities for Continuous Assessment:

1. Analyze the beams using software for different loadings.
2. Design of beams & columns using software

K D K College of Engineering, Nagpur
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Department of Civil Engineering
Curriculum for B. Tech. Programme in Civil Engineering
(Scheme: 2026-27)
FIFTH SEMESTER

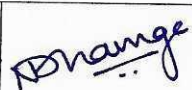
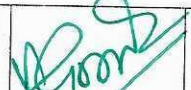
Learning Resources:

Text/Reference Books:

SN	Title of Book	Publisher	Name of author
1	Limit State design of Reinforced Concrete, 2nd Edition, 2006	PHI Learning Pvt Ltd	P.C.Varghese,
2	Design of Reinforced Concrete, 4th Edition, 2011	PHI Learning Pvt Ltd	M.L.Gambhir,
3	Fundamental of Reinforced Concrete Design, 5th Edition, 2011	PHI Learning Pvt Ltd	M.L.Gambhir,
4	Limit State Theory and Design of Reinforced Concrete (As Per IS: 456 - 2000), 7th Edition, 2013	Structures Publications,	Dr. V.L.Shah & Dr. S.R.Karve,

Online Resources:

SN	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Design of Reinforced Concrete Structures, Civil Engineering, Prof. N. Dhang, IIT Kharagpur	NPTEL	https://nptel.ac.in/courses/105105105

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KDK COLLEGE OF ENGINEERING
NAGPUR.

K D K College of Engineering, Nagpur
(An Autonomous Institute affiliated to RTM Nagpur University)
Department of Civil Engineering
Curriculum for B. Tech. Programme in Civil Engineering
(Scheme: 2026-27)
FIFTH SEMESTER

Semester V	Subject Code 5BCV01P	Name of Subject Design of RCC Structures Lab	
Total Hours Distribution per week			
Total Credit: 01	Practical (P): 02 Hours		
Examination Scheme			
Internal Examination	End Sem. Examination	Total Marks	Examination Duration:
25 Marks	25 Marks	50 Marks	

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

COs	Course Outcome
CO1	Explain the provisions of IS 456:2000 and analyze singly reinforced rectangular sections using Working Stress Method (WSM) and Limit State Method (LSM).
CO2	Design reinforced concrete beams for flexure and shear, and design one-way and two-way simply supported slabs using Limit State Method as per codal provisions.
CO3	Analyze and design short reinforced concrete columns subjected to axial load and combined axial load with uniaxial bending using Limit State Method.

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Develop the ability to understand the provisions and design philosophy of IS 456:2000 for reinforced concrete design.
2	Develop the skill to analyze and design reinforced concrete beams and slabs using Working Stress Method (WSM) and Limit State Method (LSM).
3	Develop the ability to analyze and design short reinforced concrete columns subjected to axial load and combined axial load with uniaxial bending as per codal provisions.

CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	2	1	2	2	3	1	3	—	3	2	2
CO2	3	2	2	1	2	2	3	1	3	—	3	2	2
CO3	3	2	2	1	2	2	3	1	3	—	3	2	2

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Syllabus (Practical): Any 06 experiments to perform

SN	List of Practical	CO Mapping
1	Introduction of IS456:2000	CO1
2	Analysis and design of singly reinforced rectangular section by WSM	CO1
3	Analysis and design of singly reinforced rectangular section by LSM	CO1
4	Design of beam for shear by LSM	CO2
5	Analysis & design of short axially loaded column by LSM	CO2
6	Analysis & design of short axially loaded with uniaxial moment column by LSM	CO2
7	Design of one –way, simply supported slab by LSM	CO3
8	Design of two –way, simply supported slab by LSM	CO3

Learning Resources:

Text/Reference Books:

SN	Title of Book	Publisher	Name of author
1	Limit State design of Reinforced Concrete, 2nd Edition, 2006	PHI Learning Pvt Ltd	P.C.Varghese,
2	Design of Reinforced Concrete, 4th Edition, 2011	PHI Learning Pvt Ltd	M.L.Gambhir,
3	Fundamental of Reinforced Concrete Design, 5th Edition, 2011	PHI Learning Pvt Ltd	M.L.Gambhir,
4	Limit State Theory and Design of Reinforced Concrete (As Per IS: 456 - 2000), 7th Edition, 2013	Structures Publications,	Dr. V.L.Shah & Dr. S.R.Karve,

Online Resources:

SN	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Design of Reinforced Concrete Structures, Civil Engineering, Prof. N. Dhang, IIT Kharagpur	NPTEL	https://nptel.ac.in/courses/105105105

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FIFTH SEMESTER

Semester V	Subject Code 5BCV02T	Name of Subject Transportation Engineering		
Total Hours Distribution per week				
Total Credit: 02	Lecture (L): 02 Hours		Tutorial (T):	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
15 Marks	10 Marks	25 Marks	50 Marks	2.0 Hours

Course Objectives: During teaching, the students will be:

1. Imparted knowledge on different modes of transportation & modern technologies. Acquaint them with the functions of various organization handling water, surface, & air transportation in India along with information on project execution models.
2. Equipped with knowledge of traffic studies/characteristics, alignment surveys & road geometric element designs.
3. Provided the overview of basic components & geometric elements of Railway & Airway Transportation.
4. Introduced basic components of bridge and its utility in the hydraulic design of bridge.

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

COs	Course Outcome
CO1	Explain various modes of transportation, modern technologies, transportation organizations, and project execution models.
CO2	Analyze traffic characteristics and design highway geometric elements as per relevant standards.
CO3	Apply principles of railway and airport engineering to solve basic design and operational problems.
CO4	Describe components of bridge and its utility in hydraulic design of a bridge.

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Demonstrate the ability to understand and compare multimodal transportation systems and emerging technologies.
2	Exhibit ability to analyze traffic data and design highway components using standard engineering practices.
3	Showcase the ability to apply railway and airport engineering principles to real-world transportation problems.
4	Recognize bridge engineering and its integration with highway transportation.

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FIFTH SEMESTER

CO-PO Articulating Matrix:

CO-PO Articulating Matrix:													
COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	1	–	–	–	2	1	–	1	2	1	1	1
CO2	3	3	3	2	2	2	2	–	–	1	1	1	1
CO3	3	2	2	1	2	1	2	–	–	–	1	1	1
CO4	2	1	–	–	–	2	–	–	–	1	1	1	1

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
1	Introduction: Introduction to modes of transportation (Roadway, Railway, Airway, & Waterway) & modern transportation technologies (High-speed Rail, Monorail, Electric Vehicles) & their Economic, Social & Environmental pros & cons. Transportation Organizations in India: Establishment & functions of NHAI, CRRI, IRC, RDSO, AAI, DGCA. Project Execution Models: PPP, BOT, BOLT, DBFOT, PMC	4	CO1
2	Highway Engineering: Road Traffic Engineering: PIEV theory, Traffic Studies (Spot-Speed, Traffic volume, O & D, Parking & Accident study), Road Safety Audit. Road Alignment: Surveys for new road & Phasing of Roads (numerical) Road Geometrics: Cross section (Carriageway Width, Camber, Kerb), Sight Distances (SSD, OSD), Design of Horizontal Curves (Super-elevation, Transition curves), Design of vertical curves (Summit & valley) Introduction to Pavement: Types of pavements & characteristics, Design parameters, Axle & Wheel load, tyre pressure, ESWL for dual Wheels, repetitions.	12	CO2
3	Railway Engineering: Permanent Way: Ideal requirement & brief functions of its components Traction: Tractive Resistance (numerical) Railways Geometrics: Cant, Negative Cant & Cant deficiency. Turnouts: Types of turnouts & brief functions of their components.	9	CO3
4	Introduction to Bridge Engineering: Classification, identification and site selection. economic span, waterways, scour depth, abutment, piers & wing walls.	5	CO4

Suggested Activities for Continuous Assessment: (Any Three)

- Study of Organizational Chart of MoRTH, Ministry of Railway, Ministry of Civil Aviation & Ministry of Shipping (any two)

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2. Carrying out Road Safety Audit of a section of existing road.
3. Study of Penalties (as per the Motor Vehicle Act 2019) for various types of driving faults.
4. Carrying out Spot-speed study at a given location.
5. Visit to road/bridge construction site

Learning Resources:

Text/Reference Books:

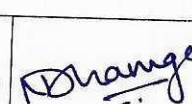
SN	Title of Book	Publisher	Edition & Year
1	Highway Engineering by Khanna S. K., Justo C.E.G., & Veeraragavan A.	Nem Chand Bros., Roorkee.	10 th (2017)
2	A textbook of Railway Engineering by S.C.Saxena and S.P.Arora,	Dhanpat Rai Publications, New Delhi.	5 th (1977)
3	Railway Track Engg. by J.S.Mundray	Tata McGraw-Hill Publishing Co. Ltd. New Delhi.	5 th (2017)
4	Airport Planning and Design by S.K. Khanna, M.G.Arora	Nem Chand Bros., Roorkee.	6 th (2022)

Online Resources:

SN	Topic	MOOCs Platform	Link
1	Traffic Engineering	NPTEL	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ce47
2	Urban Transportation & System Planning	NPTEL	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ce48

Teacher's Resource:

SN	Particulars	Link
1	Transportation Engineering Notes	
2	Railway Engineering	

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FIFTH SEMESTER

Semester V	Subject Code 5BCV03T	Name of Subject Environmental Engineering		
Total Hours Distribution per week				
Total Credit: 02	Lecture (L): 02 Hours		Tutorial (T): -	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
15 Marks	10 Marks	25 Marks	50 Marks	2 Hours

Course Objectives: During teaching, the students will be able to:

1. Understand the fundamentals of water supply systems, water quality requirements, and treatment needs.
2. Learn the principles of water treatment processes and water distribution systems.
3. Understand wastewater characteristics and sewage treatment processes.
4. Study sewage disposal methods and rural sanitation systems.

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

COs	Course Outcome
CO1	Explain water supply systems, water quality characteristics, and treatment requirements.
CO2	Apply the principles of water treatment processes and water distribution systems.
CO3	Explain wastewater characteristics and sewage treatment processes.
CO4	Describe sewage disposal methods and rural sanitation systems.

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Ability to understand water supply systems and water quality requirements.
2	Ability to apply water treatment processes for potable water supply.
3	Analysis of wastewater characteristics and sewage treatment processes.
4	Knowledge of sewage disposal methods and rural sanitation practices.

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CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	1	1	1	2	2	-	-	-	2	1	1
CO2	3	2	1	1	2	2	1	-	-	-	2	2	1
CO3	3	2	1	2	1	2	1	-	-	-	2	1	1
CO4	3	2	2	1	2	3	2	-	-	-	2	2	2

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
1	Water Supply Engineering Sources of water, Water supply schemes, water demand and factors affecting demand, intake structures, physical, chemical and biological characteristics of water, drinking water standards (WHO, CPHEEO and IS 10500), objectives of water treatment and flow sheet of a conventional water treatment plant.	7	CO1
2	Water Treatment Processes and Distribution Sedimentation and settling principles, coagulation and flocculation, types of coagulants, filtration through slow sand filters and rapid sand filters, disinfection and chlorination, types of chlorination, requirements of water distribution systems and distribution network layouts.	8	CO2
3	Wastewater Engineering Sources and types of wastewaters, physical, chemical and biological characteristics of wastewater, significance of BOD and COD, separate and combined sewer systems, flow sheet of sewage treatment plant, preliminary and primary treatment processes.	7	CO3
4	Sewage Treatment and Disposal Principles of biological treatment, Activated Sludge Process (ASP), Trickling Filters, Moving Bed Biofilm Reactor (MBBR), Sequencing Batch Reactor (SBR), and oxidation ponds, sewage disposal methods, reuse and recycling of treated wastewater, sludge treatment and disposal, rural sanitation systems including septic tank, soak pit and biogas recovery.	8	CO4

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Suggested Activities for Continuous Assessment: (Any Two)

1. Study of water supply system of a city (source, treatment and distribution).
2. Preparing flow diagram of conventional water treatment plant and sewage treatment plant.
3. Case Study on Wastewater Treatment Technologies such as ASP, MBBR or SBR adopted in a city or industry.
4. Group presentation on emerging wastewater treatment technologies and their applications.
5. Poster or infographic preparation on safe water supply, sanitation, or wastewater management.

Learning Resources:

Text/Reference Books:

S. N	Title of Book	Publisher	Edition & Year
1	Water Supply Engineering by B.C. Punmia, Ashok Jain and Arun Jain	Laxmi Publication	Reprint Edition, 2018
2	Environmental Engineering Vol. I (Water Supply Engineering) and Environmental Engineering Vol. II by Dr. P.N. Modi	Standard Book House	Revised Edition, 2019
3	Central Public Health Environmental Engineering Manual by --	(CPHEEO) New Delhi	Latest Edition, 2019
4	Environmental Engineering Vol. II by S.K. Garg	Standard Publication	Revised Edition, 2017
5	Water Supply & Sanitary Engineering by G.S. Birdie	Dhanpat Rai Publication	Revised Edition, 2016

Online Resources:

SN	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Industrial Wastewater Treatment	NPTEL	https://www.classcentral.com/course/swayam-industrial-wastewater-treatment-269716?utm
2	Physico-chemical processes for wastewater treatment	NPTEL	https://onlinecourses.nptel.ac.in/noc24_ch23/preview?utm
3	Water Supply Engineering	NPTEL	https://onlinecourses.nptel.ac.in/noc21_ce30/preview?utm

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FIFTH SEMESTER

Semester V	Subject Code 5BCV03P	Name of Subject Environmental Engineering Lab	
Total Hours Distribution per week			
Total Credit: 01	Practical (P): 02 Hours		
Examination Scheme			
Internal Examination	End Sem. Examination	Total Marks	Examination Duration:
25 Marks	25 Marks	50 Marks	

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

COs	Course Outcome
CO1	Perform physical, chemical, and bacteriological analysis of water and wastewater samples.
CO2	Conduct and evaluate water and wastewater treatment experiments.
CO3	Design basic treatment units and understand the functioning of treatment plants.

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Ability to perform and interpret physical, chemical, and bacteriological analysis of water and wastewater using standard laboratory methods.
2	Ability to conduct treatment-related experiments and evaluate water/wastewater treatment processes.
3	Ability to design basic treatment units and understand the functioning of water and sewage treatment systems through field exposure.

CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	1	2	2	2	1	-	1	-	1	3	3
CO2	2	3	2	2	2	2	1	1	1	-	1	3	3
CO3	2	2	3	2	2	3	2	1	2	1	2	3	3

Syllabus (Practical): Any 10 experiments to perform

SN	List of Practical	CO Mapping
1	Determination of pH of water sample.	CO1
2	Determination of conductivity of water sample.	CO1
3	Determination of turbidity of water sample.	CO1

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4	Determination of chlorides in water sample.	CO1
5	Determination of solids (suspended and dissolved solids).	CO1
6	Determination of acidity and alkalinity of water.	CO1
7	Determination of dissolved oxygen (DO).	CO3
8	Determination of available chlorine.	CO2
9	Determination of residual chlorine.	CO2
10	Jar test for determination of optimum coagulant dose.	CO2
11	Demonstration of Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD).	CO3
12	Bacteriological analysis: Plate count and MPN test.	CO3
13	Design of water treatment unit or wastewater treatment unit (any two units as per CPHEEO manual).	CO2
14	Visit to water treatment plant and sewage treatment plant with submission of report.	CO3

Learning Resources:

Text/Reference Books:

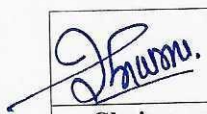
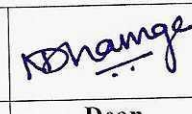
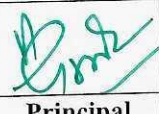
SN	Title of Book	Publisher	Edition & Year
1	Manual on Water Supply and Treatment	CPHEEO, Ministry of Urban Development, Govt. of India	3rd Edition, 1999 (Reprint 2013)
2	Environmental Engineering (Vol. I & II)	Laxmi Publications	Reprint Edition, 2018
3	Water Supply Engineering	Khanna Publishers	38th Edition, 2017

Online Resources:

SN	V-Lab Videos	Link
1	CPHEEO Manual on Sewerage and Sewage Treatment Systems	https://cpheeo.gov.in/

Teacher's Resource:

SN	Particulars	Link
1	NPTEL Video Lectures on Environmental Engineering	https://nptel.ac.in/courses/105104102

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FIFTH SEMESTER

Semester V	Subject Code 5BCV04T	Name of Subject Hydrology		
Total Hours Distribution per week				
Total Credit: 02	Lecture (L): 02 Hours		Tutorial (T): -	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
15 Marks	10 Marks	25 Marks	50 Marks	2.0 Hours

Course Objectives: During teaching, the students will

1. Understand the fundamental concepts of hydrology, hydrological cycle, and precipitation processes.
2. Explain infiltration, evaporation, and evapotranspiration mechanisms and their measurement techniques.
3. Analyze runoff processes, stream flow measurement, and hydrograph concepts for flood estimation.
4. Develop knowledge of groundwater occurrence, movement, and estimation using geo-hydrological principles.

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

COs	Course Outcome
CO1	Describe and classify hydrological processes and interpret precipitation measurement data.
CO2	Explain and apply methods to estimate infiltration, evaporation, and evapotranspiration.
CO3	Analyze and compute runoff and interpret hydrographs for engineering applications.
CO4	Analyze and evaluate groundwater flow and aquifer characteristics using Darcy's law.

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Interpret hydrological data and classify precipitation characteristics.
2	Apply techniques for estimating infiltration and evaporation losses.
3	Analyze runoff data and construct hydrographs for flood assessment.
4	Evaluate groundwater systems and assess aquifer performance.

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CO-PO Articulating Matrix:

CO-PO Articulating Matrix:													
COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	–	–	1	–	–	–	–	1	–	2	3
CO2	3	3	–	1	2	–	–	–	–	1	–	2	3
CO3	3	3	1	2	2	1	–	–	–	1	1	3	3
CO4	3	3	2	2	1	2	–	–	–	1	1	3	3

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
1	Introduction: Hydrology, definition, engineering hydrology, and its importance, development of hydrology and allied science, hydrological cycle Precipitation: Definition precipitation, artificial rains, types of precipitation, orthographic, conventional and cyclonic, factors affecting precipitation Measurement of precipitation: Non automatic and automatic rain gauges, selection of site, density and adequacy of rain gauge stations, optimal number of rain gauge	7	CO1
2	Infiltration: definition, mechanism, factors affecting infiltration, infiltration indices, measurement, application, problems. Evaporation and transpiration: definition, mechanism and factors affecting evaporation, evaporation estimations by pan, water budget, energy budget and imperial formula, control of evaporation. Evapo-transpiration and its measurement. Interception and its measurement.	8	CO2
3	Runoff: Source and components of run-off, classification of streams, factors affecting the runoff processes, estimation methods, measurement of discharge of streams by area-slope and area velocity method. Hydro-graphics: flood hydrology, definition, typical flood hydrograph and its components, base flow and base flow separation, unit hydrograph, theory, S-curve and its use, instantaneous UHG.	8	CO3
4	Geo-hydrology: Introduction, occurrence and distribution of ground water, water table and aquifer, aquiclude, aquitard and aquifuge. Groundwater exploration, electrical sensitivity method, confined and unconfined aquifer, porosity, permeability, specific yield, specific retention, Darcy's law.	7	CO4

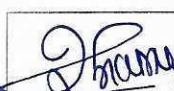
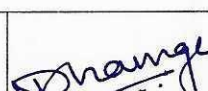
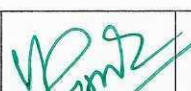
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FIFTH SEMESTER

Text/Reference Books:

SN	Title of Book	Publisher	Edition & Year
1	Engineering Hydrology	Tata McGraw-Hill Education Pvt. Ltd	4 th Edition, 2017
2	Hydrology and Water Resources Engineering	Laxmi Publications, New Delhi	2 nd Edition, 2018
3	Groundwater Hydrology	Wiley India Pvt. Ltd.	3 rd Edition, 2005
4	Introduction to Hydrology	Pearson Education	5 th Edition, 2015
5	Hydrology Principles Analysis & Design	New Age International Publishers	2 nd Edition, 2006

Online Resources:

SN	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Engineering Hydrology	NPTEL	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ce22
2	Groundwater Hydrology and Management	SWAYAM	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ge11
3	Surface Water Hydrology	NPTEL	https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_ce38

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FIFTH SEMESTER

Semester V	Subject Code 5BCV05T	Name of Subject Advanced Structural Analysis		
Total Hours Distribution per week				
Total Credit: 03	Lecture (L): 03 Hours		Tutorial (T):	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3.0 Hours

Course Objectives:

- To introduce strain energy methods and reciprocal theorems for the analysis of determinate and indeterminate trusses and frames.
- To understand the stability of columns and analyze two-hinged parabolic arches under different loading conditions.
- To introduce approximate methods for the analysis of multi-storeyed frames subjected to lateral loads.
- To understand and apply the flexibility method for the analysis of indeterminate beams and frames.
- To introduce finite element concepts and structural dynamics for analyzing static and dynamic behavior of structures.

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

COs	Course Outcome
CO1	Analyze redundant trusses and frames, determine structural deflections using Castigliano's theorem, and apply Maxwell's and Betti's theorems.
CO2	Determine critical buckling loads of columns and analyze support reactions, shear force, and normal thrust in two-hinged arches.
CO3	Analyze multi-storeyed frames using Portal and Cantilever methods and estimate member forces and moments.
CO4	Formulate flexibility equations and analyze beams and frames with up to two degrees of freedom.
CO5	Apply finite element discretization techniques and determine vibration characteristics of SDOF and MDOF systems.

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Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Formulating stiffness matrices, deriving stiffness coefficients, and applying compatibility equations to analyze simple structures.
2	Modeling and analyzing plane trusses with limited degrees of freedom to determine nodal displacements and member forces accurately
3	Applying the stiffness method to beams to compute displacements, bending moments, and shear forces efficiently
4	Applying the flexibility method to solve simple beams and trusses by calculating redundant forces and satisfying compatibility conditions.
5	Develop an ability to model structural systems using finite element concepts and evaluate their dynamic response.

CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	1	1	2	1	-	-	-	-	1	2	1
CO2	3	3	2	2	2	1	-	-	-	-	1	2	1
CO3	3	3	3	2	2	1	-	-	-	-	1	2	1
CO4	3	3	2	2	1	1	-	-	-	-	1	2	1
CO5	3	3	3	2	2	2	-	-	-	-	1	2	1

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
1	Strain energy method as applied to the analysis of redundant frames and redundant truss up to two Degrees, Determination of deflection of trusses (Determinate) by Castigliano's theorems. Maxwells reciprocal theorem. Bettis theorem.	10	CO1
2	Buckling of columns: Euler's and Rankine's formula, Secant Formula. Analysis of Two-Hinged Arches S.F. and normal thrust, parabolic arches.	7	CO2
3	Approximate method: Analysis of multi-stored frame by portal and cantilever methods. (max. two bay two story).	10	CO3
4	Introduction to Flexibility Method of structural analysis for beams and frames, up to two DOF.	8	CO4
5	Introduction to Finite Element method , basic concepts, discretization of structures. Numerical on Tapered sections. Introduction to structural dynamics, D'Alembert Principle, inertia force, equation of motion (free vibration), SDOF system, Damping, natural frequency, MDOF (up to 3 DOF), Mode shape and nodal frequency.	10	CO5

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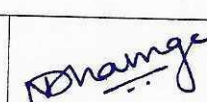
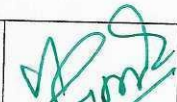
Suggested Activities for Continuous Assessment: (Any Three)

- Assignments / Tutorials – Derivations, stiffness/flexibility, truss & beam problems.
- Quizzes / Mini-tests – Short tests on numerical and conceptual understanding.
- Mini Project / Case Study – Analysis of small structures or frames.
- Classroom Problem Solving / Discussions – Active participation in solving problems.
- Simulation / Software Exercises – STAAD, SAP2000, or MATLAB modeling.
- Group Work / Peer Assessment – Collaborative problem solving and reporting.
- Oral / Viva Questions – Conceptual clarity on methods and derivations.
- Reflection / Learning Log – Summarizing problem-solving approaches and insights

Learning Resources:

Text/Reference Books:

SN	Title of Book	Publisher	Edition & Year
1	Structural Analysis (volume II) by Bhavikatti S.S.	Vikas publishing House LTD, Delhi	2nd Edition (2011)
2	Basic structural Analysis by Reddy C.S	Tata McGraw Hill Publication, New Delh	8th edition
3	Matrix Method of Structural Analysis by Meghre A.S. & Deshmukh S.K	Charotar publishing house, Anand	1st Edition (2003)
4	Matrix Method of Structural Analysis by Gere and Weaver	CBS Publication	(2004)

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FIFTH SEMESTER

Semester V	Subject Code 5BCV05P	Name of Subject Advanced Structural Analysis Lab	
Total Hours Distribution per week			
Total Credit: 01	Practical (P):	02 Hours	
Examination Scheme			
Internal Examination	End Sem. Examination	Total Marks	Examination Duration:
25 Marks	25 Marks	50 Marks	

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

COs	Course Outcome
CO1	Apply the stiffness method to formulate and assemble member and global stiffness matrices for trusses and beams, and determine nodal displacements, member forces, bending moments, and shear forces for simple structures.
CO2	Identify redundant forces and base determinate structures and solve beam and truss problems using the flexibility method, including verification and comparison with stiffness method results.
CO3	Analyze multi-story and sway frames using moment distribution, portal, and cantilever methods, and model trusses, beams, and frames in structural analysis software (MATLAB, STAAD, SAP2000) to validate manual calculations and study approximate vs exact solutions.

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Formulating and assembling stiffness matrices for trusses and beams, and in computing nodal displacements, member forces, bending moments, and shear forces using the stiffness method.
2	Identifying redundant forces, constructing base determinate structures, and solving beam and truss problems using flexibility methods, including verifying and comparing results with the stiffness method.
3	Analyzing multi-story and sway frames using moment distribution, portal, and cantilever methods, and in modeling trusses, beams, and frames using software tools (MATLAB, STAAD, SAP2000) to validate manual calculations and study approximate vs exact solutions.

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CO-PO Articulating Matrix:

CO-PO Articulating Matrix:													
COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	2	2	2	1	1	1	2	1	3	1	1
CO2	3	3	2	2	1	1	1	1	2	1	3	1	1
CO3	3	3	3	2	3	1	1	1	2	1	3	1	1

Syllabus (Practical): Any 8 experiments to perform

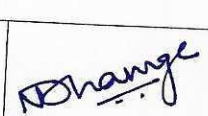
SN	List of Practical	CO Mapping
1	Formulation of stiffness matrix for a single truss member.	CO1
2	Assembly of global stiffness matrix for a small plane truss (up to 3 DOF).	CO1
3	Calculation of nodal displacements and member forces for a simple plane truss using stiffness method.	CO1
4	Formulation of beam stiffness matrix (ignoring axial deformations).	CO1
5	Analysis of simply supported and cantilever beams with 2-3 DOF using stiffness method.	CO1
6	Determination of bending moments, shear forces, and nodal displacements for beams.	CO1
7	Identification of redundant forces and base determinate structure for a given truss/beam.	CO2
8	Manual solution of beam/truss problems using flexibility methods (influence coefficients & compatibility equations).	CO2
9	Comparison of stiffness and flexibility method results for the same structure.	CO2
10	Application of moment distribution method to a two-story, two-bay frame (with sway).	CO2
11	Analysis of multi-story frames under lateral loads using portal method.	CO1
12	Analysis of multi-story frames under lateral loads using cantilever method.	CO2
13	Modeling trusses, beams, and frames in MATLAB, STAAD, or SAP2000 and verifying hand calculations.	CO3
14	Study of effect of sway in frames using software simulation.	CO3
15	Comparison of approximate vs exact analysis methods for small frames.	CO3

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Learning Resources:

Text/Reference Books:

SN	Title of Book	Publisher	Edition & Year
1	Structural Analysis (volume II) by Bhavikatti S.S.	Vikas publishing House LTD, Delhi	2nd Edition (2011)
2	Basic structural Analysis by Reddy C.S	Tata McGraw Hill Publication, New Delh	8th edition
3	Matrix Method of Structural Analysis by Meghre A.S. & Deshmukh S.K	Charotar publishing house, Anand	1st Edition (2003)
4	Matrix Method of Structural Analysis by Gere and Weaver	CBS Publication	(2004)

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FIFTH SEMESTER

Semester V	Subject Code 5BCV05T	Name of Subject Application of AI & ML in Civil Engineering		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hours		Tutorial (T): -	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives: The

Course Objectives: This course provides a comprehensive bridge between traditional civil engineering practices and modern computational intelligence. Students will explore how Machine Learning (ML) and Artificial Intelligence (AI) can optimize design, improve structural health monitoring, and streamline construction management.

Course Outcomes:

CO Code	Course Outcome
CO1	Explain the fundamental concepts of AI/ML and their relevance to the AEC (Architecture, Engineering, and Construction) industry.
CO2	Apply data preprocessing, transformation, feature engineering, and visualization techniques on real civil engineering datasets such as structural, transportation, and environmental data.
CO3	Implement supervised learning algorithms such as Linear Regression, Logistic Regression, KNN, and Decision Trees to develop predictive models for civil engineering problems.
CO4	Analyze civil engineering datasets using unsupervised learning methods to extract meaningful patterns and hidden relationships for engineering decision-making.
CO5	Evaluate the sustainability, ethical challenges, and future trends of AI implementations in urban planning.

Course Competencies:

- Ability to curate, clean, and pre-process civil engineering-specific datasets (e.g., sensor logs, borehole data, traffic counts).
- Proficiency in selecting and deploying the appropriate machine learning architecture for specific civil engineering problems.
- Mastery of AI-driven optimization techniques to improve traditional engineering designs.
- Critical evaluation of the environmental impact and ethical implications of automated systems in the built environment.

CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	1	-	-	1	-	-	-	-	-	2	1	2
CO2	2	3	-	3	3	-	-	-	-	-	1	2	3
CO3	3	3	3	2	3	1	-	-	-	-	1	3	3
CO4	2	2	2	-	3	-	-	1	1	3	2	3	3
CO5	1	-	-	-	-	3	3	-	-	-	3	3	3

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Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
I	Unit I: Fundamentals of Artificial Intelligence and Machine Learning Introduction to AI in Civil Engineering, Definition of Machine Learning, Difference between Artificial Intelligence and ML, Types of Machine Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning, Types of AI systems, Narrow AI, General AI, Overfitting vs Under fitting	8	CO1
II	Unit II: Supervised Learning Algorithms Regression techniques: Linear Regression, Multiple Linear Regression Classification techniques: Logistic Regression, K-Nearest Neighbors (KNN), Decision Tree Classifier, Model evaluation metrics: Accuracy, Precision, Recall	8	CO2
III	Unit III: Unsupervised Learning Clustering concepts, K-Means Clustering, Hierarchical clustering, Principal Component Analysis (PCA), Concept of training and testing datasets	7	CO3
IV	Unit IV: Data Processing and Feature Engineering for Civil Applications - Data types: numerical, categorical, image, time-series - Data cleaning and handling missing values - Normalization and scaling techniques - Feature extraction in civil engineering datasets - Introduction to datasets: Structural health monitoring data, Traffic flow data, Rainfall and hydrology data, Data visualization techniques	8	CO4
V	Unit V: Case Studies on Smart Infrastructure and Environmental Engineering Smart Cities: AI for traffic flow prediction and Intelligent Transportation Systems (ITS). Environmental Engineering: Predicting Air Quality Index (AQI) and optimizing wastewater treatment plant operations.	7	CO5

Suggested Activities for Continuous Assessment: Quizzes, Case Study Presentations, and ML Model Mini-project.

Term Work (12 HOURS) : Case Study based assignments, Presentations, and ML Model.

Self-Learning (18 HOURS) : NPTEL & UDEMY lecture videos

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Learning Resources:

Text/Reference Books:

SN	Title of Book/ Software	Publisher	Edition & Year
1	Textbook: Artificial Intelligence and Machine Learning in Civil Engineering by G.H. Galal.	-	-
2	Research Article: Lagaros, N. D., & Plevris, V. Artificial Intelligence (AI) Applied in Civil Engineering. <i>Applied Sciences</i> , 12(15), 7595. https://doi.org/10.3390/app12157595	-	2022
3	Software: Python (Scikit-Learn, TensorFlow), MATLAB (Deep Learning Toolbox), or RapidMiner.	-	-

Online Resources:

SN	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Artificial Intelligence (AI) applications for Civil Engineer	UDEMY	https://www.udemy.com/course/artificial-intelligence-ai-applications-for-civil-engineer/?srsltid=AfmBOoo6Fx02Ij4PpIwmlZr5LwPGN00chglpjlerSNOI8ikvssyu7xw0&couponCode=CM2600504IN

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FIFTH SEMESTER

Semester V	Subject Code 5BCV05P	Name of Subject Application of AI & ML in Civil Engineering Lab	
Total Hours Distribution per week			
Total Credit: 1	Practical (P): 2 Hours		
Examination Scheme			
Internal Examination	End Sem. Examination	Total Marks	Examination Duration:
Marks	Marks	Marks	Hours
25	25	50	-

Course Outcomes:

CO1: Analyze and pre-process raw civil engineering datasets (structural, geotechnical, and environmental) by implementing normalization, feature scaling, and exploratory data analysis to ensure data quality for model training.

CO2: Construct and train machine learning models—including Regression, Random Forests, and Neural Networks—to solve domain-specific problems such as strength prediction, soil classification, and flood forecasting.

CO3: Evaluate model performance using industry-standard metrics (MSE, R-squared, Confusion Matrices) and utilize modern computational tools (Python/OpenCV/TensorFlow) to automate site inspections and optimize construction resource management.

Course Competencies:

- Ability to curate, clean, and pre-process civil engineering-specific datasets (e.g., sensor logs, borehole data, traffic counts).
- Proficiency in selecting and deploying the appropriate machine learning architecture for specific civil engineering problems.
- Mastery of AI-driven optimization techniques to improve traditional engineering designs.

CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	1	2	3	-	1	-	-	-	-	2	2
CO2	3	3	3	2	3	1	2	-	-	-	1	3	3
CO3	2	3	3	3	3	2	2	1	1	-	2	3	3

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Syllabus (Practical): Minimum 6 practical to be performed.

SN	List of Practical	CO Mapping
1	Introduction to Python for AI/ML: • Installation of Python and Jupyter Notebook • Basic Python programming (variables, operators, loops, functions) • Introduction to NumPy and Pandas libraries	CO1 & CO2
2	Data Loading and Visualization • Import a civil engineering dataset (traffic/rainfall/construction data) • Display dataset statistics • Visualize data using line graphs, bar charts, and histograms	CO1 & CO2
3	Data Pre-processing • Handling missing values • Removing duplicate records • Basic data cleaning techniques using Pandas.	CO2 & CO3
4	Data Normalization and Scaling • Min-Max Scaling • Standardization (Z-score normalization) • Comparison of scaled and unscaled data	CO2 & CO3
5	Linear Regression for Civil Engineering Applications • Predicting concrete strength or construction cost using Linear Regression • Plotting regression line • Performance evaluation using Mean Squared Error (MSE)	CO1 & CO2
6	Multiple Linear Regression • Model training and prediction • Interpretation of regression coefficients	CO3
7	Classification using K-Nearest Neighbors (KNN) • Classification of road conditions or structural condition categories • Training and testing KNN model • Calculation of Accuracy	CO3
8	Decision Tree Classification • Classification of infrastructure condition data • Building and visualizing Decision Tree • Evaluation using Accuracy, Precision, and Recall	CO3
9	K-Means Clustering • Clustering traffic flow or rainfall datasets • Determination of optimal number of clusters • Visualization of clustered data	CO2 & CO3
10	Mini Case Study on Civil Engineering Dataset Selection of any one dataset: Traffic Flow Data or Rainfall Data or Structural Health Monitoring Data or Air Quality Data	CO3

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Suggested Lab Setup

- **Platform:** Anaconda Distribution / Google Colab (Free and requires no installation).
- **Key Libraries:** Pandas (Data), Matplotlib (Visuals), Scikit-learn (General ML), Keras/TensorFlow (Deep Learning).
- **Data Sources:** UCI Machine Learning Repository (Concrete dataset) and Kaggle (Construction/Traffic datasets).

Rubrics for evaluation/ to grade the practical:

1. **Code Logic & Execution (40%):** Does the model run without errors and produce logical results?
2. **Engineering Interpretation (30%):** Can the student explain the "civil engineering meaning" behind the AI output (e.g., why a certain feature affects concrete strength)?
3. **Visualization & Documentation (30%):** Quality of plots, heatmaps, and the final lab report.

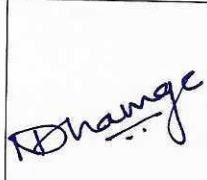
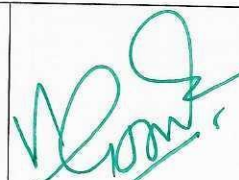
Learning Resources:

Key Libraries & Data Sources:

SN	Particulars
1	Key Libraries: Pandas (Data), Matplotlib (Visuals), Scikit-learn (General ML), Keras/TensorFlow (Deep Learning).
2	Data Sources: <u>UCI Machine Learning Repository</u> (Concrete dataset) and <u>Kaggle</u> (Construction/Traffic datasets).

Online Resources:

SN	V-Lab Videos	Link
1	Artificial Intelligence Virtual Lab	https://ai-amrt.vlabs.ac.in/List%20of%20experiments.html

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FIFTH SEMESTER

Semester V	Subject Code 5BCVMD03T	Name of Subject IoT Architectures & Smart Infrastructure Systems		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hours	Tutorial (T): -		
Examination Scheme				
Mid Sem. Examination 30 Marks	Continuous Assessment 20 Marks	End Sem. Examination 50 Marks	Total Marks 100 Marks	Theory Examination Duration: 3 Hours

Course Objectives:

This course is designed to provide students with a solid technical foundation in IoT frameworks while maintaining a focus on practical infrastructure applications. It bridges the gap between hardware electronics and civil asset management.

Course Outcomes:

CO Code	Course Outcome
CO1	Analyze the fundamental concepts of IoT, its architecture, and smart infrastructure systems with applications in smart cities and engineering domains.
CO2	Analyze IoT system architecture including perception, network, processing, and application layers, and explain edge, fog, and cloud computing concepts.
CO3	understand and interpret the working of IoT sensors, actuators, and embedded devices used in smart infrastructure applications
CO4	Apply knowledge of IoT communication protocols and data management techniques for reliable data transmission in smart infrastructure systems.
CO5	Design and evaluate IoT-based smart infrastructure solutions for applications such as smart buildings, transportation systems, and environmental monitoring

Course Competencies:

- Ability to specify a complete IoT stack (Hardware to Cloud) based on site geography and data requirements.
- Ability to calibrate and deploy digital sensors for real-world measurements like strain, vibration, or flow.
- Ability to identify vulnerabilities in cyber-physical systems and propose mitigation strategies for public infrastructure safety.

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CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	2	3	2	-	-
CO2	3	2	2	2	3	-	-	-	1	3	2	2	2
CO3	2	3	3	3	3	2	-	1	2	2	3	3	3
CO4	2	2	3	-	3	3	-	1	2	2	2	3	3
CO5	1	-	-	-	-	2	3	2	3	1	-	3	3

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
I	Unit I: Introduction to IoT and Smart Infrastructure Definition of Internet of Things (IoT), Evolution of IoT and smart systems, Characteristics of IoT systems , Components of IoT ecosystem Concept of Smart Infrastructure and Smart Cities Applications in engineering domains: Civil infrastructure Transportation systems ,Environmental monitoring	8	CO1
II	Unit II: IoT Architecture Layers of IoT architecture: Perception layer, Network layer, Processing layer, Application layer, Cloud-based IoT architecture, Edge and fog computing concepts, IoT system design principles, Data flow in IoT systems	8	CO1, CO2
III	Unit III: Sensors, Actuators & Devices Types of sensors used in IoT: Temperature, humidity, pressure, Vibration and strain sensors ,Water level and flow sensors, Actuators and their role ,Sensor data acquisition and interfacing Calibration and accuracy issues	8	CO2, CO3
IV	Unit IV: Communication Technologies in IoT Wired and wireless communication Protocols: MQTT ,HTTP/HTTPS ,CoAP (basic idea) Wireless technologies: ,Wi-Fi ,Bluetooth ,Zigbee ,LoRaWAN	8	CO3, CO4

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V	Unit V: Smart Infrastructure Systems Traffic Monitoring Systems: 1. IoT-based traffic data collection 2. Vehicle counting and density estimation 3. CCTV + sensor integration systems 4. Real-time traffic flow analysis 5. Data communication to central control system Temperature Quality Monitoring: Parameters of Temperature quality: Temperature, Humidity, Air Movement	7	CO1, CO5
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Activity:

- **Virtual Prototyping:** Use **Wokwi** or **Tinkercad** to design a "Bridge Overload Alert System" using tilt and force sensors.
- **Case Study Presentation:** Analyze a real-world project (e.g., The smart sensors on the Burj Khalifa or a local Smart City project).

Term Work (12 HOURS): Assignments, Presentations, and Case studies.

Self-Learning (18 HOURS): NPTEL & UDEMY lecture videos

Learning Resources:

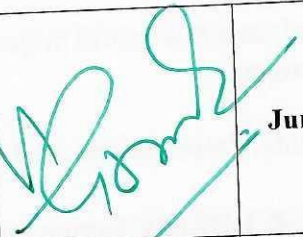
Text/Reference Books:

Sr. No.	Title of Book/ Software	Publisher	Year
1	<i>IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the IoT</i> by David Hanes	Cisco Press	2017
2	<i>Structural Health Monitoring of Civil Infrastructure Systems</i> by Vistasp Karbhari.	Elsevier	2009
3	<i>Internet of Things: A Hands-On Approach</i> by Arshdeep Bahga and Vijay Madiseti.	VPT	2014
4	<i>Smart Cities: Foundations, Principles, and Applications</i> by Houbing Song, Ravi Srinivasan, et al.	John Wiley & Sons	2017
5	<i>Structural Health Monitoring: A Machine Learning Perspective</i> by Charles R. Farrar and Keith Worden.	John Wiley & Sons	2012

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Online Resources:

Sr. No.	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Wokwi: <u>ESP32 Simulator</u> (Excellent for testing code and wiring without buying hardware).	-	https://wokwi.com/esp32
2	Coursera: <u>IoT Wireless & Cloud Computing Emerging Technologies</u>	Coursera	https://www.coursera.org/learn/iot-wireless-cloud-computing
3	NPTEL Course: <u>Introduction to Internet of Things (IIT Kharagpur)</u>	NPTEL	https://nptel.ac.in/courses/106105166

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FIFTH SEMESTER

Semester V	Subject Code 5BCVMD03T	Name of Subject Geospatial Information Systems & Spatial Data Analytics		
Total Hours Distribution per week				
Total Credit: 03	Lecture (L): 03 Hours	Tutorial (T):		
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3.0 Hours

Course Objectives: The objectives will enable teacher:

1. To introduce the fundamental concepts of Geospatial Information Systems (GIS), including coordinate systems, projections, and spatial data models.
2. To familiarize students with the methods of spatial data acquisition, processing, and database management.
3. To develop proficiency in conducting foundational spatial analysis and geoprocessing tasks using raster and vector data.
4. To explore advanced spatial data analytics, including network analysis, geostatistics, and spatial autocorrelation.
5. To impart skills in cartographic visualization, Web GIS, and the application of geospatial tools to real-world decision-making.

Course Outcomes:

CO Code	Course Outcome
CO1	Understand and articulate the theoretical foundations of GIS and spatial data structures.
CO2	Acquire, digitize, and manage spatial data using appropriate geospatial database technologies
CO3	Perform core spatial analysis (buffers, overlays, map algebra) to solve geographical problems.
CO4	Apply advanced spatial data analytics and geostatistical modeling to uncover spatial patterns and relationships.
CO5	Design compelling map visualizations and deploy basic web-based geospatial applications

Course Competencies: Students will acquire:

- Interpret and conceptualize real-world problems using geographic location, spatial relationships, and GIS principles.
- Apply geospatial data acquisition, digitization, and database management techniques using standard GIS tools and spatial databases
- Analyze spatial problems by selecting and executing appropriate GIS operations such as buffering, overlay analysis, and map algebra.

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- Evaluate spatial datasets using advanced analytics and geostatistical methods to identify patterns and relationships.
- Design and develop effective map visualizations and basic web-based geospatial applications for decision-making.

CO-PO Articulating Matrix:

CO-PO Articulating Matrix:													
COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	–	–	–	3	2	–	–	–	1	3	2
CO2	2	3	–	2	2	2	–	–	–	–	–	2	3
CO3	2	2	3	2	3	3	–	–	–	–	–	3	3
CO4	2	3	3	2	2	3	3	2	2	2	2	3	3
CO5	2	2	3	2	2	3	3	2	-	-	-	3	3

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
I	Introduction to GIS and Spatial Data Fundamentals: Concepts of GIS: Definition, history, components of a GIS, and its role in modern decision-making. Earth Modeling & Coordinate Systems: Geoids, ellipsoids, datums (WGS84, etc.), Geographic vs. Projected Coordinate Systems, map projections and distortions. Spatial Data Models: Vector data model (points, lines, polygons, topology) vs. Raster data model (grids, resolution, bands). Non-Spatial (Attribute) Data: Relational database concepts, joining spatial and tabular data.	10	CO1
II	Spatial Data Acquisition and Management: Data Sources: Primary and secondary data collection, GNSS/GPS principles, introduction to Remote Sensing and satellite imagery. Data Digitisation: Scanning, manual digitizing, heads-up digitizing, and correcting topological errors. Spatial Databases: Introduction to Geodatabases and Spatially-enabled RDBMS (e.g., PostgreSQL with PostGIS). Open Data: Utilizing OpenStreetMap (OSM), government geospatial portals, and standard data formats (Shapefiles, GeoJSON, KML, GeoTIFF).	9	CO2
III	Core Spatial Analysis and Geoprocessing: Vector Analysis: Buffering, overlay operations (intersect, union, erasing), proximity analysis, and point-in-polygon queries. Raster Analysis: Map algebra, local/focal/zonal/global functions,	8	CO3

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	reclassification, and terrain analysis (DEMs, slope, aspect, hillshade). Multi-Criteria Evaluation (MCE): Suitability modeling and site selection using weighted overlays.		
IV	Advanced Spatial Data Analytics: Network Analysis: Routing, shortest path algorithms (Dijkstra's), service areas (isochrones), and location-allocation modeling. Geostatistics & Interpolation: Spatial sampling, deterministic methods (IDW, Spline), and introduction to Kriging. Spatial Pattern Analysis: Spatial autocorrelation (Moran's I), hot-spot analysis (Getis-Ord Gi*), and point pattern analysis (density, clustering).	9	CO4
V	Cartography, Web GIS, and Emerging Trends: Cartographic Design: Principles of map design, visual hierarchy, color theory, symbology, and creating map layouts. Web GIS & Geovisualization: Architecture of Web GIS, Map Servers (Geo Server), and web mapping libraries (Leaflet, Mapbox, or Open Layers). Scripting & Future Trends: Introduction to Python for geospatial analytics (GeoPandas, Shapely), and the intersection of AI/ML with spatial data (GeoAI).	9	CO5

Suggested Activities for Continuous Assessment:

- 1. Campus Mapping Project:** Students use mobile GPS apps (or standard GPS units) to collect waypoints of campus assets (e.g., dustbins, parking, trees) and create a mapped inventory.
- 2. Suitability Analysis Lab:** A mini project where students must find the "optimal location" for a new facility (e.g., a hospital or solar farm) using weighted overlay techniques on provided raster datasets.
- 3. Open-Source Contribution:** Extracting, editing, and contributing local infrastructure data to OpenStreetMap (OSM).
- 4. Spatial Dashboard Creation:** Building a simple interactive web map or dashboard tracking a real-world dataset (e.g., regional COVID-19 cases, real estate prices, or pollution levels) using QGIS2Web or basic Python/Folium.
- 5. Article Review Presentation:** Students read a recent academic paper or industry case study detailing an advanced application of Spatial Analytics and present their findings in a 5-minute lightning talk.

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Learning Resources:
Text/Reference Books:

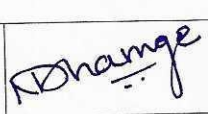
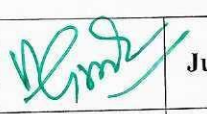
Title of Book	Publisher	Edition & Year
Textbooks <i>GIS Fundamentals: A First Text on Geographic Information Systems</i> by Paul Bolstad	Eider Press White Bear Lake, Minnesota	5th Edition, 2016
<i>Geographic Information Science and Systems</i> by Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind (4th Edition).	John Wiley & Sons, Inc.	4 th Edition, 2015
<i>An Introduction to Geographical Information Systems</i> by Ian Heywood, Sarah Cornelius, Steve Carver.	Pearson	4 th Edition, 2011
Reference Books <i>Spatial Decision Support Systems: Principles and Practices</i> by Ramanathan Sugumaran and John DeGroot	CRC Press	2011
<i>Geocomputation with Python</i> by Michael Dorman, et al. (Great for the analytics and modern coding side of the syllabus).	CRC Press	1 st Edition, 2025
<i>Designing Better Maps: A Guide for GIS Users</i> by Cynthia A. Brewer (For Unit 5 cartography).	Esri Pr	2 nd Edition, 2015

Online Resources:

SN	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Geo Spatial Analysis In Urban Planning	NPTEL	https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_ce26
2	Geographic Information Systems	NPTEL	https://nptel.ac.in/courses/105107206

Teacher's Resource:

SN	Particulars	Link
1	YouTube Videos/PPT/Notes/Lab Manual/Question Banks, etc.	https://www.youtube.com/playlist?list=PLbRMhDVUMnge82bjZncVW83GErY5D38rW

			June 2026	1.0	Applicable from AY 2026-27 Onwards
Chairman (Head in CE)	Dean (Academics)	Principal	Date of Release	Version	

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KDK College of Engineering, Nagpur

B. Tech.

CE/ ME/ EE/ CSE/ IT/ AI&DS/ ETC Engineering

Semester V	Subject Code:	Name of Subject:		
	5BOE03T - C	Insurance and Banking Management		
Total Distribution per week				
Total Credit: 3	Lecture (L): 3	Tutorial (T): 0	Practical (P): 0	
Examination Scheme				
Continuous Assessment	Mid Semester Examination	End Semester Examination	Total Marks	Examination Duration:
20 Marks	30 Marks	50 Marks	100 Marks	3 Hrs

Course Objectives	
1	To introduce the structure and functioning of the banking industry, with a focus on commercial and corporate banking in India.
2	To understand key commercial banking operations and regulatory frameworks like KYC, AML, FEMA, and payment systems (NEFT, RTGS, SWIFT).
3	To explore banking risk management practices, including ALM, NPA management, credit risk, and other financial risks.
4	To provide insights into insurance fundamentals, types of insurance policies, and risk measurement techniques
5	To examine the operational aspects of insurance companies including underwriting and claims management.

Course Outcomes	
After completion of syllabus, the student will be able to	
1	Explain the structure and types of banking institutions in India and the concept of core and universal banking.
2	Describe key operations in commercial banking and apply regulatory norms such as KYC, AML, RTGS, NEFT, and FEMA.
3	Evaluate asset-liability management processes and prudential norms related to NPAs and credit risk management.
4	Illustrate the concepts and types of life and general insurance, and understand premium calculation and risk measurement.
5	Analyze the operational aspects of insurance companies including underwriting principles and claims settlement processes.

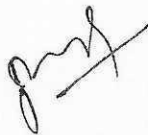
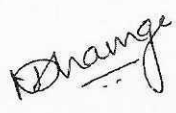
Course Competencies	
1	Understand the structure and regulations of banking and insurance in India.
2	Apply risk management practices and compliance frameworks like KYC, AML, FEMA, NEFT, and RTGS.
3	Analyze insurance policies and claims processes to evaluate financial and operational risks.

CO_PO Mapping											
	Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	2	-	-	-	2	3
CO2	-	-	-	-	2	2	2	-	-	3	3
CO3	-	-	-	-	2	2	-	-	-	3	3
CO4	-	-	-	-	3	2	2	-	-	3	2
CO5	-	-	-	-	3	2	2	-	-	3	2

Course Contents		Mapped with CO
Unit I : Introduction to Banking: Banking Industry: Structure of Banking Industry - Public and Private Sectors Banks in India - Corporate Banking and Universal Banking - Core Banking Innovation in Banking: E-Banking - Delivery Channels - ATM - EFTPOS - Phone Banking - Internet Banking - SMS Banking - Mobile Banking - Credit/Debit Cards - Smart Cards - UPI - Bancassurance.	8	CO1
Unit II : Commercial Banking Operations: Banking Operations: Payment and Settlement System - New Age Clearing - New Age Payment - RTGS - NEFT - SWIFT - NTGS - KYC Norms and Anti - Money Laundering - FEMA. Asset Liability Management (ALM): Concept - Organization and Techniques - Provision for NPA's - NPA's in Commercial Banks - Causes and Suggestions - Prudential Norms.	8	CO2
Unit III : Management of Banking Organization: Credit Risk Management: Introduction - Capital Adequacy Norms - Standardized and Advanced Approaches for Credit Risk - Credit Rating/Credit Scoring - Rating System Design. Loan Management: Contents of Loan Policy - Evaluating Credit Applicant Market Risk - Liquidity Risk - Interest Rate Risk - FOREX Risk.	8	CO3
Unit IV Introduction to Insurance: Introduction, Concept - Nature - Scope and Significance - Investment Patterns - Types of Policies. Life insurance: Premium Calculations - Annuities - Measurement of Risk and Morality Table. General Insurance: Fire Insurance - Conditions of Fire Insurance - Subrogation and Reinsurance - Accident and	8	CO4

Motor Insurance - Types of Motor Insurance - Factors to be considered for Premium Fixing - Concept of Health Insurance - Group Insurance - Home Insurance - Catastrophe Insurance		
Unit V : Management of Insurance Companies:	8	CO5
Underwriting: Functions - Principles - Underwriting in Life Insurance - Underwriting in Non-Life Insurance. Claims Management: Claim Settlement in General Insurance - Accident Benefit - Disability Benefit - Permanent Disability Benefit - Claim Settlement in Life Insurance - Maturity Claims and Death Claims.		

Text/ Reference Books	
1	N.R. Mohan Prakash, Banking, Risk and Insurance Management, Vikas Publishing
2	M.N. Mishra & S.B. Mishra, Insurance: Principles and Practice, S. Chand & Co
3	Sunil Kumar, Essentials of Banking and Insurance, JSR Publishing House
4	Bank Management and Financial Services (Indian Edition), Peter Rose & Sylvia Hudgins, 8th Edition, McGraw Hill Education
5	Principles And Practice of Bank Management, 2nd Revised Edition, Dr. P. Subba Rao & Dr. Promod Kumar Khanna, Himalaya Publishing House

			June 2026	1.00	Applicable for AY 2026-27 onwards
Chairman BoS	Dean (Acad.)	Principal	Date of release	Version	

KDK College of Engineering, Nagpur

B. Tech.

CE/ ME/ EE/ CSE/ IT/ AI&DS/ ETC Engineering

Semester V	Subject Code:	Name of Subject:		
	5BOE03T - D	Total Quality Management		
Total Distribution per week				
Total Credit: 3	Lecture (L): 3	Tutorial (T): 0	Practical (P): 0	
Examination Scheme				
Continuous Assessment	Mid Semester Examination	End Semester Examination	Total Marks	Examination Duration:
20 Marks	30 Marks	50 Marks	100 Marks	3 Hrs

Course Objectives	
1	Understand the principles, history, and key contributors of Total Quality Management (TQM)
2	Learn and apply essential quality tools like Kaizen, Six Sigma, and cost analysis.
3	Manage customer satisfaction, employee involvement, and supplier relationships.
4	Use quality improvement techniques such as control charts and the DMAIC process.
5	Apply advanced TQM tools like Benchmarking, QFD, TPM, and FMEA to enhance quality and reliability

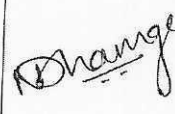
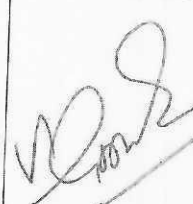
Course Outcomes	
After completion of syllabus, the student will be able to	
1	Develop an understanding about Quality management in corporate world.
2	Employ various techniques being used in Total Quality Management.
3	Engage into control of processes in manufacturing and operations
4	Audit control systems and Quality management
5	Apply TQM tools like Benchmarking, QFD, Taguchi Loss Function, TPM, and FMEA to improve quality and reliability in industrial and service processes.

Course Competencies	
1	Apply Total Quality Management (TQM) principles in real-world corporate settings.
2	Operate quality tools and techniques to improve processes and ensure product reliability.
3	Evaluate and audit quality systems to support continuous improvement.

CO_PO Mapping											
	Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	2	-	2	1	-	-	-	1	1
CO2	-	2	2	-	3	1	-	-	-	2	2
CO3	-	2	3	-	2	1	1	2	-	2	2
CO4	-	2	2	2	2	1	1	-	-	2	2
CO5	-	2	3	-	3	1	1	-	2	2	2

Course Contents		Mapped with CO
Unit I: Introduction to Total Quality Management Introduction to Total Quality Management, A brief history, the concept of quality, evolution of total quality, principles of total quality, Gurus of total quality management, their philosophies and contributions, characteristics of quality leader, customer satisfaction, customer perception of quality, feedback, customer complaints.	8	CO1
Unit II: Tools of Quality Management Process, Problem solving method, Kaizen, Six Sigma, performance measures, Cost of Quality, Tools for Quality Assurance,	8	CO2
Unit III: Customers and Suppliers Management TQM Principles - Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement –Juran Trilogy, PDCA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy	8	CO3
Unit IV: Quality Improvement Techniques Quality Improvement Techniques - Control Charts for Variables – Definitions, Variation: Common vs. Special Causes, Process capability, Concept of six sigma - Introduction, advantages of six sigma, six sigma DMAIC process	8	CO4
Unit V: Total Productive Maintenance TQM Tools - Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA	8	CO5

Text Books	
1	Dale H.Besterfield, et al., Total Quality Management Pearson Education Asia, 1999. (Indian Areprint 2002)
2	Total Quality Management by Dale H. Besterfield,2019, Perason
Reference Books	
1	James R.Evans & William M.Lidsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5)
2	Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991
3	Oakland.J.S. "Total Quality Management" Butterworth – Hcinemann Ltd., Oxford. 1989

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Chairman BoS	Dean (Acad.)	Principal	Date of release	Version	

KDK College of Engineering, Nagpur

B. Tech.

CE/ ME/ EE/ CSE/ IT/ AI&DS/ ETC Engineering

Semester V	Subject Code: 5BOE03T - E	Name of Subject: Campus Sustainability		
Total Distribution per week				
Total Credit: 3	Lecture (L): 3	Tutorial (T): 0	Practical (P): 0	
Examination Scheme				
Continuous Assessment	Mid Semester Examination	End Semester Examination	Total Marks	Examination Duration:
20 Marks	30 Marks	50 Marks	100 Marks	3 Hrs

Course Objectives	
1	Develop an understanding of the principles and practices of sustainability in the context of educational institutions.
2	Build awareness of ecological, economic, and social sustainability challenges on campuses.
3	Enable students to assess and reduce the environmental footprint of academic activities.
4	Introduce tools and strategies for energy, water, and waste efficiency within campuses.
5	Promote student engagement and leadership in sustainability initiatives.

Course Outcomes	
After completion of syllabus, the student will be able to	
1	Explain the concept of sustainability and its relevance to campus ecosystems.
2	Evaluate current campus practices in energy, water, and waste management.
3	Analyze the application of green infrastructure and sustainable mobility in institutions.
4	Propose practical and technical strategies for improving campus sustainability.
5	Demonstrate environmental responsibility through individual and group actions.

Course Competencies	
1	Understand the concept of sustainability and its application to campus ecosystems.
2	Evaluate and improve energy, water, and waste practices within institutions.
3	Apply green infrastructure strategies and promote sustainable mobility on campuses.

CO_PO Mapping											
Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	3	3	-	2	-	2
CO2	-	-	-	-	-	2	3	-	-	2	2
CO3	-	-	-	2	-	2	2	-	2	2	2
CO4	-	-	-	2	-	2	2	-	2	3	2
CO5	-	-	-	-	-	2	3	3	3	2	-

Course Contents		Mapped with CO
Unit I: Foundations of Sustainability Introduction to sustainability: environmental, economic, social dimensions, The role of academic institutions in promoting sustainability, UN Sustainable Development Goals (SDGs) and Education for Sustainable Development (ESD), Examples of sustainable campuses worldwide	8	CO1
Unit II: Energy Management in Campus Infrastructure Campus energy audits: methods and case studies, Renewable energy integration: solar, wind, biomass, Energy conservation in labs, hostels, and classrooms, Smart grids, sensors, and building automation systems	8	CO2
Unit III: Water Conservation and Solid Waste Management Water audits and sustainable usage, Rainwater harvesting systems and greywater reuse, Solid waste segregation, composting, and recycling models, E-waste handling and hazardous waste precautions	8	CO3
Unit IV: Green Buildings and Sustainable Transportation Concepts of green building: LEED, GRIHA, EDGE certifications, Use of sustainable construction materials, Campus biodiversity and green landscaping Bicycle-friendly campuses, EV charging, carpool systems	8	CO4
Unit V: Community Engagement and Behavior Change Building a green culture through clubs and campaigns, Institutional policies and green charters, Sustainability reporting and auditing tools, Design and presentation of a campus sustainability project	8	CO5

Text book/Reference Books	
1	Geng, Yong, and Brent, Daniel. Sustainable Campus: Theory and Practice. Springer, 2021.
2	Agyeman, Julian et al. Local Environment: The International Journal of Justice and Sustainability (Selected papers)
3	United Nations. UN Sustainable Development Goals Reports – https://sdgs.un.org/
4	National Institute of Urban Affairs. Campus Sustainability Guidelines for Indian Institutions
5	AICTE & TERI Green Campus Manual (India-specific guidelines)

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B. Tech.

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Semester V	Subject Code: 5BOE03T - F	Name of Subject: Indian Stock Market		
Total Distribution per week				
Total Credit: 3	Lecture (L): 3	Tutorial (T): 0	Practical (P): 0	
Examination Scheme				
Continuous Assessment	Mid Semester Examination	End Semester Examination	Total Marks	Examination Duration:
20 Marks	30 Marks	50 Marks	100 Marks	3 Hrs

Course Objectives	
1	Provide an in-depth understanding of the Indian capital and stock market structure.
2	Equip students with knowledge of equity, derivatives, mutual funds, and trading platforms.
3	Build analytical skills through fundamental and technical evaluation of securities.
4	Develop understanding of portfolio construction and investment strategies
5	Familiarize students with the regulatory framework, investor protection, and ethical investing

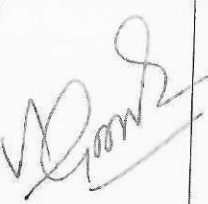
Course Outcomes	
After completion of syllabus, the student will be able to	
1	Explain the structure and functions of Indian stock markets and financial instruments.
2	Demonstrate knowledge of trading mechanisms and regulatory compliance.
3	Apply technical and fundamental analysis to evaluate investment opportunities.
4	Analyze and compare financial products like mutual funds, ETFs, and derivatives
5	Construct and manage a diversified portfolio applying key risk-return concepts.

Course Competencies	
1	Understand the structure and functions of the Indian stock market and its financial instruments.
2	Apply analytical tools and trading knowledge to evaluate investments and build portfolios.
3	Demonstrate understanding of regulatory compliance and ethical investing practices.

CO_PO Mapping											
	Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	2	-	-	2	-	-	-	1	2
CO2	2	1	2	-	-	3	-	-	2	2	3
CO3	1	2	3	-	-	2	-	-	-	3	3
CO4	1	1	2	-	-	2	-	-	-	2	3
CO5	2	1	3	-	-	2	-	-	-	3	3

Course Contents		Mapped with CO
Unit I: Overview of Financial Markets & Stock Exchanges	8	CO1
Introduction to financial markets: Money vs. Capital market, Primary & Secondary markets, Stock exchanges in India: NSE, BSE, MCX, Role of SEBI and regulatory framework, Market participants: FIIs, DIIs, retail, HNIs Demat & Trading accounts, clearing & settlement (T+1 cycle)		
Unit II: Equity Market Instruments & Trading Mechanism	8	CO2
Types of securities: Equity, preference shares, debentures, IPO Process and Book Building, Market indices: Nifty, Sensex (construction & relevance), Order types: market, limit, stop-loss, Trading mechanisms: intraday vs. delivery, Circuit breakers, price bands, margin systems		
Unit III: Technical & Fundamental Analysis	8	CO3
Charts: Line, bar, candlestick, Patterns: head & shoulders, double top/bottom, triangles, Indicators: Moving Average, RSI, MACD, Bollinger Bands Fundamental analysis: P&L statement, Balance Sheet, Cash Flow Key ratios: EPS, P/E, ROE, Debt-equity ratio, DCF Model basics		
Unit IV: Derivatives and Mutual Funds	8	CO4
Introduction to Derivatives: Futures and Options, Hedging, speculation, arbitrage, Option chain, Greeks (basic understanding), Mutual funds: Types, NAV, SIP, SWP, AUM, ETFs and Index Funds, Fund selection and performance metrics		
Unit V: Portfolio Management & Regulatory Environment		
Risk-return analysis and investor profiling, Asset allocation & diversification strategies, Basics of portfolio construction, Regulatory bodies: SEBI, AMFI, NISM, Insider trading, corporate governance, taxation (STCG, LTCG), Investor protection and grievance redressal	8	CO5

Text Books	
1	Indian Financial System" By M. Y. Khan
2	McGraw Hill Education (Covers capital markets, SEBI, trading mechanisms, mutual funds)
Reference Books	
1	"Security Analysis and Portfolio Management" – S. Kevin, PHI Learning
2	"Fundamentals of Financial Markets" – V. A. Avadhani, Himalaya Publishing
3	"Fundamental Analysis for Investors" – Raghunathan V., McGraw Hill
4	NSE Academy Certified Capital Market Professional (E-NCCMP) modules
5	NISM Series: Equity Derivatives & Mutual Funds Distributor Study Material

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KDK College of Engineering, Nagpur

B. Tech.

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Semester V	Subject Code:	Name of Subject:		
	5BOE03T - G	Climate Change		
Total Distribution per week				
Total Credit: 3	Lecture (L): 3	Tutorial (T): 0	Practical (P): 0	
Examination Scheme				
Continuous Assessment	Mid Semester Examination	End Semester Examination	Total Marks	Examination Duration:
20 Marks	30 Marks	50 Marks	100 Marks	3 Hrs

Course Objectives	
1	Understand the scientific principles underlying climate change.
2	Explore the causes and evidence of global warming and climate change.
3	Analyze the impacts of climate change on ecosystems, societies, and economies
4	Examine national and international climate policies, treaties, and frameworks.
5	Identify engineering and technological strategies for climate mitigation and adaptation.

Course Outcomes	
After completion of syllabus, the student will be able to	
1	Explain the basic science of climate systems and greenhouse effect.
2	Interpret evidence and data supporting global climate change.
3	Assess environmental, social, and economic impacts of climate change.
4	Describe national and international responses and frameworks like UNFCCC, Kyoto Protocol, Paris Agreement.
5	Propose technological and policy-based solutions to mitigate and adapt to climate change.

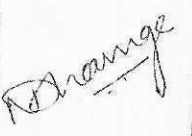
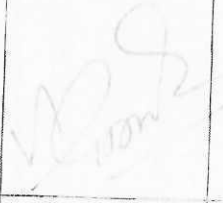
Course Competencies	
1	Inculcate the scientific basis of climate systems and global warming.
2	Analyze climate change impacts and interpret related environmental data.
3	Evaluate global climate policies and propose strategies for mitigation and adaptation.

CO_PO Mapping											
	Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	2	-	-	-	-	-	-	-	-	2
CO2	-	3	-	2	2	-	-	-	-	-	3
CO3	-	2	-	-	3	2	-	-	2	2	-
CO4	-	-	-	-	3	3	-	-	-	2	2
CO5	-	2	3	2	2	3	3	1	1	2	-

Course Contents		Mapped with CO
Unit I: Climate Science Fundamentals	8	CO1
Earth's energy balance and the greenhouse effect, Natural vs anthropogenic causes of climate change, Role of carbon cycle and feedback mechanisms, Climate models and prediction tools		
Unit II: Evidence of Climate Change	8	CO2
Observed temperature and precipitation trends, Melting glaciers, sea-level rise, ocean acidification, IPCC reports and global climate data sources, Regional climate change patterns in India		
Unit III: Impacts of Climate Change	8	CO3
Environmental: biodiversity, forests, oceans, Social: health, migration, and agriculture, Economic: infrastructure, energy, and livelihoods, Case studies: floods, droughts, cyclones		
Unit IV: Climate Change Governance	8	CO4
Global treaties: UNFCCC, Kyoto Protocol, Paris Agreement, National policies: NAPCC, SAPCCs (India's response), Role of international bodies: IPCC, UNEP, COP summits, Climate finance and carbon trading		
Unit V: Mitigation and Adaptation Strategies	8	CO5
Renewable energy technologies and carbon capture, Sustainable urban and industrial design, Disaster-resilient infrastructure, Behavioral and lifestyle changes, Role of engineers in climate innovation		

Text Books	
1	"Climate Change: From Science to Sustainability" by A. Barrie Pittock – Earthscan
2	"Global Warming: Understanding the Forecast" by David Archer – Wiley
3	"Introduction to Climate Change" by D. G. Martin – Oxford University Press

Reference Books	
1	IPCC Sixth Assessment Report (AR6) – https://www.ipcc.ch
2	India's National Action Plan on Climate Change (NAPCC) – https://moef.gov.in
3	"The Climate Solution" by Mridula Ramesh – Hachette India
4	UN SDG Goal 13 Reports – https://sdgs.un.org/goals/goal13

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**Syllabus of 6th Semester B. Tech.
Civil Engineering**

K D K College of Engineering, Nagpur

Proposed Scheme (2026-27)

Bachelor of Technology (Civil Engineering)

Semester: Sixth

Bachelor of Technology (Civil Engineering)															
Semester: Sixth					BoS	Teaching Scheme			Total Credit	Examination Scheme					
Sr. No.	Course Category	Course Code	Name of Course	Theory		Tutorial	Practical	Exam Hrs		CA	MSE	ESE	CA	ESE	Practical
1	PCC-X	6BCV01T	Fluid Mechanics	Civil	2	-	-	2	2	10	15	25	-	-	
2	PCC-X	6BCV01P	Fluid Mechanics Lab	Civil	-	-	2	1	-	-	-	25	-	-	
3	PCC-XI	6BCV02T	Surveying	Civil	2	-	-	2	2	10	15	25	-	25	
4	PCC-XII	6BCV03T	Design of Steel Structures	Civil	2	-	-	2	2	10	15	25	-	-	
5	PCC-XII	6BCV03P	Design of Steel Structures Lab	Civil	-	-	2	1	-	-	-	-	25	-	
6	PEC-II	6BCV04T	Refer PEC Basket	Civil	3	-	-	3	3	30	20	50	-	25	
7	PEC-II	6BCV04P	Refer PEC Basket	Civil	-	-	2	1	-	-	-	-	-	-	
8	PEC-III	6BCV05T	Refer PEC Basket	Civil	2	-	-	2	2	10	15	25	-	25	
9	PEC-IV	6BCV06T	Refer PEC Basket	Civil	2	-	-	2	2	10	15	25	-	-	
10	MDN-I-IV	6BCVMD04T	Refer MDM Basket	Civil	2	-	-	2	2	10	15	25	-	-	
11	VSEC	6BSE04P	Refer VSEC Basket	Civil	-	-	4	2	-	-	-	25	-	-	
				Total	15	0	10	20	15	90	110	200	125	125	
									Total Marks		650				

			June 2026	1.0	Applicable from AY 2026-27 Onwards
Chairman BoS in CE Head	Dean (Academics)	Principal	Date of Release	Version	

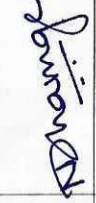
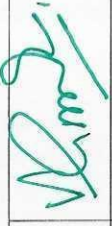
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Dr. N. R. Dhamge
Dean (Academic)
K.D.K. College of Engineering
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K D K College of Engineering, Nagpur
Bachelor of Technology (Civil Engineering)
EXIT SCHEME

After Sixth Semester			BoS	Teaching Scheme			Total Credit	Examination Scheme					
Sr. No.	Course Category	Course Code		Theory	Tutorial	Practical		Exam Hrs	CA	MSE	ESE	CA	ESE
1	Exit Course	CVEXT01P	Civil	-	-	2	1	-	-	-	-	50	50
2	Exit Course	CVEXT02P	Civil	-	-	2	1	-	-	-	-	25	25
3	Exit Course	CVEXT03P	Civil	-	-	12	6	-	-	-	-	-	100
						16	8	0	0	0	0	75	175
							Total Marks						250

 Chairman BoS in CE Head	 Dean (Academics) Dr. N. R. Dhangar	 Principal	June 2026	1.0	Applicable from AY 2026-27 Onwards
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Department of Civil Engineering
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K D K College of Engineering, Nagpur
Faculty of Science & Technology
Department of Civil Engineering
For Students Migrating from RTMNU Affiliated Scheme to Autonomous Scheme
ABSORPTION SCHEME

SEMESTER – V

RTMNU Affiliated Scheme		Autonomous Scheme	
Code No.	Name of Subject	Code No.	Name of Subject
BTCVE501T	Hydraulic Engineering	-----	-----
BTCVE501P	Hydraulic Engineering (Practical)	-----	-----
BTCVE502T	Reinforced Cement Concrete Design	5BCV01T	Design of RCC Structures
BTCVE502P	Reinforced Cement Concrete Design (Practical)	5BCV01P	Design of RCC Structures Lab
BTCVE503T	Civil Engineering Materials, Testing & Evaluation	-----	-----
BTCVE503P	Civil Engineering Materials, Testing & Evaluation (Practical)	-----	-----
BTCVE504T	Professional Practice, Law, & Ethics	-----	-----
BTCVE505T	Elective - I	5BCV05T	Refer PEC Basket
BTCVE506T	Elective - II	6BCV04T	Refer PEC Basket
BTCVE507P	Industrial Training & Professional Skill Training	-----	-----
BTCVE508AU	Organizational Behavior	5BOE03T	Refer Open Elective Basket
		5BCVMD03T	Refer MDM – II Basket
		5BCV04T	Hydrology
		5BOE03T	Refer OE-III Basket

SEMESTER – VI

RTMNU Affiliated Scheme		Autonomous Scheme	
Code No.	Name of Subject	Code No.	Name of Subject
BTCVE601T	Estimating & Costing	-----	-----
BTCVE601P	Estimating & Costing (Practical)	-----	-----
BTCVE602T	Construction Engineering & Management	5BOE03T	Refer Open Elective-III Basket
BTCVE603T	Water Resource Engineering	-----	-----
BTCVE604T	Elective - III	6BCV05T	Refer PEC-III Basket
BTCVE605T	Open Elective - I	-----	-----
BTCVE606P	Computer Aided Civil Engineering Drawing (Practical)	-----	-----
		6BSE04P	Refer VSEC-IV Basket
		6BCV03T	Design of Steel Structures
		6BCV03P	Design of Steel Structures Lab
		6BCV06T	Refer PEC-IV Basket

NOTES

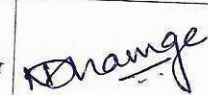
- Students migrating from RTMNU affiliated scheme to the Autonomous scheme shall be absorbed semester-wise as per the above equivalence scheme.
- Wherever a subject of RTMNU scheme is offered in a higher semester in the Autonomous Scheme, the student shall be treated as having completed equivalent for that subject.

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3. To compensate the credit deficiency arising due to curriculum restructuring, the student shall complete the additional technical/elective subjects prescribed by the Autonomous Institute.
4. Laboratory/practical subjects shall be treated equivalent along with corresponding theory subjects wherever applicable.
5. The final absorption shall be subject to approval of the Academic Council/Board of Studies of the Autonomous Institute.
6. Any discrepancy not covered in this scheme shall be resolved by the authorized committee of the Autonomous Institute.

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K D K College of Engineering, Nagpur
(An Autonomous Institute affiliated to RTM Nagpur University)
Department of Civil Engineering
Syllabus for B. Tech. Programme in Civil Engineering
(Scheme: 2026-27)
SIXTH SEMESTER

Semester: VI	Subject Code 6BCV01T	Name of Subject Fluid Mechanics		
Total Hours Distribution per week				
Total Credit: 02	Lecture (L): 02 Hours		Tutorial (T):	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
15 Marks	10 Marks	25 Marks	50 Marks	2.0 Hours

Course Objectives: The course enables teacher to

1. Explain the fundamental properties of fluids and principles of pressure measurement.
2. Apply principles of fluid flow to analyze flow through pipes and evaluate head losses.
3. Analyze uniform flow characteristics in open channels using hydraulic equations.
4. Evaluate non-uniform flow behaviour in open channels including GVF and hydraulic jump.

Course Outcomes:

1. Describe and apply fluid properties and pressure measurement techniques to solve engineering problems.
2. Analyze pipe flow systems and compute frictional losses using standard equations.
3. Determine and analyze uniform flow parameters in open channels using Chezy's and Manning's equations.
4. Evaluate and interpret non-uniform flow phenomena such as hydraulic jump and flow profiles.

Course Competencies:

1. Demonstrate understanding of fluid properties and pressure measurement in practical applications.
2. Analyze and design pipe flow systems considering energy losses and network behaviour.
3. Solve and evaluate open channel flow problems for efficient hydraulic design.
4. Assess and predict flow behaviour in non-uniform conditions for hydraulic structures.

CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	-	1	-	-	1	-	-	-	-	2	-
CO2	3	3	2	2	1	-	2	-	-	-	1	3	1
CO3	3	3	2	3	1	-	3	-	-	-	1	3	1
CO4	3	3	2	3	1	1	2	-	-	-	1	3	2

K D K College of Engineering, Nagpur
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Syllabus for B. Tech. Programme in Civil Engineering
(Scheme: 2026-27)
SIXTH SEMESTER

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
1	Fluid Properties Basic Properties, viscosity and its Significance, Surface Tension, Capillarity, Compressibility, Vapour pressure Pressure and its measurement Pressure at a point and its representation, atmospheric and gauge pressure, Pressure measurement by manometer Flow measuring Devices Notches and weirs, orifice and its types, hydraulic coefficients, venturimeter	7	CO1
2	Flow through Pipes Hydraulically smooth and rough pipes: Frictional resistance to flow of fluid in smooth and rough pipes; Darcy-Weisbach & Hazen-William's equation for frictional head loss; Pipes in series and parallel; Branched pipes; Hardy-Cross methods of pipe networks	7	CO2
3	Uniform Flow Through Open Channels General: Types of channels and their geometrical properties; Types of flow in open channel. Uniform Flow: Chezy's and Manning's equations; Hydraulically most efficient rectangular, triangular and trapezoidal sections; Computations of normal depth of flow, conveyance of channel, section factor for uniform flow, normal slope and normal discharge. Critical Flow: Specific energy and its diagram; alternate depths; Computations of critical depth, section factor for critical flow, critical slope; normal, critical slope.	8	CO3
4	Non-Uniform Flow through Open Channel Gradually Varied Flow: Dynamic equation for GVF; Classification and characteristics of surface profiles; direct Step method of computing profile length. Rapidly Varied Flow: Definition of hydraulic jump; Equation of hydraulic jump in horizontal, rectangular channel; Length & height of jump; Energy loss in jump classifications of jump	8	CO4

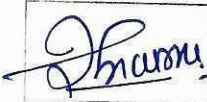
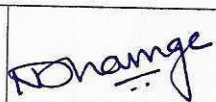
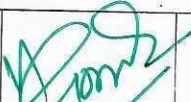
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SIXTH SEMESTER

Text/Reference Books:

SN	Title of Book	Publisher	Edition & Year
1	Hydraulics, Fluid Mechanics and Fluid Machines	Dhanpat Rai Publishing Co. New Delhi	9 th (2011)
2	Fluid Mechanics and Hydraulic Machines	Laxmi Publications (P) Ltd., New Delhi	9 th (2005)
3	Hydraulics, Fluid Mechanics and Hydraulic Machines	Standard Book House, Delhi	21 st (2017)
4	Hydraulics Engineering	AG Publishing House	1 st (2024)
5	Fluid Mechanics and Hydraulic Machines	S Chand & Company (P) Ltd., New Delhi	6 th (2015)

Online Resources:

SN	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Introduction to Fluid Mechanics	NPTEL	https://nptel.ac.in/courses/112105269
2	Hydraulic Engineering	NPTEL	https://nptel.ac.in/courses/105105203
3	Advanced Hydraulics	NPTEL	https://nptel.ac.in/courses/105107059

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SIXTH SEMESTER

Semester VI	Subject Code 6BCV01P	Name of Subject Fluid Mechanics Lab	
Total Hours Distribution per week			
Total Credit: 01	Practical (P): 02 Hours		
Examination Scheme			
Internal Examination	End Sem. Examination	Total Marks	Examination Duration:
25 Marks	25 Marks	50 Marks	

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

COs	Course Outcome
CO1	Apply principles of fluid mechanics to measure and calculate discharge using flow measuring devices such as rectangular notch, triangular notch, and orifice meter.
CO2	Analyze fluid flow behavior by verifying Bernoulli's theorem, computing friction losses in pipes, and examining hydraulic jump characteristics.
CO3	Evaluate the performance characteristics of hydraulic machines such as Pelton wheel turbine, centrifugal pump, and reciprocating pump under varying operating conditions.

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Perform and compute discharge using flow measuring devices.
2	Examine and evaluate fluid flow behavior and losses in pipe and open channel systems.
3	Perform and evaluate experiments to analyze performance characteristics of hydraulic machines under varying conditions.

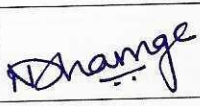
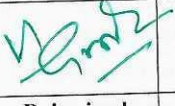
CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	—	3	2	—	—	—	1	1	—	2	2
CO2	3	3	—	3	2	—	—	—	1	1	—	2	2
CO3	3	3	—	3	2	—	—	—	1	2	—	2	2

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SIXTH SEMESTER

Syllabus (Practical): Any 8 experiments to perform

SN	List of Practical	CO Mapping
1	To determine the coefficient of discharge of Rectangular Notch	CO1
2	To determine the coefficient of discharge of Triangular Notch	CO1
3	To determine the coefficient of discharge of Orifice meter	CO1
4	Determination of Darcy – Weisbach friction factor for given pipes	CO2
5	To verify Bernoulli's theorem	CO2
6	Study of hydraulic jump in an open channel	CO2
7	Study and performance of Pelton Wheel turbine.	CO3
8	Study and performance of Centrifugal pump.	CO3
9	Study and performance of Reciprocating pump.	CO3
10	Analysis of a Water Distribution network by Hardy cross method	CO4
11	Determination of coefficient of impact of jet	CO4
12	Determination of Chezy's and Manning's constant for open channel.	CO4

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Syllabus for B. Tech. Programme in Civil Engineering
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SIXTH SEMESTER

Semester VI	Subject Code 6BCV02T	Name of Subject Surveying		
Total Hours Distribution per week				
Total Credit: 02	Lecture (L): 02 Hours		Tutorial (T):	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
15 Marks	10 Marks	25 Marks	50 Marks	2.0 Hours

Course Objectives: The course enables teacher to:

1. Develop understanding of fundamental surveying principles, measurement theory, errors, accuracy, precision, and geoinformatics concepts.
2. Train students in linear, angular, and elevation measurements using conventional and electronic surveying methods.
3. Enable students to perform levelling, contouring, and terrain representation for engineering applications.
4. Develop competency in traversing, triangulation, trilateration, and Total Station-based surveying for modern infrastructure projects.

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

COs	Course Outcome
CO1	Explain surveying principles, geoinformatics concepts, measurement errors, accuracy, precision, and instrument adjustments.
CO2	Apply linear, angular, and elevation measurement techniques using conventional and electronic surveying instruments.
CO3	Analyze levelling data and develop contour maps for terrain representation and engineering planning.
CO4	Perform traverse computations and utilize Total Station technology for coordinate determination and engineering surveys.

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Interpret surveying concepts, measurement principles, and error analysis.
2	Conduct engineering measurements using appropriate surveying instruments and methods.
3	Generate and analyze terrain information through levelling and contouring techniques.
4	Apply modern surveying technologies for positioning, mapping, and infrastructure development

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Syllabus for B. Tech. Programme in Civil Engineering
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SIXTH SEMESTER

CO-PO Articulating Matrix:

CO-PO Articulating Matrix:													
COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	–	–	1	–	–	–	–	–	1	2	2
CO2	3	3	2	2	2	–	–	–	–	–	–	3	2
CO3	2	3	2	3	2	2	–	–	–	–	–	3	2
CO4	2	3	3	2	3	–	–	–	–	–	2	3	3

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
1	Introduction: Geoinformatics- definition, disciplines covered, importance. Field Surveying- definition & objectives; classification of surveys; principles of surveying Errors in measurements- sources, types of errors and their treatment. Random error distribution, accuracy, precision and uncertainty. Surveying instruments- temporary and permanent adjustment concept, principle of reversal.	6	CO1
2	Linear & Angular Measurements: Prismatic compass, Bearings, local attraction and correction to bearings, calculation of included angles from bearing. Optical methods- tacheometers, sub tense bar; Electronic methods- EDMs. Measurement Of Elevations: Methods of height determination; Spirit leveling- different types of levels and staves; booking and reduction of data, classification and permissible closing error; profile leveling and cross sectioning; curvature & refraction and collimation errors; reciprocal leveling. Contours- characteristics, uses	8	CO2
3	Levelling and Contouring Terminologies: Level surfaces, level line, Horizontal and vertical surfaces, Datum, Benchmarks- GTS, Permanent, Arbitrary and Temporary, Reduced Level, Line of collimation, Back sight, Fore sight, intermediate sight, Change point, Height of instruments. Reduced level by Plane of collimation method and Rise/ Fall Method. Simple, Differential, Fly, Profile and Reciprocal Levelling Contour, contour interval, horizontal equivalent. Contour maps: Characteristics and uses of Contour maps Methods of Locating Contour: Direct and Indirect	8	CO3
4	Traversing, Triangulation and Trilateration: Purpose and classification of each; Compass and theodolite traverses- balancing of traverses, computation of coordinates, omitted measurements. Triangulation- network, strength of figures. Total Station: Introduction, component parts with their functions, and Applications of Total Station, Temporary adjustments, sources of errors in Total Station, Measurements of Horizontal angles, vertical angles, distances and coordinates using Total Station.	8	CO4

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SIXTH SEMESTER

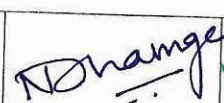
Suggested Activities for Continuous Assessment: (Any Two)

1. Infrastructure survey Planning Case study
2. Traverse computation and adjustment assignment
3. Contour Interpretation and Terrain Analysis Activity

Learning Resources:

Text/Reference Books:

SN	Title of Book	Publisher	Edition & Year
1	Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II,	Lakshmi Publications Pvt Ltd, New Delhi,	Sixteenth Edition, 2016.
2	T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2,	Pune Vidyarthi Griha Prakashan, Pune,	2008.
3	Surveying, Vol I and II,	S. K. Duggal	Second Edition, 2012.
4	K. R. Arora, Surveying Vol I & II,	Standard Book House,	Twelfth Edition 2013.

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 Syllabus for B. Tech. Programme in Civil Engineering
 (Scheme: 2026-27)
SIXTH SEMESTER

Semester VI	Subject Code 6BCV03T	Name of Subject Design of Steel Structures		
Total Hours Distribution per week				
Total Credit: 02	Lecture (L): 2 Hours		Tutorial (T):	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
15 Marks	10 Marks	25 Marks	50 Marks	2.0 Hours

Course Objectives: This course will enable teacher to:

1. Introduce the properties of structural steel, rolled steel sections, plastic analysis concepts, and limit state design philosophy as per IS 800:2007 for the design of bolted and welded connections.
2. Familiarize the design of axially loaded tension and compression members of trusses considering yielding, rupture, block shear, buckling, and connection requirements as per Codal provisions.
3. Impart knowledge for the analysis and design of steel beams subjected to bending, shear, deflection, buckling, and stability requirements using elastic and plastic behavior concepts.
4. Enable students to design built-up compression members using lacing and batten systems ensuring economy, structural stability, and compliance with IS 800:2007.

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

COs	Course Outcome
CO1	Explain the properties of structural steel, rolled sections, and apply limit state design philosophy as per IS 800:2007 to design bolted and welded connections
CO2	Design axially loaded tension and compression members of trusses considering yielding, rupture, block shear, buckling, and connection requirements as per Codal provisions.
CO3	Analyze and design steel beams subjected to bending considering elastic and plastic behavior, shear, deflection, buckling, and stability requirements
CO4	Design built-up compression members using lacing and batten systems ensuring economy, stability, and compliance with IS 800:2007.

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Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Demonstrate understanding of structural steel properties and sections, and design safe bolted and welded connections using limit state design as per IS 800:2007.
2	Apply Codal provisions to design axially loaded steel tension and compression members by evaluating possible failure modes and selecting suitable connections.
3	Evaluate and design steel beams subjected to bending by considering strength, stability, and deflection requirements
4	Develop economical solutions for built-up compression members using lacing and batten systems in compliance with IS 800:2007.

CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	2	1	2	2	3	1	–	–	3	3	3
CO2	3	2	2	1	2	2	3	1	–	–	3	3	3
CO3	3	2	2	1	2	2	3	1	–	–	3	3	3
CO4	3	2	2	1	2	2	3	1	–	–	3	3	3

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
1	Introduction Steel as a structural material and its properties, various rolled sections, Concept of Limit state design philosophy, Introduction to IS 800:2007 and steel table. Design of connections: Types of joints and fasteners: Lap joint, Butt Joint with single and double cover plate, packing plate. Efficiency of joint. Types of Bolts, Ordinary and HSFG bolts, shearing, bearing and ultimate tensile strength of bolts, prying force, Strength reduction factors, Bolt strength. Types of welds, size and effective throat, fillet and butt weld, intermittent weld, weld strength.	8	CO1
2	Design of Axially Loaded Members (Truss members) Tension members: Yield and rupture strength of plate, chain and staggered arrangement of fasteners, Block shear failure, shear lag effect in angles. Lug angle (Bolted connection) Compression Members: Behaviour of slender compression member, local and overall buckling, section classification, effect of initial out-of straightness,	8	CO2

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	eccentricity and residual stresses, Elastic stability of columns, IS provisions. Design of struts. (Bolted connection)		
3	Design of Members subjected to Bending: Simple Beam: Elastic and plastic behaviour, flexural strength, Low and high shear cases, deflection, web buckling and web crippling effect. Laterally supported and unsupported beams. Design of rolled section. Design of Built-up Beams.	7	CO3
4	Design of compression Members: Design of Built-up Column, economical section, Single and double lacing, battened columns.	7	CO4

Suggested Activities for Continuous Assessment:

1. Analyze the beams using software for different loadings
2. Design of tension members, compression members using software

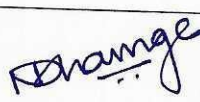
Learning Resources:

Text/Reference Books:

SN	Title of Book	Publisher	Name of author
1	Design of Steel Structures	Tata McGraw Hill	S.K. Duggal
2	Limit State Design of Steel Structures as per IS:800/2007	TechSar / IK Publishing	S. Kanthimathinathan
3	Design of Steel Structures: Limit State Method	I.K. International / Wiley India	S. S. Bhavikatti
4	Design of Steel Structures (Limit State Method)	Oxford University Press	N. Subramanian

Online Resources:

SN	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Design of Steel Structures by Prof. Damodar Maity	NPTEL	https://nptel.ac.in/courses/105105162

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SIXTH SEMESTER

Semester V	Subject Code 6BCV03P	Name of Subject Design of Steel Structures Lab	
Total Hours Distribution per week			
Total Credit: 01	Practical (P): 02 Hours		
Examination Scheme			
Internal Examination	End Sem. Examination	Total Marks	Examination Duration:
25 Marks	25 Marks	50 Marks	

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

COs	Course Outcome
CO1	Design safe and efficient bolted and welded connections and tension members of steel trusses in accordance with IS 800:2007 considering different modes of failure.
CO2	Analyze and design compression members, simple beams, built-up beams, and plate girders by considering strength, stability, buckling, and serviceability requirements as per Codal provisions
CO3	Design simple columns, built-up columns, and column bases to ensure adequate load transfer, stability, and structural safety of steel structures.

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Apply Codal design principles to develop safe and economical bolted and welded connections and tension members of steel trusses by assessing possible failure modes as per IS 800:2007
2	Evaluate structural performance to design compression members, beams, and plate girders by considering strength, stability, buckling, and serviceability requirements in accordance with standard codes
3	Formulate reliable designs for columns and column bases to ensure proper load transfer, structural stability, and overall safety of steel structures.

CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	2	1	2	2	3	1	3	—	3	3	3
CO2	3	2	2	1	2	2	3	1	3	—	3	3	3
CO3	3	2	2	1	2	2	3	1	3	—	3	3	3

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Syllabus (Practical): Any 08 experiments to perform

SN	List of Practical	CO Mapping
1	Design of bolted connections	CO1
2	Design of welded connections	CO1
3	Design of tension member (Truss member)	CO1
4	Design of compression member (Truss member)	CO1
5	Design of simple beams	CO2
6	Design of built-up beams	CO2
7	Design of plate girder	CO2
8	Design of simple column	CO3
9	Design of Built-up column	CO3
10	Design of column base	CO3

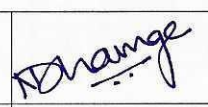
Learning Resources:

Text/Reference Books:

SN	Title of Book	Publisher	Name of author
1	Design of Steel Structures	Tata McGraw Hill	S.K. Duggal
2	Limit State Design of Steel Structures as per IS:800/2007	TechSar / IK Publishing	S. Kanthimathinathan
3	Design of Steel Structures: Limit State Method	I.K. International / Wiley India	S. S. Bhavikatti
4	Design of Steel Structures (Limit State Method)	Oxford University Press	N. Subramanian

Online Resources:

SN	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Design of Steel Structures by Prof. Damodar Maity	NPTEL	https://nptel.ac.in/courses/105105162

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Semester VI	Subject Code 6BCV04T	Name of Subject Advanced RCC Design		
Total Hours Distribution per week				
Total Credit: 03	Lecture (L): 03 Hours		Tutorial (T):	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3.0 Hours

Course Objectives: This course will make teacher to:

- Familiarize the analysis and design of circular and rectangular reinforced concrete water tanks using Working Stress Method and relevant IS code provisions.
- Impart knowledge of the design principles of reinforced concrete columns subjected to biaxial bending and the design of isolated footings for various loading conditions.
- Enable students to analyze and design RCC retaining structures, including cantilever and counterfort retaining walls, using Limit State Method.
- Familiarize the analysis and design of single-bay single-storey portal frames with hinged and fixed base conditions.
- To provide knowledge and skills for the design of combined foundations, including rectangular, strap beam, trapezoidal, and raft footings.

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

COs	Course Outcome
CO1	Design circular and rectangular RCC water tanks resting on ground using Working Stress Method and applicable IS code provisions.
CO2	Analyze and design RC columns subjected to biaxial moments, long columns, and isolated footings of different shapes as per IS code requirements.
CO3	Design RCC cantilever and counterfort retaining walls considering earth pressure, stability, and structural safety requirements.
CO4	Analyze and design single-bay single-storey RCC portal frames with hinged and fixed base supports under various loading conditions...
CO5	Design rectangular, strap beam, trapezoidal, and raft footings based on soil conditions, load transfer mechanisms, and code requirements.

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Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Design and detail circular and rectangular RCC water tanks resting on ground using Working Stress Method and relevant IS code provisions.
2	Analyze and design RCC columns subjected to biaxial bending and design isolated footings of various shapes for safe load transfer to the soil.
3	Design RCC cantilever and counterfort retaining walls considering earth pressure, stability requirements, and structural safety.
4	Analyze and design single-storey RCC portal frames with hinged or fixed support under different loading conditions.
5	Design combined footing systems including rectangular, strap beam, trapezoidal, and raft footings based on structural and geotechnical requirements.

CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	2	2	2	3	1	1	1	1	1	2	1
CO2	3	3	2	2	2	3	1	1	1	1	1	2	1
CO3	3	3	3	2	2	3	2	2	1	1	1	2	1
CO4	3	3	2	2	2	3	1	1	1	1	1	2	1
CO5	3	3	2	2	2	3	1	1	1	1	1	2	1

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
1	Design of circular water tank with roof slab/dome resting on ground by approximate methods/IS code method (by Working Stress Method). Design of rectangular water tank with one-way roof slab resting on ground by approximate methods/IS code method (by Working Stress Method).	10	CO1
2	Analysis and design of columns subjected to biaxial moments. Design of long columns. Design of isolated footing for uniaxial moment, for square, rectangular & circular footings.	10	CO2
3	Design of RCC cantilever and counterfort retaining wall.	7	CO3
4	Analysis and design of portal frames (single bay single storey) hinged or fixed at base.	8	CO4

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5	Design of combined footing: 1. Rectangular footing 2. Strap beam footing 3. Trapezoidal footing 4. Raft footing	10	CO5
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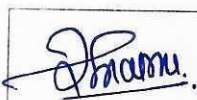
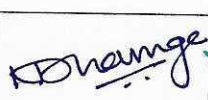
Suggested Activities for Continuous Assessment: (Any Three)

- Design Assignments – Beams, slabs, bridges, water tanks, footings
- Numerical Problem Solving / Tutorials – Bending, shear, torsion, punching shear, load calculations
- Reinforcement Detailing Exercises – Drawing sheets or CAD software
- Mini Projects – Small bridge or tank design with reinforcement layout

Learning Resources:

Text/Reference Books:

SN	Title of Book	Publisher	Edition & Year
1	Reinforced Concrete Design by S. Unnikrishna Pillai and Devdas Menon	McGraw Hill Education (India) Private Limited	3rd Edition, 2017
2	Limit State Design of Reinforced Concrete by P.C. Varghese	PHI Learning Pvt. Ltd., New Delhi	2nd Edition, 2015
3	Comprehensive RCC Designs by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain	Laxmi Publication (P)	11th Edition, 2022
4	Advanced Reinforced Concrete Design (Vol.-II) by S.S. Bhavikatti	New age international publisher, New Delhi	1st edition
5	Advanced R. C. C. Design by Krishna Raju N	CSB Publisher and Distributor, New Delhi	3rd edition

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SIXTH SEMESTER

Semester VI	Subject Code 6BCV04P	Name of Subject Advanced RCC Design Lab	
Total Hours Distribution per week			
Total Credit: 01	Practical (P): 02 Hours		
Examination Scheme			
Internal Examination	End Sem. Examination	Total Marks	Examination Duration:
25 Marks	25 Marks	50 Marks	

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

COs	Course Outcome
CO1	Design, model, and analyze RCC water tanks using Working Stress Method, IS code provisions, and structural analysis software.
CO2	Analyze and design RCC columns and foundation systems including isolated footings subjected to various loading conditions using manual methods and software tools..
CO3	Design and analyze RCC retaining walls, portal frames, and combined foundation systems using codal provisions and structural design software.

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Apply principles of liquid-retaining structure design to safely design and analyze circular and rectangular RCC water tanks using manual calculations and software tools.
2	Apply reinforced concrete design principles to analyze and design columns and foundation elements ensuring structural safety, stability, and serviceability.
3	Design and evaluate advanced RCC structural systems including retaining walls, portal frames, and combined footings using engineering judgment, codal provisions, and software-based analysis.

CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	3	2	2	1	1	1	2	1	3	2	1
CO2	3	3	3	2	2	1	1	1	2	1	3	2	1
CO3	3	3	3	2	2	1	1	1	2	1	3	2	1

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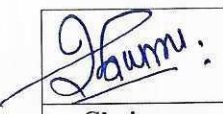
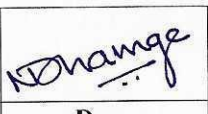
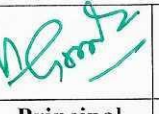
Syllabus (Practical): Any 8 experiments to perform

SN	List of Practical	CO Mapping
1	Design of circular RCC water tank with dome roof resting on ground by Working Stress Method – Manual	CO1
2	Design of rectangular RCC water tank with one-way roof slab resting on ground by Working Stress Method – Manual	CO1
3	Modeling and analysis of circular RCC water tank using STAAD Pro / ETABS	CO1
4	Design of biaxially loaded RCC column using IS code charts and interaction diagrams – Manual	CO1
5	Design of long RCC column considering slenderness effects – Manual	CO1
6	Design of square isolated footing subjected to axial load and uniaxial moment – Manual	CO1
7	Design of rectangular and circular isolated footing – Manual	CO2
8	Analysis and design of isolated footing using SAFE / STAAD Foundation	CO2
9	Design of RCC cantilever retaining wall considering earth pressure and stability checks – Manual	CO2
10	Design of RCC counterfort retaining wall – Manual	CO2
11	Modeling and analysis of retaining walls using STAAD Pro / ETABS	CO1
12	Analysis and design of single-bay single-storey portal frame with hinged base – Manual	CO2
13	Analysis and design of single-bay single-storey portal frame with fixed base using STAAD Pro / ETABS	CO3
14	Design of rectangular, strap beam and trapezoidal combined footing – Manual	CO3
15	Analysis and design of raft footing under multiple column loads using SAFE / STAAD Foundation	CO3

Learning Resources:

Text/Reference Books:

SN	Title of Book	Publisher	Edition & Year
1	Design of Concrete Structures by Arthur H. Nilson, David Darwin & Charles W. Dolan	McGraw-Hill Education	15th Edition

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SIXTH SEMESTER

Semester VI	Subject Code 6BCV05T	Name of Subject Advanced Geotechnical Engineering		
Total Hours Distribution per week				
Total Credit: 02	Lecture (L): 02 Hours		Tutorial (T):	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
15 Marks	10 Marks	25 Marks	50 Marks	2.0 Hours

Course Objectives: This will enable teacher to

1. Provide knowledge of various methods of subsurface investigation and their suitability and preparation of reports.
2. Impart the students the knowledge of shear strength of soil and its determination for varied applications in Civil engineering.
3. Impart the students the knowledge of slope stability analysis by various methods
4. Impart the students the knowledge earth pressure analysis by various methods and determine stability of retaining structures

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

COs	Course Outcome
CO1	Explain various objectives, and methods of soil exploration and their suitability for engineering projects.
CO2	Select suitable test and determine shear strength parameters of different types of soils for various geotechnical analyses
CO3	Determine the stability of given slope by various methods
CO4	Determine the earth pressures and retaining structures for various fields situations and determine the stability of such structures

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Evaluate subsurface soil conditions and apply the principles of soil mechanics
2	Determine soil shear parameters using laboratory and field tests to predict soil behaviour under load
3	Execute stability analysis for various slope types using methods.
4	Calculate lateral earth pressures to evaluate the factor of safety for retaining walls.

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CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	xz	PO 11	PSO1	PSO2
CO1	3	2	1	3	3	2	—	—	2	2	1	1	1
CO2	3	3	3	2	2	2	1	—	—	—	1	1	1
CO3	3	2	2	1	2	1	2	—	—	—	1	1	1
CO4	3	2	2	1	1	-	—	—	—	—	1	1	1

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
1	Soil Exploration: Objectives and methods of exploration, soil boring, boring log, hand augers, wash boring, percussion drilling, rotary drilling, Type of samples and samplers, area ratio, inside and outside clearance, Field Tests and geophysical methods, Soil investigation report, Planning of subsurface programs, Stages in subsurface exploration, Reconnaissance, Lateral extent and depth of exploration	6	CO1
2	Shear Strength of Soil: Mohr circle of stress and its characteristics, principal planes, relation between major and minor principal stresses, sources of shear strength, Concept of failure, Mohr-Coulomb theory of failure, Determination of shear strength parameters by lab tests, types of shear tests: unconfined compression test, vane shear test, direct shear test, triaxial compression tests, UU, CU and CD tests, pore-pressure measurement, computation of effective shear strength Parameters.	8	CO2
3	Stability of Slopes: Stability analysis of infinite and finite slope of soil; Taylor's stability number, Friction circle method, Swedish circle method	8	CO3
4	Earth Pressure: Earth Pressure, Active, passive and earth pressure at rest, Rankin's and Coulombs theory of earth pressure, influence of surcharge, water table, wall friction, Graphical methods - Rebhann's and Culmann's method, Different types of retaining structures	8	CO4

Suggested Activities for Continuous Assessment: (Any Three)

1. Field Visit / Virtual Site Study & Report on soil investigation methods observed at a construction site.
2. Demonstrate slope stability using software MIDAS GTS-NX/ GEO5 / PLAXIS / SLOPE-W (if available).
3. Case Study - Analysis of failure/success of retaining structures

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Learning Resources:

Text/Reference Books:

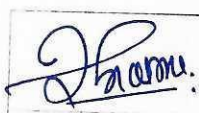
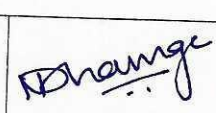
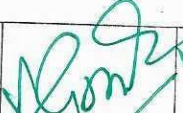
SN	Title of Book	Publisher	Edition & Year
1	Soil Mechanics and Foundation Engineering, K. R. Arora,	Standard Publishers and Distributors, New Delhi	7 th (2019)
2	Basic and Applied Soil Mechanics, Gopal Ranjan and A. V. S. Rao	New Age International Publishers	5 th (2024)
3	Geotechnical Engineering, S K Gulhati & M Datta, Tat McGraw Hill Publishing Company Ltd.	Tata McGraw-Hill Publishing Co. Ltd.	3 rd (2017)
4	Geotechnical Engineering, Venkatramaiah C.	New Age International (P) Ltd., Publishers, New Delhi	6 th (2018)
5	Textbook of Soil Mechanics and Foundation Engineering, Murthy V. N. S	CBS Publishers & Distributors Pvt. Ltd, India	1 st (2009)

Online Resources:

SN	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Soil Exploration	NPTEL	https://nptel.ac.in/courses/105101083
2	Slope Stability	NPTEL	https://media.dev.nptel.ac.in/content/mp4/105/101/105101001/MP4/mod05lec40.mp4

Teacher's Resource:

SN	Particulars	Link
1	YouTube Videos/PPT/Notes/Lab Manual/Question Banks, etc.	https://www.youtube.com/watch?v=UPMdj-zwte8

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SIXTH SEMESTER

Semester: VI	Subject Code: 6BCV06T	Name of Subject Quality and Safety in Civil Engineering		
Total Hours Distribution per week				
Total Credit: 2	Lecture (L): 2 Hours		Tutorial (T):	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
15 Marks	10 Marks	25 Marks	50 Marks	2 Hours

Course Objectives

After studying this course, the students will be able to:

1. Develop an understanding of quality management principles, quality assurance, and quality control practices in construction projects.
2. Familiarize students with quality management systems, standards, inspection procedures, and methods for achieving construction quality.
3. Enable the students to identify, analyze, and understand construction hazards, accidents, and safety risks using systematic assessment techniques.
4. Understanding the planning, implementing, and evaluating safety and quality programs in construction organizations.

Course Outcomes:

After successful completion of the course, the student will be able to:

COs	Course Outcome
CO1	Explain the principles of construction organization, quality management systems, and the roles of various stakeholders in Quality Assurance (QA) and Quality Control (QC).
CO2	Apply quality management tools, standards, inspection procedures, and QA/QC techniques to achieve quality objectives in construction projects.
CO3	Analyze factors affecting construction quality, failure modes, and the influence of materials, specifications, and codal provisions on project performance.
CO4	Evaluate construction hazards and safety risks and develop appropriate safety management and accident prevention measures in compliance with industrial safety regulations.

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Course Competencies:

On completion of the course, students will develop the following competencies:

1. Apply quality management systems, standards, and inspection methods to ensure compliance with construction quality requirements.
2. Analyze and evaluate construction processes, materials, drawings, and specifications to identify and control quality-related issues.
3. Assess construction hazards and risks using systematic hazard identification and analysis techniques such as HAZOP, FMEA, and FMECA.
4. Plan, implement, and monitor safety programs, safety audits, and accident prevention strategies to improve workplace safety and regulatory compliance.

CO-PO Articulating Matrix:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	2	1	1	-	-	-	2	1	-	-	1	-	-
CO2	2	1	1	-	-	-	2	1	-	-	1	-	-
CO3	3	1	1	-	-	-	2	1	-	-	1	-	-
CO4	2	1	1	-	-	-	2	1	-	-	1	-	-

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
1	Construction Organization Types of Organization-Inspection, Control and enforcement-Quality Management Systems and Method- Responsibilities and authorities in Quality assurance and Quality control of Architects, Engineers, Contractors, and Consultants	6	CO1
2	Quality Management Quality policy, Objectives and methods in construction industry. Consumer satisfaction-Ergonomics-Time of Completion-Statistical Tolerance-Taguchi's concept of quality-Codes and standards Documents-Contract and construction programming- Inspection procedures-Processes and products-Total QA / QC Programme and cost implication	8	CO2
3	Quality Assurance and Control Objectives-Regularity agent-Owner, Design, Contract and Construction Oriented Objectives, Methods-Techniques and Needs Of QA/QC-Different Aspects of Quality-Appraisals, Factors Influencing Construction Quality-Critical, Major Failure Aspects and Failure Mode Analysis.	8	CO3

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	Standardization - Selection of New Materials-Influence of Drawings, Detailing and Specification Based on Codal Provisions		
4	Construction Accidents Injury and Accidents-Definitions-Unsafe Act -Unsafe Condition Causes, Investigations and Prevention of Accidents, Hazards, Type of Industrial Hazards-Nature, Causes and Control Measures, Hazard Identifications and Control Techniques -HAZOP, FMEA, FMECA. - Cost of Construction Injuries-Legal Implications Safety Programmes - Introduction to the Concept of Safety-Need- Safety Provisions in the Factory Act-Laws related to the Industrial Safety-Measurement of Safety Performance, Safety Audit, Problem Areas in Construction 10 25 Safety-Elements of an Effective and Safety Programme-Job site Safety assessment- Safety Meetings-Safety Incentives	8	CO4

Suggested Activities for Continuous Assessment:

1. Conducting Field Visit for Quality Control and Assurance in collaboration with BIS.
2. Conduction of Drill activity in collaboration with Fire Engineering services/NMC for Safety of college evacuation during emergencies.

Text/Reference Books:

SN	Title of Book	Publisher	Edition & Year
1	" Quality planning and Analysis ", Juran Frank, J.M. and Gryna, F.M	Tata McGraw Hill	1982
2	"Productivity Improvement in Construction", Clarkson H. Oglesby ",	McGraw Hill	1989
3	" The Management of Quality in Construction ", John Ashford	E & F.N Spon, New York	1989

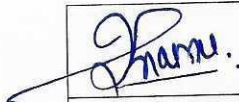
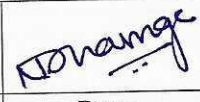
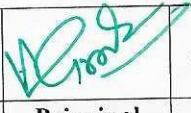
Online Resources:

SN	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Principal of Management	NPTEL	https://www.youtube.com/playlist?list=PLWnoy5z_3BOBvFtBlowxM05D-q0VAWEs
2	Quality Assurance	NPTEL	https://www.youtube.com/watch?v=jwXv_t-Tr4M

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Teacher's Resource:

SN	Particulars	Link
1	YouTube Videos/PPT/Notes/Lab Manual/Question Banks, etc.	https://www.youtube.com/playlist?list=PLWnoySz_3BObBvFtBlowxM05D-q0VAWEs

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Semester VI	Subject Code 6BCV06T	Name of Subject Application of IoT in Civil Engineering		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hours		Tutorial (T): -	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives:

1. To introduce the fundamentals of Internet of Things (IoT) and its components.
2. To understand the role of sensors and communication technologies in civil engineering.
3. To explore IoT applications in smart infrastructure and smart cities.
4. To develop basic understanding of monitoring systems used in civil engineering.
5. To analyze real-world IoT-based solutions for sustainable infrastructure

Course Outcomes:

CO Code	Course Outcome
CO1	Describe basic concepts, architecture, and components of IoT systems used in civil engineering applications.
CO2	Identify and select suitable sensors, actuators, and communication technologies for infrastructure monitoring.
CO3	Apply IoT concepts for smart buildings, transportation, water resource, and environmental monitoring systems.
CO4	Analyze IoT-generated data for decision-making in civil engineering projects and infrastructure management.
CO5	Design simple IoT-based solutions for civil engineering problems considering sustainability and smart city requirements.

Course Competencies:

1. Explain the basic concepts, architecture, components, and communication technologies of Internet of Things (IoT) systems relevant to civil engineering applications.
2. Select and utilize appropriate sensors, actuators, and data acquisition systems for monitoring civil engineering infrastructure and environmental parameters.
3. Apply IoT technologies for smart buildings, structural health monitoring, transportation systems, water resource management, and environmental monitoring.
4. Interpret and analyze data collected from IoT-enabled systems to support infrastructure maintenance, safety assessment, and resource management decisions
5. Design and evaluate simple IoT-enabled civil engineering systems considering efficiency, reliability, sustainability, and societal needs.

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CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	-	-	2	-	-	-	-	-	2	-	-
CO2	2	3	1	1	3	1	-	-	-	-	1	2	2
CO3	2	2	3	1	3	-	2			-	1	3	3
CO4	2	3	1	3	2	-	1			-	2	3	3
CO5	1	2	3	2	3	2	3	-	1	1	3	3	3

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
I	Unit I: Fundamentals of IoT Introduction to Internet of Things (IoT) , Evolution and Need of IoT, Characteristics and Components of IoT , IoT Architecture (Basic Three-Layer Architecture), Sensors, Actuators, Controllers, Communication Technologies: Wi-Fi, Bluetooth, ZigBee, Role of IoT in Civil Engineering, Applications in Smart Infrastructure and Smart Cities	8	CO1
II	Unit II: IoT Sensors and Data Acquisition Introduction to Sensors and Actuators, Temperature Sensors, Humidity Sensors ,Water Level Sensors, Pressure Sensors, Vibration Sensors, Data Acquisition Systems, Introduction to Arduino and NodeMCU, Basics of Wireless Sensor Networks (WSN).	8	CO2
III	Unit III: Smart Buildings and Structural Health Monitoring Concept of Smart Buildings, Energy Monitoring Systems, Smart Lighting and HVAC Systems, Structural Health Monitoring (SHM)	8	CO3
IV	Unit IV: Smart Transportation Traffic Monitoring Systems, Intelligent Traffic Signals, Smart Parking Systems, Vehicle Tracking Systems	8	CO4
V	Unit V: Smart Environmental Monitoring Air Quality Monitoring, Noise Pollution Monitoring, Weather Monitoring Systems.	7	CO3, CO5

Activity: Students visit a local structure (a bridge, a retaining wall, or a water tank) and design a theoretical IoT deployment plan.

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Term Work (12 HOURS): Assignments, Presentations, and case studies.

Self-Learning (18 HOURS): NPTEL & UDEMY lecture videos.

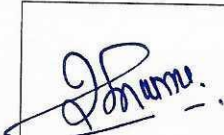
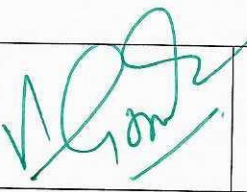
Learning Resources:

Text/Reference Books:

SN	Title of Book/ Software	Publisher	Edition & Year
1	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the IoT by David Hanes	Cisco Press	2017
2	Structural Health Monitoring of Civil Infrastructure Systems by Vistasp Karbhari.	Elsevier ISBN: 1845696824, 9781845696825	2009

Online Resources:

S N	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Wokwi: <u>ESP32 Simulator</u> (Excellent for testing code and wiring without buying hardware).	-	https://wokwi.com/esp32
	MQTT Explorer: A tool to visualize the data flow from sensors.	-	https://mqtt-explorer.com/
	NPTEL Course: <u>Sensors and Actuators</u> by Prof. Hardik J. Pandya (IISc).	NPTEL	https://nptel.ac.in/courses/108108147

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Semester VI	Subject Code 6BCVMD04T	Name of Subject Construction Data Analytics & Digital Cost Engineering		
Total Hours Distribution per week				
Total Credit: 02	Lecture (L): 02 Hours		Tutorial (T):	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
15 Marks	10 Marks	25 Marks	50 Marks	2.0 Hours

Course Objectives: This will make teacher to

- Introduce fundamentals of construction data analytics and types of data used in the construction industry.
- Impart skills in data collection, preprocessing, and visualization using modern tools.
- Provide knowledge of digital cost engineering, estimation techniques, and BIM integration.
- Familiarize students with predictive analytics, regression, and machine learning applications in construction.

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

COs	Course Outcome
CO1	Explain construction data types, lifecycle, and their role in project planning and control.
CO2	Apply data collection, cleaning, and visualization techniques using tools like Excel and Power BI.
CO3	Perform quantity take-offs and cost estimation using traditional and digital approaches with BIM integration.
CO4	Analyze construction data using basic predictive models, regression, and risk analysis techniques.

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Apply data analytics concepts for effective construction project decision-making.
2	Utilize digital tools for data processing, visualization, and reporting in construction projects
3	Implement digital cost engineering techniques for accurate estimation and cost control.
4	Use predictive analytics and basic machine learning methods for construction data analysis.

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CO-PO Articulating Matrix:

CO-PO Articulating Matrix:													
COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	-	1	1	-	-	-	-	1	-	1	1
CO2	2	2	-	-	3	-	-	-	1	1	-	1	1
CO3	3	2	2	2	3	-	1	-	1	-	3	1	1
CO4	3	3	1	1	2	-	-	-	-	-	1	1	1

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
1	Introduction to Construction Data Analytics: Overview of data in construction industry, Types of construction data (structured, unstructured, real-time), Data lifecycle: collection, storage, processing, visualization, Role of data analytics in project planning, monitoring, and control, Introduction to Big Data Analytics in construction, Case studies: data-driven construction projects	7	CO1
2	Data Collection, Processing & Visualization: Data sources: site data, sensors, drones, BIM models, Data cleaning and preprocessing techniques, Introduction to spreadsheets and databases (Excel, SQL basics), Data visualization techniques (charts, dashboards) Tools: Microsoft Excel, Power BI	7	CO2
3	Fundamentals of Digital Cost Engineering: Principles of cost estimation in construction, Types of estimates: preliminary, detailed, revised, Quantity take-off methods (manual vs digital), Introduction to rate analysis and cost indices, Integration of cost with BIM (5D BIM concepts) Software tools: Primavera P6, Autodesk Revit	8	CO3
4	Advanced Analytics & Predictive Modeling Introduction to predictive analytics in construction, Basics of regression and forecasting techniques, Risk analysis using data models, Application of Machine Learning in cost prediction, Time-cost optimization using data-driven approaches	8	CO4

Suggested Activities for Continuous Assessment: (Any Three)

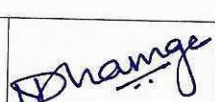
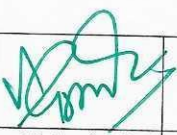
Assignments, quizzes, software-based practical's (Excel/Power BI), data analysis mini-projects, case studies, seminars/presentations,

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Learning Resources:

Text/Reference Books:

SN	Title of Book	Publisher	Edition & Year
1	Construction Project Management: A Complete Introduction by Alison Dykstra	Kirshner Publishing,	2nd Edition, 2018
2	Building Information Modeling: Planning and Managing Construction Projects by Chuck Eastman	Wiley,	2nd Edition, 2018
3	Construction Cost Estimating and Cost Control by Paul F. Smith	Pearson	1st Edition, 2014
4	Introduction to Data Analytics for Accounting by Vernon J. Richardson	McGraw-Hill	1st Edition, 2019
5	Smart Construction and Digital Engineering by Mark Farmer	ICE Publishing	1st Edition, 2021

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SIXTH SEMESTER

Semester VI	Subject Code 6BCVMD04T	Name of Subject Digital Project Management and Responsive Systems		
Total Hours Distribution per week				
Total Credit: 02	Lecture (L): 02 Hours		Tutorial (T):	
Examination Scheme				
Mid Sem. Examination	Continuous Assessment	End Sem. Examination	Total Marks	Theory Examination Duration:
15 Marks	10 Marks	25 Marks	50 Marks	2 Hours

Course Objectives: This will make teacher to:

1. To introduce the fundamental concepts of digital project management, project life cycle, and Building Information Modelling in civil engineering.
2. To provide knowledge of modern digital tools and technologies such as BIM, GIS, IoT, and project management software for effective project execution.
3. To develop understanding of project planning, scheduling, and cost control techniques using digital methods like Work Breakdown Structure and Earned Value Management.
4. To familiarize students with responsive systems, smart infrastructure, and sensor-based technologies in civil engineering applications.

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

COs	Course Outcome
CO1	Interpret the concepts of digital project management, project life cycle, and Building Information Modelling in civil engineering projects.
CO2	Apply modern digital tools and technologies such as BIM, GIS, IoT, and project management software for effective execution of civil engineering projects.
CO3	Analyze project planning, scheduling, and cost control techniques using digital methods such as Work Breakdown Structure and Earned Value Management
CO4	Evaluate the performance and effectiveness of responsive systems, smart infrastructure, and sensor-based technologies in civil engineering applications.

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Explain the fundamental concepts of digital project management and the application of BIM in construction projects.
2	Utilize modern digital tools and technologies for effective planning and execution of civil engineering projects.
3	Examine project scheduling and cost control techniques using digital approaches.
4	Assess smart and responsive systems in civil engineering for practical real-world applications.

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CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	1	3	2	3	3
CO2	2	2	2	-	3	1	1	-	-	3	2	2	3
CO3	3	3	2	2	-	-	-	-	1	3	2	2	3
CO4	2	3	-	-	3	2	-	-	1	-	2	3	3

Syllabus (Theory)

Unit	Details of Topic	Hours	CO Mapping
1	Introduction to Digital Project Management: Concept of Digital Project Management, Project Life Cycle in Construction, Role of digital tools in civil engineering projects, Overview of BIM (Building Information Modelling)	8	CO1
2	Digital Tools and Technologies: Project management software, BIM tools, Cloud-based collaboration platforms, GIS integration in project planning, IoT applications in construction monitoring.	7	CO2
3	Planning, Scheduling and Cost Control: Work Breakdown Structure, Network techniques, Resource allocation and leveling, Cost estimation using digital tools, Earned Value Management.	7	CO3
4	Responsive Systems in Civil Engineering: Concept of responsive and smart systems, Smart infrastructure and adaptive buildings, Sensor-based monitoring systems, Real-time data acquisition and control, Applications in smart cities	8	CO4

Learning Resources:

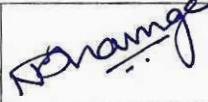
Text/Reference Books:

SN	Title of Book	Publisher	Edition & Year
1	Construction Project Management: Planning, Scheduling and Controlling	Tata McGraw Hill	2 nd Edition, 2014
2	Project Management: A Systems Approach to Planning, Scheduling, and Controlling	Wiley	12 th Edition, 2017
3	Digital Twin Driven Smart Design of Built Environment	Academic Press (Elsevier)	1 st Edition, 2020
4	Construction Project Management	Pearson	1 st Edition, 2011
5	Construction Project Management: Theory and Practice	Pearson	2 nd Edition, 2015

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Online Resources:

SN	Topic	MOOCs Platform (NPTEL, SWAYAM, UDEMY)	Link
1	Project Planning & Control	NPTEL	https://nptel.ac.in/courses/105106149
2	Construction Management	NPTEL	https://onlinecourses.nptel.ac.in/noc26_ce33/preview

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Vocational Skill Enhancement Courses (VSEC)

Semester: VI	Subject Code BSE6P02	Name of Subject Field Survey Lab	
Total Hours Distribution per week			
Total Credit: 2	Practical (P): 4 Hours		
Examination Scheme			
Internal Examination	End Sem. Examination	Total Marks	Examination Duration:
50 Marks	50 Marks	100 Marks	

Course Outcomes:

CO	Course Outcome
CO1	Perform field measurements using surveying instruments and record observations accurately.
CO2	Process survey observations and prepare engineering survey outputs such as coordinates, RLs, profiles, and contours.
CO3	Execute engineering surveys using Total Station and modern surveying methods for infrastructure applications.

Course Competencies:

1. Conduct field measurements safely and accurately.
2. Analyze survey observations and prepare survey computations.
3. Apply modern surveying technologies for engineering mapping and layout.

CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	2	2	2	–	–	–	–	–	–	3	2
CO2	2	3	2	3	2	2	–	–	–	–	–	3	2
CO3	2	3	3	2	3	–	–	2	2	–	2	3	3

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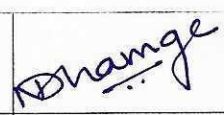
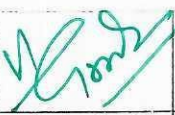
Syllabus (Practical): Minimum – 8 Practical

Category	List of Practical	CO Mapping
A Practical	1. Study of surveying instruments and temporary adjustments.	CO1
	2. Determination of magnetic bearings using prismatic compass.	CO1
	3. Local attraction detection and correction of bearings.	CO1
	4. Computation of included angles from bearings.	CO1
	5. Distance/Volume measurement using EDM.	CO2
	6. Tacheometric determination of distance and elevation.	CO2
	7. Measurement of horizontal and vertical angles.	CO2
	8. Differential levelling and booking of observations.	CO2
	9. Determination of RL by Height of Instrument method.	CO2
	10. Determination of RL by Rise and Fall method.	CO2
	11. Reciprocal levelling and error determination.	CO2
	12. Contour survey and contour map preparation.	CO2
	13. Closed traverse survey and coordinate computation.	CO3
	14. Total Station survey for measurement of horizontal angle, vertical angle, distance, and coordinates.	CO3
B	One/Two days Survey Camp	CO1, CO2, CO3

Learning Resources:

Text/Reference Books:

SN	Title of Book	Publisher	Edition & Year
1	Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II,	Lakshmi Publications Pvt Ltd, New Delhi,	Sixteenth Edition, 2016.
2	I. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts I & 2,	Pune Vidyarthi Griha Prakashan, Pune,	2008.
3	Surveying, Vol I and II,	S. K. Duggal	Second Edition, 2012.
4	K. R. Arora, Surveying Vol I & II,	Standard Book House,	Twelfth Edition 2013.

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SIXTH SEMESTER

Semester: VI	Subject Code CVEXT01P	Name of Subject Estimating & Costing (Practical)	
Total Hours Distribution per week			
Total Credit: 1	Practical (P): 2 Hours		
Examination Scheme			
Internal Examination	End Sem. Examination	Total Marks	Examination Duration:
50 Marks	50 Marks	100 Marks	Hours

Course Outcomes (Exact 3):

1. Prepare the preliminary estimate for administrative approval & technical sanction for a civil engineering project.
2. Write the specifications of the work to be undertaken, prepare the tender documents, fill the contracts and make use of knowledge of different contract submission & opening in awarding the work to the contractor.
3. Use the technique of Rate analysis in estimating the exact cost of material & manpower and hence the entire project.

Course Competencies (Max 3):

1. **Interpret construction drawings and specifications:** - Read and understand architectural, structural, and services drawings for quantity take-off.
2. **Perform quantity take-off accurately:** - Measure quantities of materials for buildings and infrastructure works using standard methods of measurement.
3. **Apply standard data and schedules of rates:** - Use current schedule of rates, standard data, and market rates in cost estimation.

CO-PO Articulating Matrix:

COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	3	-	-	-	2	2	3	-	3	1	1
CO2	3	3	3	-	-	-	2	2	3	-	3	1	1
CO3	3	3	3	-	-	-	2	2	3	-	3	1	1

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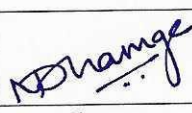
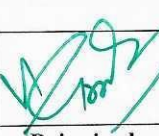
Syllabus (Practical): Minimum – 8 Practical

Category	List of Practical	CO Mapping
A Practical	1- Detailed estimate of Load bearing structure.	CO1
	2- Detailed estimate of Frame structure.	CO1
	3- Calculation of steel with bar bending Schedule.	CO1
	4- Detailed estimate of earthwork of road for approximate 1km length.	CO1
	5- Draft Detailed specification for 5 (Five) major items.	CO2
	6- Collection of four different types of Tenders	CO2
	7- Analysis the unit rate of 5(Five) major items of work contained.	CO3
	8- Market survey for material and labor rates for various items.	CO3
	9- Calculation of annual and total Depreciation and book value of the end of each year.	CO3
	10-Detailed planning and estimate of plumbing work.	CO1
B Activities	Collection of different bank rates of nearby location, Comparative study of different units e.g. - Brass, foot, meter, cm, cum etc. is compulsory.	CO2, CO3

Learning Resources:

Text/Reference Books:

SN	Title of Book	Publisher	Edition & Year
1	Estimating & Costing in Civil Engg... Theory & Practice by B.N.Dutta, S.Dutta & Co., Lucknow	C & S Publication & Distribution	28 th Edition 2020
2	Estimating, Costing & Specification in Civil Engg. by M. Chakarborty, Calcutta	Chakraborti Publishing house	29 th Edition 2006
3	Estimating and Costing for Building & Civil Engg.Works by P.L.Bhasin, S.Chand & Co., N. Delhi	S Chand & Co.	2 nd Edition
4	Building Construction Estimating by George H. Cooper, McGraw Hill Book Co., New York	McGraw Hill	1 st Edition

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Department of Civil Engineering
Syllabus for B. Tech. Programme in Civil Engineering
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SIXTH SEMESTER

Semester VI	Subject Code CVEXT02P	Name of Subject Application Software in Civil Engineering	
Total Hours Distribution per week			
Total Credit: 01	Practical (P): 02 Hours		
Examination Scheme			
Internal Examination	End Sem. Examination	Total Marks	Examination Duration:
50 Marks	50 Marks	100 Marks	

Course Objectives

1. To introduce industry-standard software used in various civil engineering domains.
2. To develop hands-on skills in drafting, modeling, analysis, and project management.
3. To enable integration of software tools for solving real-world civil problems.

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

COs	Course Outcome
CO1	Identify and explain the basic tools and settings of CAD software for civil engineering drafting.
CO2	Prepare 2D drawings of building plans, sections, and elevations using appropriate layers and dimensions.
CO3	Create simple 3D models of civil engineering structures using extrusion and solid editing tools.
CO4	Apply rendering and visualization techniques to produce basic 3D presentations of models.

Course Competencies: On completion of the course, students will develop the following competencies:

No.	Course Competency
1	Identify, describe, and properly configure the basic CAD environment including drawing units, limits, layers, line types, and coordinate systems for civil engineering drafting tasks.
2	Produce accurate 2D civil engineering drawings (plan, section, elevation) of a small residential building using proper layering, dimensioning, annotation, and plotting techniques as per standard drafting conventions.
3	Construct basic 3D solid models of civil engineering elements (e.g., beam, column, slab, simple building frame) using extrusion, Boolean operations, and solid editing commands.
4	Enhance 3D models with materials, lighting, and shadows, and generate rendered images or basic walkthrough animations for presentation purposes.

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CO-PO Articulating Matrix:

CO-PO Articulating Matrix:													
COs	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	3	3	3	—	3	3	3	—	3	2	2
CO2	3	3	3	3	3	—	3	3	3	—	3	2	2
CO3	3	3	3	3	3	—	3	3	3	—	3	2	2

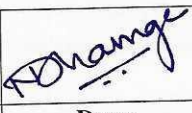
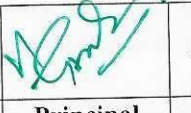
Syllabus (Practical):

SN	List of Practical	Hours	CO Mapping
1	Introduction to CAD environment, drawing settings, layers, dimensioning	7	CO1
2	2D drafting of plans, sections, elevations (Building, Road cross-section)	7	CO2
3	Introduction to 3D modeling – extrusion, lofting, solid editing	8	CO3
4	Creation of simple architectural models and rendering basics	7	CO4

Learning Resources:

Text/Reference Books:

SN	Title of Book	Publisher	Name of author
1	AutoCAD 202X – A Problem-Solving Approach.	CADCIM Technologies	Sham Tickoo,

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Semester: VI	Subject Code: CVEXT03P	Name of Subject: Capstone Project	
Total Hours Distribution per week			
Total Credit: 6	Practical (P): 12 Hours		
Examination Scheme			
Internal Examination	End Sem. Examination	Total Marks	Examination Duration:
---	100 Marks	100 Marks	-----

Course Objectives: (Practical)

After studying this course, the students will be able to:

1. Develop the ability to identify, review, and understand technical literature, standards, codal provisions, and recent developments related to a selected engineering topic.
2. Acquire skills in organizing, preparing, and presenting technical information effectively through professional reports, seminar presentations, and multimedia tools.
3. Understand the problem-solving techniques to design and develop a model, demo, experiment, mini-project, or working model based on the selected topic.

Course Outcomes (Practical)

After successful completion of the course, the student will be able to:

COs	Course Outcome
CO1	Analyze technical literature, codal provisions, and research findings to prepare a structured seminar synopsis on a selected topic
CO2	Prepare and deliver seminar presentation and technical report incorporating methodology, results, conclusions, and future scope.
CO3	Design and develop a demo, model, experiment, or mini working prototype to demonstrate the practical application of the selected topic.

Course Competencies: (Practical)

On completion of the course, students will develop the following competencies:

1. Conduct literature surveys and critically analyze technical information for topic selection and seminar preparation.
2. Develop and communicate technical ideas effectively through reports, presentations, and seminar discussions.
3. Design and implement innovative models, demonstrations, experiments, or mini projects to address engineering problems and showcase practical applications.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	3	3	3	2	1	2	2	1	2	1	1
CO2	3	3	3	3	3	2	1	2	2	1	2	1	1
CO3	3	3	3	3	3	2	1	2	2	1	2	1	1

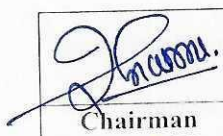
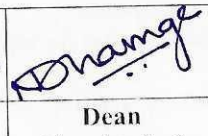
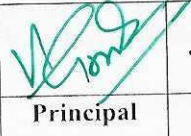
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Syllabus (Capstone Project)

Practical Number	Details of Topic	Hours	CO Mapping
Project Work	At the start students must prepare a synopsis on the chosen topic which will be reviewed in the topic finalization seminar and two progress seminars in the semester has to be presented in power point presentation. At end student of semester will able to prepare a pre submission seminar on power point presentation and after successful acceptance the spiral/bounded report that contain Index covering Introduction, Literature Review, Codal Provision, Methodology, Material and Methods, Result Analysis, Conclusion, Future Scope of work References on the topic chosen and to develop Demo Model/ Experiments/Mini working models/Experimental Works in Laboratory etc	90	CO1 to CO3

Teacher's Resource:

SN	Particulars	Link
1	YouTube Videos/PPT/Notes/Lab Manual/Question Banks, etc.	YouTube videos on project based on civil engineering projects can be referred.

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