Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Civil Engineering				
CE3501: Structural Mechanics				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	03 Hrs

Prerequisite : Mechanics of Material

Course Outcomes (CO): Students will be able to

CO1	Determine combined stresses for column and stability analysis of gravity dams.
CO2	Analyse and compute the slope and deflection of determinate beams with various methods.
CO3	Evaluate strain energy, Consistent deformation method and force methods in structural analysis.
CO4	Construct and interpret Influence Line Diagrams (ILDs) for beams and statically determinate trusses.

	Course Contents	CO	Hours
Unit 1	**Direct and Bending Stresses:** Combined direct and bending stresses, eccentric loads, stability analysis of gravity dams, retaining walls.	**CO1**	**(06)**
Unit 2	Computation of Slope and deflections in determinate beams - Double integration method, Macaulay's method, moment area method. Analysis of long columns, Euler's and Rankine's theory	**CO2**	**(07)**
Unit 3	Concept of determinacy and indeterminacy, Degrees of freedom and structural redundancy, Methods of analysis. Clapeyeron's theorem of three moments in continuous beam, sinking of support, beam with different flexural rigidities. Consistent deformation method: propped cantilever with uniform section, fixed beam.	**CO3**	**(09)**
Unit 4	**Energy principles in structural Analysis:** Strain energy stored due to axial loading – strain energy stored due to bending- work done by a force on an member-Law of Reciprocal Deflections—Betti's law - the first theorem of Castigliano-deflection of beam and truss.	**CO3**	**(07)**
Unit 5	Slope deflection and moment distribution method	**CO3**	**(04)**
Unit 6	**Influence Line Diagrams** Muller- Breslau's Principle and its application to statically determinate simple and compound beams, Influence line diagrams for support reaction, shear force and bending moment, ILD for member forces in statically determinate bridge trusses.	**CO4**	**(07)**

Text Books

1. Reddy C.S., "Basic Structural Analysis", Tata McGraw Hill, 3rd Edition, 2017 (Unit 1, Unit 2, Unit 5)
2. Devdas Menon, "Structural Analysis", Alpha Science Intl, Ltd., 2nd Edition, 2008 (Unit 3, Unit 4, Unit 6)

Reference Books

1. Russell C. Hibbeler, "Structural Analysis", Pearson 11th edition,2023 (Unit-3,4,5,6)
2. Bhavikatti S.S., "Structural Analysis-II", Vikas Publishing House 5th Edition,2021 (Unit- 2,6)
3. T.H.G. Megson, "Structural and Stress Analysis" , Butterworth-Heinemann, 4th Edition 2019 (Unit-1,2,6)

Useful Links

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1.	https://archive.nptel.ac.in/courses/105/105/105105166/?utm_source=chatgpt.com PROF. AMIT SHAW Department of Civil Engineering, IIT Kharagpur
2.	https://archive.nptel.ac.in/courses/105/101/105101085/?utm_source=chatgpt.com IIT Bombay
3.	https://www.youtube.com/watch?v=oa5ojjGEUSw&list=PLUogGZJOiMtNOus85Tq1zNvg9EU3aJ8VO&index=1. PROF. AMIT SHAW, Department of Civil Engineering, IIT Kharagpur

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	2	2	3	-	-	-	-	1	1	-	2	1	2
CO 2	1	3	1	-	-	2	-	1	-	-	2	1	2
CO 3	1	2	2	-	-	-	-	1	-	-	2	2	1
CO 4	1	1	2	-	-	1	-	1	2	-	2	2	2

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	20
Understand	5	4	-
Apply	5	4	10
Analyse	-	4	20
Evaluate	5	4	10
Create	-	-	-
TOTAL	20	20	60

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Government College of Engineering, Karad				
Third Year (Sem –V) B. Tech. Civil Engineering				
CE3502 :Building Planning and Design				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basic Civil Engineering, Building material knowledge

Course Outcomes (CO): Students will be able to

CO1	Explain the fundamental principles of building planning, identify various components of buildings
CO2	Identify and evaluate different construction materials and finishing services used in building construction.
CO3	Demonstrate the functional requirements and methods of application for various building services, including plumbing, electrical, and HVAC systems.
CO4	Describe the principles and practices involved in the maintenance of structures.

	Course Contents	CO	Hours
Unit 1	Components of Building Basic requirements of a building as a whole: strength and stability, Dimensional stability, comfort and convenience, damp prevention, water-proofing techniques, heat insulation, day lighting and ventilation. Building components and their uses: Foundations, plinth, walls and columns in superstructure, floors, doors and windows, sills, lintels, roofs, steps and stairs, utility fixtures. Foundations: Types and their suitability	**CO1, CO2**	**(07)**
Unit 2	Components of Building and designing Introduction to Stone masonry – Random Rubble, Un-coursed Rubble, Coursed Rubble and Ashlar Masonry. Brickwork and Brick Bonds - English, Flemish. Arches: Technical terms in arches, types of arches, methods of construction. Lintel: Classification, Doors and Windows: Classification, Stairs: Technical terms, types, Design of stairs, Ramps, lifts and escalator. Roofs and floor: types and their suitability	**CO2**	**(07)**
Unit 3	Introduction to construction maintenance and Water proofing. Repairs, Maintenance Water proofing: materials, methods Introduction to sustainability and green building: Introduction to sustainable materials and the concept of green building, comparison between conventional building and green building, Green building and its rating systems	**CO4**	**(06)**
Unit 4	Building Planning Building Planning Byelaws and regulations as per SP-7. Planning of Residential Building (Bungalows, Row Bungalows, Apartments and Twin Bungalows), Procedure of Building Permission, significance of commencement certificates, plinth Completion certificate and occupancy certificate.	**CO2, CO3**	**(06)**
Unit 5	Building Services Plumbing system: Various types of traps and plumbing systems, Fittings, Chambers, Need of Septic Tank, Concept of Plumbing and Drainage plan Electrification: - Concealed and Open Wiring, Requirements and Location of various points, Concept of Earthing. Fire resistance in building: Fire protection precautions, confining of fire, fire hazards	**CO2, CO4**	**(07)**

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	Functions of Indian Patent Office as Receiving Office, Computer related Patent Applications		
Unit 6	Building Ventilation and Finishing Ventilation: requirement, various system and section criteria. Thermal Insulation: - General concept, Materials, Methods. Introduction to Acoustics: Absorption of sound, various materials, conditions for good acoustics. Sound Insulation and modern techniques of noise control Plastring- Types ,defects and Methods, Pointing- Types; Paints- Ingredients and types	**CO1, CO2**	**(07)**

Text Books	
1.	R. Shah, S. Kale, and P. Patk, Building Design. New Delhi, India: Tata McGraw-Hill, 2015. (Unit 1, 2,4,6)
2.	S. P. Bindra and V. Arora, Building Design. New Delhi, India: S. Chand, 2008. (Unit 1,2,3,5,6)
3.	D. Chowdhari, Building Construction and Materials. New Delhi, India: Dhanpat Rai Publications, 2014. (All Units)
Reference Books	
1.	Bureau of Indian Standards, National Building Code *SP-7*, 2005. (Unit 1,2)
2.	Technical Teacher's Training Institute, Chandigarh, Civil Engineering Materials. (Unit 2,3)
3.	B. C. Punmia, A. K. Jain, and A. K. Jain, Building Construction. (All Units)
4.	S. C. Rangwala, Building Construction. (All Units)
5.	S. S. Bhavikatti, Building Materials and Construction.(Unit 1,3,4)
Useful Links	
1.	https://easyengineering.net/building-materials-duggal/ (Unit1 ,2,3)

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	1	-	3	-	2	1	-	-	2	-	-	-	2
CO 2	-	3	1	-	-	-	-	-	-	-	-	1	-
CO 3	-	-	3	-	-	2	-	-	1	-	-	2	-
CO 4	-	1	2	-	-	-	-	-	1	-	-	2	-

Guideline for Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	20
Understand	5	4	-
Apply	5	4	10
Analyse	-	4	20
Evaluate	5	4	10
Create	-	-	-
TOTAL	20	20	60

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Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Civil Engineering				
CE3503: Transportation Engineering				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Basic knowledge of building construction materials and transportation fundamentals

Course Outcomes (CO): Students will be able to

CO1	Understand highway planning, road development programs, and geometric design of highways and railways
CO2	Apply traffic engineering knowledge to analyze traffic characteristics, design intersections, signals, and assess highway capacity.
CO3	Suggest appropriate highway materials, construction methodologies, and maintenance techniques
CO4	Understand the fundamental concepts and key terminologies of railway engineering and tunnel engineering

	Course Contents	CO	Hours
Unit 1	**Highway Engineering:** Highway planning, road development in India - NHAI, NHDP, PMGSY, MSRDC, road classification, highway cross-section elements , highway alignment - factors governing it, geometric design - sight distance-requirement and types, horizontal alignment - design speed, super-elevation, extra widening, transition curves and their significance, vertical alignment - gradients, vertical curves	**CO1**	**(08)**
Unit 2	**Traffic Engineering:** Traffic characteristics, traffic engineering studies - types, PCU, highway capacity and level of service of rural and urban roads, traffic regulation and control measures - signs, pavement markings and signals, traffic signal design by Webster's method, types of intersections and traffic islands, highway lighting - importance, factors affecting and design of lighting system	**CO2**	**(07)**
Unit 3	**Highway Materials and Highway Construction:** Highway materials – types, various tests on highway materials and selection criterion, bituminous mix design., highway construction – methods, MoRTH, practices, components and their functions, factors affecting, highway maintenance - types of failures in flexible and rigid pavements with remedial procedures, highway drainage - need, types, recent trends, risk management in transportation engineering, Introduction to Risk Management - overview of identifying, assessing, and mitigating risks in construction and engineering projects.	**CO3**	**(07)**
Unit 4	**Pavement Design:** Introduction to Pavement Design – importance, types of pavements, components and their functions, factors affecting, design of flexible pavement (IRC 37: 2012) , design of rigid pavement (IRC 58: 2011), Key components of DPR – work activities, quantity executed, manpower, machinery, material usage, site issues, and photographic records.	**CO3**	**(05)**
Unit 5	**Railway Engineering:** Permanent way- ideal requirements, components of track & their requirements, gauges, track alignment - requirements & factors controlling, track geometrics - negative cant, coning of wheels, points and crossing, track maintenance - defects in rails and corrective measures, PWI, railway signaling, future trends in rail transport. **Introduction to Airport engineering:** development of airport in India, factors affecting selection of site for airport, important components of airport layout, Windrose diagram, aircraft characteristics, types of	**CO4**	**(07)**

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	airports, factors affecting runway operation		
Unit 6	**Tunnel Engineering:** Classification of tunnels, tunnel surveying, methods of tunnelling in soft rock, methods of tunnelling hard rock, tunnel lining, tunnel drainage, ventilation in tunnels - methods, tunnel lighting, tunnel hazards, recent trends in tunnelling..	**CO4**	**(06)**

Text Books	
1.	Justo C. E. G., Khanna S. K., Veeraragavan A., "Highway Engineering" , Nemchand & Bros (10th Edition). 2015. (All Units)
2.	Kadiyali L. R. and Lal N. B., "Principles and Practices of Highway Engineering", Khanna Publishers (7 th Edition). 2013. (Unit 1,3,4)
3.	Kadiyali L. R., "Traffic Engineering and Transport Planning", Khanna Publishers, (9 th Edition). (Unit 4,5)
4.	Satish Chandra, Agarwal M. M., "Railway Engineering", Oxford University Press, (2 nd Edition). 2013. (Unit 5)
5.	Saxena S. C., "Tunnel Engineering", Dhanpat Rai & Sons. 2013. (Unit 6)
Reference Books	
1.	Kadiyali L. R., "Transportation Engineering", Khanna Publishers. 2016. (Unit 4,5)
2.	Clifford F. Bonnett, "Practical Railway Engineering", Imperial College Press, (2 nd Edition). 2005. (Unit 5)
3.	Wright P. H. and Dixon K., "Highway Engineering", Wiley India Pvt. Ltd., (7 th Edition). 2009. (All Units)
4.	Chakroborty P. and Das A., "Principles of Transportation Engineering", PHI Learning Pvt. Ltd., (2 nd Edition). 2017. (Unit 1,2,6)
5.	Brockenbrough R. L. and Boedecker K. J., "Highway Engineering Handbook", McGraw Hill, (2 nd Edition). 2003. (All Units)
6.	Garber N. J. and Hoel L. A., "Traffic and Highway Engineering", Cengage Learning, (4 th Edition). 2009. (All Units)
7.	Rao G. V., "Principles of Transportation and Highway Engineering", Tata McGraw Hill. 2000. (Unit 2,3,4)
Useful Links	
1.	https://nptel.ac.in/courses/105/105/105105107/ - Introduction to Transportation Engineering – Dr. K.S. Reddy, Dr. Bhargab Maitra, IIT Kharagpur. (Unit 1,2)
2.	https://nptel.ac.in/courses/105/105/105105204/_– Introduction to multi-modal transport – Prof. Arkopal Kishore Goswami, IIT Kharagpur. (Unit 2)
3.	https://nptel.ac.in/courses/105/106/105106200/ – Characterization of Construction Materials – Prof. Piyush Chaunsali, Prof. Manu Santhanam, IIT Madras. (Unit 3)
4.	https://nptel.ac.in/courses/105/106/105106203/ – Mechanical Characterization of Bituminous Materials – Multi – Faculty, IIT Madras. (Unit 4)
5.	https://nptel.ac.in/courses/105/107/105107123/ – Railway Engineering – Prof. Rajat Rastogi, IIT Roorkee. (Unit 5)

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	3	2	2	1	2	2	-	-	-	1	2	-	2
CO 2	3	3	3	2	2	2	-	-	2	2	2	1	-
CO 3	3	2	3	2	3	2	-	-	-	1	1	2	-
CO 4	2	1	2	1	2	1	-	-	-	-	1	1	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	20
Understand	4	4	-
Apply	6	6	10
Analyse	-	3	20
Evaluate	5	3	10
Create	-	-	-
TOTAL	20	20	60

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Government College of Engineering, Karad				
Third Year (Semester – V) B. Tech. Civil Engineering				
CE3504 : Design of Steel Structure				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	03 Hrs 00 Min

Prerequisite : Engineering Mechanics, Mechanics of Materials.

Course Outcomes (CO): Students will be able to

CO1	Analyze and design the various connections and identify the potential failure modes.
CO2	Design analytically tension and compression members along with roofing system by Limit State Design.
CO3	Examine steel column and beam and its built-up sections for different loading conditions as per IS code provisions.
CO4	Discuss recent approaches for steel structure design as plastic analysis and PEB structures.

	Course Contents	CO	Hours
Unit 1	**Introduction to Design of Steel Structures & Connections:** Design philosophy, comparison of LSM & WSM, advantages and disadvantages of steel structures, types of steel structures, grades of structural steel, various rolled steel structures, loads and load combinations, partial safety factors for load and materials, Connections: Types of bolts & welds, analysis and design of axially and eccentrically loaded bolted and welded connections (subjected to bending and torsion).	**CO1**	**(07)**
Unit 2	**Tension and Compression Members:** Behavior of tension and compression member, common sections, net area, modes of failure, effective length, slenderness ratio, load carrying capacity, design of axially loaded tension members, design of compression members, and design of end connections (bolted and welded).	**CO2**	**(07)**
Unit 3	**Column and Column Base:** Design of columns subjected to axial and eccentric loading, design of lacing, battening system, column splices, Column bases: Design of slab bases & gusseted base subjected to axial and eccentric load and design of concrete pedestal.	**CO3**	**(06)**
Unit 4	**Flexure Members (Beams):** Laterally supported & unsupported beams, design of simple beams, built up beams using flange plates, curtailment of flange plates, web buckling & web crippling, secondary and main beam arrangement, beam to beam connections.	**CO3**	**(06)**
Unit 5	**Roofing System:** Gantry girder: Forces acting on a gantry girder, commonly used sections, introduction to design of gantry girder as laterally unsupported beam, connection details, Roof trusses: Components of an industrial shed, types of trusses, load calculations and combinations, design of truss members, design of purlins, design of bracing.	**CO2**	**(07)**
Unit 6	**Introduction to Plastic Analysis:** Hinge Formation, Collapse Mechanism, Recent approaches in Steel Structure design based on Plastic Analysis Method and Limit State Approach, Introduction to Pre-engineered Building (PEB) structures: Primary Members / Main	**CO4**	**(07)**

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	Frames, Secondary Members / Cold Formed Members, Roof & Wall Panels.		

Text Books	
1.	Subramanian N., "Design of Steel Structures - Limit State Method", Oxford University Press, New Delhi. 2015
2.	Duggal S. K., "Limit State Design of Steel Structures", McGraw Hill Education (India) Pvt Ltd. (3rd Edition). 2019.
3.	Shiyekar M. R., "Limit State Design in Structural Steel", PHI Publications. (3rd Edition). 2011.
4.	Sairam K. S., "Design of Steel Structures", Pearson Education India, (2nd Edition). 2013.
Reference Books	
1.	IS: 800 – 2007, IS: 875 (Part I, II and III), SP 6 (1) & SP 6 (6), IS: 808-1989.
2.	Steel Construction Manual, AISC, (15th Edition). 2017.
3.	Shah V. L., Gore V., "Limit State Design of Steel Structures IS: 800 – 2007", Structures Publication, Pune. 2012.
Useful Links	
1.	http://nptel.ac.in/courses/105106112/ – Civil Engineering – Design of Steel Structures I – Satish Kumar, IIT Madras
2.	http://nptel.ac.in/courses/105106113/ – Civil Engineering – Design of Steel Structures II – Satish Kumar, IIT Madras
Codes	
1.	IS 800:2007, Indian standard Code
2.	IS 875:1987 Part I, II, III Indian standard Code
3.	IS Handbook Steel Table
Note	
1.	Use of IS 800:2007 code and steel table is allowed in examinations.

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	3	2	2	-	-	-	-	-	-	-	-	1	1
CO 2	3	2	2	-	-	-	-	-	-	-	-	1	1
CO 3	3	2	2	-	-	-	-	-	-	-	-	1	1
CO 4	3	2	2	-	-	-	-	-	-	-	-	1	1

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	20
Evaluate	5	4	10
Create	-	4	10
TOTAL	20	20	60

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Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Civil Engineering				
CE3505 MDM: Building Planning and Drawing				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basic Civil Engineering, Building material knowledge

Course Outcomes (CO): Students will be able to

CO1	Knowledge about various building components and their application.
CO2	Draw the different building components and demonstrate requirements and suitability of those components.
CO3	Plan and design of buildings as well as its components as per SP-7 and National Building Code.
CO4	Demonstrate requirements and method of application of various building services.

	Course Contents	CO	Hours
Unit 1	**Building Components:** Foundations, plinth, walls and columns in superstructure, floors, doors and windows, sills, lintels, roofs, steps and stairs, utility fixtures.	**CO1 CO2**	**(07)**
Unit 2	**Building Components and Design :** Foundations: Types and their suitability. Stone masonry – Random Rubble, Un-coursed Rubble, Coursed Rubble and Ashlar Masonry. Brickwork and Brick Bonds – Types of brick bonds English and Flemish. Arches: Technical terms in arches, types of arches, methods of construction. Lintel: Classification, Doors and Windows: Classification, Stairs: Technical terms, types, Design of stairs, Roofs and floor: types and their suitability.	**CO1 CO2**	**(07)**
Unit 3	**Building Planning By Laws and Regulation** : Introduction, Terminology, Objectives of building byelaws, Floor Area Ratio (FAR) – Floor Space Index (FSI),Principles underlying building byelaws, classification of buildings, Open space requirements, built up area limitations, Height of Buildings – Wall thickness, lighting and ventilation requirement.	**CO3**	**(06)**
Unit 4	**Planning of Buildings (Residential and Public):** Site Selection criteria, Principles of Building planning. Significance Sun path diagram. Wind Diagram, Orientation, Factors affecting and criteria under Indian condition. Building Planning Byelaws and regulations as per SP-7.	**CO3**	**(07)**
Unit 5	**Sign Conventions and Bonds :** Sign Conventions- Plumbing System, Electrification System, Furniture system, Building materials and component, Brick, stone, plaster, sand filling, concrete, glass, steel, cast iron, copper alloys, aluminum alloys etc., lead, zinc, tin etc., earth, rock, timber and marbles. English bond and Flemish bond- odd and even courses for one, one-half, two and two & half brick walls in thickness at the junction of a corner.	**CO4**	**(07)**
Unit 6	**Doors, Windows, Ventilators And Roofs:** Panelled door, panelled and glassed door, glassed windows, paneled windows, swing ventilators, fixed ventilators, coupled roof, collar roofs. King Post truss, Queen Post truss Sloped and flat roof buildings: drawing plans, Elevations and Cross Sections of given sloped roof buildings.	**CO4**	**(06)**

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Text Books	
1.	Building Design by Shah, Kale, Patki. Tata Mc-Graw Hill Publications. (Edition 2015) (All Units)
2.	Building Design by Bindra & Arora –S.Chand.(Edition 2008) (All Units)
3.	Building Construction and materials by Chowdhari DhanpatRai Publication. (Edition 2014) (Unit 5,6)
Reference Books	
1.	National Building code SP-7. (Edition 2005) (Unit 4,5,6)
2.	Civil Engineering Materials - Technical Teacher's Training Institute, Chandigarh (Unit 1,2,6)
3.	Building construction By Rangawala (All Units)
4.	Building Construction by B.C Punmia, Ashok ku. Jain, Arun Kumar Jain. (All Units)
5.	Building materials and construction by SS Bhavikatti. (Unit 1,2,6)
Useful Links	
1.	https://easyengineering.net/building-materials-duggal/ (Unit 1,2,6)
2.	https://bharatskills.gov.in/Home/StudyMaterial?var=EDAGX24kJCO/9o2J0MaRDg==&Default=YES (Unit 2,4)

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	2	-	2	-	-	1	-	-	2	-	-	2	2
CO 2	2	-	3	-	-	-	-	-	-	-	-	2	2
CO 3	2	-	3	-	1	2	-	-	1	-	-	2	2
CO 4	2	-	2	-	1	-	-	-	-	-	-	2	2

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	5	5	15
Apply	5	5	15
Analyse	-	-	-
Evaluate	-	-	-
Create	5	5	20
TOTAL	20	20	60

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Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Civil Engineering				
CE3516: (Open Elective- 03) Environmental Impact Assessment				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
0			Duration of ESE	02 Hrs 30 Min

Prerequisite : Environmental Science, Chemistry

Course Outcomes (CO): Students will be able to

CO1	Knowledge of the fundamental concepts of EM and EIA
CO2	Trace the evolution of EIA and use it as EM tool
CO3	Apply environment impact assessment process for construction projects
CO4	Prepare project report which is comply with environmental clearance procedure

	Course Contents	CO	Hours
Unit 1	**Introduction:** Environmental Management, Definition, Scope, Goals and need. International Environmental Movement, Environmental concerns in India.	**CO1**	**(04)**
Unit 2	**Policies & Programmes:** Environmental Policies and Programmes in India, Environmental laws and Legislations, Evolution of Indian Legislations, Constitution of India.	**CO1, CO2**	**(04)**
Unit 3	**Environmental Impact Assessment:** Introduction, Purpose, Evolution, Forecasting environmental changes, Environment Impact Statement (EIS), Strategic Environmental Assessment (SEA). Screening and Scoping.	**CO2, CO3**	**(04)**
Unit 4	**EIA Documentation and Processes:** Preliminary Stages of EIA, Impact Prediction, Evaluation and Mitigation, Impact on Decisions, Cost Benefit Analysis of EIA of Construction Projects.	**CO3**	**(05)**
Unit 5	**Environmental Auditing:** Audit Methodology, Life Cycle Assessment (LCA) – Purpose, Evolution and Stages. Environment Impact Statement (EIS), Requisites of good EIS.	**CO3**	**(05)**
Unit 6	**Environment Management System:** EMS Standards: IS14000, Benefits of Implementing ISO 14001.	**CO4**	**(04)**

Text Books

1. L. Canter, Environmental Impact Assessment, 2nd ed. New York: McGraw Hill, 1996. (All Units)
2. United Nations Development Programme (UNDP), Handbook and Guidelines for Environmental Management and Sustainable Development. New York: Environment and Natural Resources Group, UNDP, 1992.

Reference Books

1. World Bank, Environmental Performance Monitoring and Supervision: Update. Environmental Assessment Sourcebook. Washington, DC: World Bank, 1997.
2. B. Lohani, J. W. Evans, H. Ludwig, R. R. Everitt, R. A. Carpenter, and S. L. Tu, Environmental Impact Assessment for Developing Countries in Asia, vol. 1. Asian Development Bank, 1997.
3. Ministry of Environment and Forests, "EIA Notification," The Gazette of India, Extraordinary, Part-II, Section 3, Sub-section (ii), 14th September 2006. (All Units)

Useful Links

1. http://NPTEL.iitm.ac.in. T. V. Ramchandra, Environmental Management

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	2	1	-	-	1	-	-	-	-	-	-	2	2
CO 2	3	1	-	-	-	-	-	-	-	1	1	2	3
CO 3	1	-	2	1	-	2	-	-	-	-	1	2	3
CO 4	-	-	2	-	2	1	2	1	2	-	-	2	2

Guideline for Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	15
Understand	5	4	15
Apply	5	4	12
Analyse	3	4	9
Evaluate	2	4	9
Create			
TOTAL	20	20	60

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Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Civil Engineering				
CE3526: OE- 03 – (MOOC) Environmental Impact Assessment				
Teaching Scheme			**Examination Scheme**	
Lectures	-		MSE	-
Tutorials	-		ISE	-
Total Credits	02		ESE	100

Course Outcomes (CO): Students will be able to	
CO1	Knowledge of the fundamental concepts of EM and EIA
CO2	Trace the evolution of EIA and use it as EM tool
CO3	Apply environment impact assessment process for construction projects
CO4	Prepare project report which is comply with environmental clearance procedure

Course Contents

Students should complete the MOOC course certification in the domain of Environmental Impact Assessment and submit a copy of the certificate to Head of Department prior to ESE.

Guidelines:

- Selection of the MOOC course should be with the prior permission of Head of Department
- Duration for completion of MOOC course certification is minimum 8Weeks.
- Platform: NPTEL or SWYAM only
- Assessment Guideline:- The evaluation of the MOOC Course will be based on at actual score secured by the student in NPTEL or SWAYAM course certification and it will be converted to ESE score.
- If the student unable to submit the NPTEL or SWAYAM completion Certificate, in such cases evaluation will be based on assignment score (60% weightage) of registered NPTEL/SWAYAM and internal evaluation (40 % weightage).
- The rubrics for internal evaluation are given below.

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Department of Civil Engineering

A. Y. 2025-26

Course Code : **Assessment Sheet** **Class:**

Course Title :-

Sr No.	Reg. No	Name of Student	Course Title	Knowledge of Course (08 Marks)	Communication Skill (08 Marks)	Presentation Skill (08 Marks)	Content (08 Marks)	Q & A (08 Marks)	Total Marks (out of 40)
1									
2									

Faculty Name and Sign. **Head of the Department**

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Government College of Engineering, Karad					
Third Year (Sem – V) B. Tech. Civil Engineering					
CE3507: Building Planning and Design Lab					
Laboratory Scheme:			**Examination Scheme:**		
Practical	2 Hrs/week		**ISE**	**25**	
Total Credits	**1**		**ESE**	**25**	

Prerequisite: Basic knowledge of different building units and components.
Auto CAD software skill.

Course Outcomes (CO): Students will be able to

CO1	Design and prepare detailed drawings of staircases in accordance with functional requirements and design standards.
CO2	Plan and design residential buildings both manually (on drawing sheets) and digitally using Computer-Aided Design (CAD) software.
CO3	Interpret and analyze municipal submission drawings and working drawings using AutoCAD.
CO4	Plan and layout various types of public buildings in compliance with SP-7 guidelines and applicable building byelaws.

Course Contents		CO
Experiment 1	Staircase design and Drawing.	**CO1**
	Full set of drawings for the building planned in residential building on drawing sheet	
Experiment 2	Municipal Submission drawing.	**CO2, CO3,CO4**
Experiment 3	Working drawings	**CO2, CO3,CO4**
Experiment 4	Foundation / Centre Line Drawing.	**CO2**
Experiment 5	Furniture layout plan.	**CO2**
Experiment 6	Electrification plan	**CO2,**
Experiment 7	Water supply and drainage plan.	**CO2**
Experiment 8	Vertical and horizontal ventilation	**CO2**
	Full set of drawings for the building planned in residential building by using CAD	
Experiment 9	Municipal Submission drawing by using CAD.	**CO2, CO3,CO4**
Experiment 10	Working drawings by CAD	**CO2, CO3,CO4**
Experiment 11	Foundation / Centre Line Drawing.	**CO2**
Experiment 12	Furniture layout plan.	**CO2**
Experiment 13	Electrification plan	**CO2**
Experiment 14	Introduction to Revit	**CO1**

List of Submission:

1.	Minimum number of Experiments : 12

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2	1	3	-	1	1	1	-	-	-	-	2	2
CO2	1	3	3	2	3	2	3	-	2	2	1	2	2
CO3	1	3	3	2	3	2	3	-	2	2	1	2	2
CO4	2	1	2	3	2	2	2	-	1	2	-	2	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Exp 13	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25	25	25	25

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Government College of Engineering, Karad					
Third Year (Sem – V) B. Tech. Civil Engineering					
CE3508: Transportation Engineering Lab					
Laboratory Scheme:			**Examination Scheme:**		
Practical	2 Hrs/week		**ISE**	**25**	
Total Credits	**1**				

Prerequisite: Basic knowledge of building construction materials.

Course Outcomes (CO): Students will be able to

CO1	Understand and test the basic properties of aggregates and bitumen using standard methods.
CO2	Perform standard laboratory tests to assess the suitability of materials for pavement construction.
CO3	Analyse test results and choose the best materials for strong and durable roads.
CO4	Implement quality control measures and recommend improvements in pavement material selection based on test outcomes.

Course Contents		CO
Experiment 1	Determination of Flakiness Index and Elongation Index of coarse aggregate by IS: 2386 (Part I) 1963 method	**CO 1**
Experiment 2	Determination of specific gravity and water absorption value of aggregate by IS: 2386 (Part III) 1963 method	**CO 1**
Experiment 3	Determination of Aggregate Impact Value of coarse aggregate by IS: 2386 (Part IV) – 1963	**CO 2**
Experiment 4	Determination of Abrasion Value of coarse aggregates by Los Angeles abrasion value test by IS: 2386 (Part IV) 1963 method	**CO 2, CO3**
Experiment 5	Determination of Aggregate Crushing Value of coarse aggregates by IS: 2386 (Part IV) – 1963	**CO3**
Experiment 6	Determination of CBR Value of subgrade material of pavement by IS: 2720 Part 16 1987 method	**CO3, CO4**
Experiment 7	Determination of Stability, Flow and Bulk Density of Bituminous Mixes by Marshall Method by IS:17127:2019	**CO3, CO4**
Experiment 8	Determination of penetration value of bitumen by IS: 1203 – 1978 method	**CO3**
Experiment 9	Determination of softening point value of bitumen by IS: 1205 – 1978 method	**CO3**
Experiment 10	Determination of flash & fire point value of bitumen by IS: 1209 – 1978 method	**CO4**
Experiment 11	Determination of ductility value of bitumen by IS: 1203 – 1978 method	**CO4**
Experiment 12	Determination of viscosity value of tar by IS: 1206 – 1978 method	**CO4**

List of Submission:

1. Minimum number of Experiments: 10

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	-	2	-	-	-	-	-	-	1	2	2
CO2	3	2	1	2	1	-	-	-	-	-	1	2	2
CO3	1	3	3	2	1	1	-	-	1	-	1	3	2
CO4	1	3	3	-	-	2	-	-	-	-	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25	25	25

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Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Information Technology				
CE3509 : Structural Mechanics Lab				
Laboratory Scheme:			**Examination Scheme:**	
Practical	2 Hrs/week		**ISE**	**25**
Total Credits	**1**		**ESE**	**25**

Prerequisite : Engineering Mechanics, Mechanics of Material

Course Outcomes (CO): Students will be able to

CO1	Analyse Structural Stability
CO2	Validate Experimental vs. Theoretical Results
CO3	Analyse, determine, and apply the appropriate loading mechanism based on the type of material, structural element.
CO4	Construct and Validate Influence Line Diagrams (ILDs)

	Course Contents	CO
Experiment 1 &2	Analyse given structures and classify them as determinate or indeterminate. Compute degrees of freedom and redundancy. Verify results using different analytical methods.	**CO1, CO 3**
Experiment 3& 4	Apply load to column model and measure resulting deflections and stresses using dial gauges strain gauges. Compare experimental values with analytical methods.	**CO1, CO2, CO3**
Experiment 5 & 6	Apply a known load on a supported beam model measure slope or deflection at different points with dial gauges. Compare experimental values with analytical methods.	**CO1, CO2, CO3**
Experiment 7& 8	Load column models of different lengths and cross sections record its failure pattern. OR Record critical buckling modes for various boundary conditions Verify results from theoretical predictions.	**CO1, CO2, CO3**
Experiment 9&10	Move a load across the statically determinate beams or truss structure and record reactions at different load positions. Compare results with computed values.	**CO1, CO3**
Experiment 11&12	Construct a model that explains the Influence Line Diagram for at least two factors. Verify results by using Muller Breslaus principle.	**CO1, CO4**

List of Submission:

1.	Minimum number of Experiments : 06

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2	2	2	2	2	1	-	2	1	1	2	1	1
CO2	2	2	2	2	2	1	-	2	1	1	2	1	1
CO3	2	1	2	2	2	1	-	2	1	1	2	1	1
CO4	2	1	2	2	2	1	-	2	1	1	2	1	1

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25	25	25

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Government College of Engineering, Karad			
Third Year (Sem – V) B. Tech. Civil Engineering			
CE3510 MDM: Building Planning and Drawing Lab			
Laboratory Scheme:		**Examination Scheme:**	
Practical	2 Hrs/week	**ISE**	**50**
Total Credits		**ESE**	-

Prerequisite : Basic Civil Engineering, Building material knowledge

Course Outcomes (CO): Students will be able to

CO1	Draw various buildings as per the building by-laws and regulation.
CO2	Skills of drawing building elements and plan the buildings as per requirements.
CO3	Apply the knowledge of buildings planning in different building units.
CO4	Apply the building bye laws and principles of planning for residential and public buildings

Course Contents		CO
Experiment 1	Draw component parts of a single storied residential building with suitable symbols and scales.	CO1, CO2, CO4
Experiment 2	Draw different types of stone and brick masonry.	CO1, CO2
Experiment 3	Draw different types of shallow foundation.	CO1, CO2
Experiment 4	Draw different types of deep foundation.	CO1, CO2
Experiment 5	Draw different types of doors and windows.	CO1, CO2
Experiment 6	Draw different types Staircase.	CO1, CO2
Experiment 7	Draw a line plan of residential building.	CO1, CO2,CO3,CO4
Experiment 8	Prepare the Drawing of Sign Conventions/Symbol for electrical wiring system.	CO3
Experiment 9	Prepare the Drawing of Sign Conventions/Symbol for Plumbing system.	CO3
Experiment 10	Drawing line plans of public buildings (select one building from of the following types): 1. Educational buildings 2. Office Buildings 3. Buildings for transportation 4. Assembly buildings	CO1, CO2,CO3,CO4

List of Submission:

1.	Minimum number of Experiments : 08

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2	-	2	-	1	1	-	-	1	2	2	2	2
CO2	2	-	2	-	1	-	-	-	-	1	1	2	1
CO3	2	-	2	-	1	-	-	-	2	1	1	2	1
CO4	2	-	2	-	1	1	-	-	-	2	2	2	2

1: Slight (Low) 2: Moderate(Medium) 3: Substantial(High)

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Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

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Government College of Engineering, Karad				
Third Year (Semester – V) B. Tech. Civil Engineering				
CE3511 : Industrial Training				
Teaching Scheme			**Examination Scheme**	
			ISE	25
Tutorials	01 Hrs/week			
Total Credits	01			

Prerequisite: Surveying, Building Constructions and Drawing, Structural Analysis.

Course Outcomes (CO): Students will be able to

CO1	Apply theoretical knowledge to practical civil engineering tasks in an industrial setting.
CO2	Describe use of advanced tools and techniques encountered during industrial training and visit.
CO3	Collaborate effectively within multidisciplinary teams to achieve project goals.
CO4	Prepare professional work reports and presentation.

Course Contents

Students need to choose the right area of Civil Engineering out of following discipline,

I. Construction work.
II. Planning and design.
III. Quantity Estimation.
IV. Survey.
V. Investigations.
VI. Management.

They must approach the respective authority/company through proper communication channel to obtain the permission from the authority/company and undergo field training to achieve course learning outcomes.

Period of Industrial Training

The period of Industrial Training must be after fourth semester and in summer vacations. The student has to devote 90 - 100 man - hours (@ 20 days – 5 hour/day) distributed over the vacations since completion of Second Year B. Tech, Civil Engineering Program.

Reporting and Submission requirements

At the start of fifth semester, the student must submit a report to mentor; based on the area they have completed for the course fulfillment. The report must be attached with certificate from appropriate authority/company, actual photographs, videos and day wise field notes. The field notes may consist of:

1. Communication records.
2. Log of activities.
3. Work specifications.
4. Analysis of material.
5. Laboratories and cost requirements.
6. Details of billing system.
7. Regular reporting to Mentor.
8. Certificate from Company/Organization/Firm stating attendance, satisfactory completion of work assigned.
9. Feedback by employer.
10. Report consisting of introduction.
11. Study/Work carried out.
12. Observations and outcomes

Guideline for Assessment Pattern

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Student must submit finalized report at the end of the semester. Student has to present his/her work to examiner for evaluation.		

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	3	3	3	3	-	-	3	-	-	-	-	-	-
CO 2	-	-	-	-	-	3	-	-	3	-	-	-	-
CO 3	-	-	-	-	3		-	-	-	-	2	3	-
CO 4	-	-	-	-	-	-	-	-	-	3	-	-	3

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE
Remember	-
Understand	10
Apply	10
Analyse	10
Evaluate	10
Create	10
TOTAL	50

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year 2025-26 GCE KARAD

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Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Civil Engineering				
CE3601: Foundation Engineering				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Geotechnical Engineering

Course Outcomes (CO): Students will be able to

CO1	Understand the importance of site exploration and investigation methods for civil engineering projects.
CO2	Describe the concept of slope stability and provide an overview of rock fill structures.
CO3	Evaluate the bearing capacity, analyse and design shallow and deep foundations
CO4	Familiarize with the modern substratum techniques.

	Course Contents	CO	Hours
Unit 1	**Soil exploration and geotechnical investigation:** Significance of site exploration, site reconnaissance, site exploration, methods of site exploration, soil sampling and samplers, types of soil sample: disturbed & undisturbed samples, in – situ tests (Standard Penetration Test, Dynamic Cone Penetration Test, Static Cone Penetration Test, Test using pressure meter, field vane shear test), preparation of soil investigation report.	**CO1**	**(06)**
Unit 2	**Stability of slopes:** Slope failure basis of analysis, types of slope failure, stability of an infinite slope of cohesive and cohesion less soils, wedge failure, Culmann's method, Taylor's stability number, Bishop's method, Swedish circle method, concept of friction circle method, improving stability of slopes.	**CO2**	**(06)**
Unit 3	**Bearing capacity of shallow foundations:** Definitions, Rankine's analysis, Prandtl's analysis, Terzaghi's bearing capacity theory, bearing capacity failures, I.S. code method (IS 6403: 2002), effect of various factors on bearing capacity (size & shape, depth, water table, eccentricity), bearing capacity evaluation from plate load test (IS 2911: 2010) and SPT (IS 8009: 1980), foundation settlements, methods of computing settlements, numerical on calculation of ultimate and net bearing capacity.	**CO3**	**(08)**
Unit 4	**Design of shallow foundations:** Types and their selection, Rankine's analysis for minimum depth of foundation, principle of design of footings, assumptions & limitations of rigid design analysis, geotechnical design (numerical) of isolated, combined, strap footing (rigid analysis), raft foundation (elastic analysis), floating foundations – concept.	**CO3**	**(08)**
Unit 5	**Pile foundations:** Types and their Necessity, classification, construction methods of concrete bored piles, driven cast in-situ piles, load carrying capacity based on static analysis for cohesive and cohesion less soils, pile capacity using in- situ penetration tests and pile load test as per (IS 2911: 2010) specifications, negative skin friction, dynamic methods and their limitations, ultimate capacity, settlement of pile groups in sand and clay (IS 2911: 2010) and critical depth method, tension piles.	**CO3**	**(07)**

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Unit 6	**Foundations in difficult subsoil:** General considerations, foundations in expansive soil and collapsible soil, significance of soil reinforcement, techniques of ground improvement – stone columns, vibro-flotation, preloading technique, sand drains, prefabricated vertical drains.	**CO4**	**(05)**

Assignment on each unit

Text Books

1.	Arora K. R., "Soil Mechanics and Foundation Engineering", Standard Publishers (7th Edition). 2019. (All units)
2.	Punmia B. C., "Soil Mechanics and Foundation Engineering", Laxmi Publications (17th Edition). 2018. (Unit 1,4)
3.	Murthy V. N. S., "Soil Mechanics and Foundation Engineering", CBS Publishers & Distributors (1st Edition). 2018. (All Units)
4.	Ranjan G. & Rao A. S., "Basic and Applied Soil Mechanics", New Age International Publishers (3rd Edition). (Unit 1,2)

Reference Books

1.	Dass B. M., "Foundation Engineering", Cengage Learning (7th Edition). 2013. (All Units)
2.	Murthy V.N.S., "Advanced Foundation Engineering", CBS Publishers & Distributors, (1st Edition). 2017. (Unit 4,5,6)
3.	Nayak N. V., "Foundation Design Manual", Dhanpat Rai Publications, (7th Edition). 2018. (Unit 1,3,4,5,6)
4.	Terzaghi K. & Peck Wiley R., "Soil Mechanics in Engineering Practice", Willey India Pvt. Ltd., (3rd Edition). 1996. (All Units)
5.	Relevant Indian Standard Specifications and Codes

Useful Links

1.	https://nptel.ac.in/courses/105/107/105107120/ –NPTEL Course – Civil Engineering – Foundation Engineering – Mahendra Singh, Priti Maheswari and N. K. Samadhiya, IIT Roorkee (All Units)
2.	https://nptel.ac.in/courses/105/105/105105176/ – Foundation Engineering – Koushik Deb, IIT Kharagpur (All Units)
3.	https://nptel.ac.in/courses/105/105/105105185/ –NPTEL Course – Civil Engineering – Geotechnical Engineering II Foundation Engineering – Dilip Kumar Baidya, IIT Kharagpur (Unit 1,2,3)
4.	https://nptel.ac.in/courses/105/101/105101001/ –NPTEL Course – Civil Engineering – Advanced Geotechnical Engineering – B.V.S. Viswanadham, IIT Bombay (All Units)

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	1	2	-	3	2	1	-	-	1	-	-	3	2
CO 2	3	2	2	2	-	2	-	-	-	-	-	3	3
CO 3	3	3	3	2	-	1	-	-	2	-	-	3	3
CO 4	1	1	-	1	3	-	-	-	-	-	-	2	3

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Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	4	4	15
Understand	4	4	15
Apply	4	4	10
Analyse	4	4	10
Evaluate	4	4	10
Create	-	-	-
TOTAL	20	20	60

DEPARTMENT OF CIVIL ENGINEERING
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Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Civil Engineering				
CE3602 : Limit State Design of Concrete Structures				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	03 Hrs

Prerequisite : Strength of Mechanics

Course Outcomes (CO): Students will be able to

CO1	Understand the Stress-Strain Behaviour and Design Philosophies
CO2	Analyse and Design Structural Members for Limit State of Collapse
CO3	Apply Serviceability Criteria and Design Structural Elements.
CO4	Design and Analyse Columns and Footings

	Course Contents	CO	Hours
Unit 1	Introduction: Stress - Strain behaviour of concrete and steel, behaviour of RCC, permissible stresses in steel and concrete, different design philosophies, various limit states, characteristic strength and characteristic load, load factor, partial safety factors, stress block parameters.	**CO1**	**(07)**
Unit 2	Limit state of collapse (flexure): Analysis and design of singly and doubly reinforced rectangular sections, singly reinforced T and L beams.	**CO2, CO3**	**(07)**
Unit 3	a) Limit state of collapse (shear and bond): Shear failure, design of shear reinforcement, bond - types, factors affecting bond resistance, check for development length. b) Limit state of serviceability: deflection criteria, cracking - classification and types of cracks, causes, mechanism, and IS recommendations.	**CO2, CO3**	**(07)**
Unit 4	a) Design of slabs: Cantilever slabs, simply supported one way slab, two way slabs with different support conditions. b) Design of staircase: simply supported single flight staircase and dog legged staircase.	**CO3**	**(07)**
Unit 5	Analysis and design of axially and eccentrically loaded circular and rectangular columns, interaction diagrams, circular column with helical reinforcement.	**CO3**	**(06)**
Unit 6	Design of isolated rectangular column footing with constant depth subjected to axial load and moment, design of combined rectangular footing, introduction to eccentric footing (numerical are not expected).	**CO4**	**(06)**

Text Books

1.	Dr. V. L. Shah and Dr. S. R. Karve , "Limit State Theory and Design of Reinforced Concrete",Standard Publishers (9th Edition) 2023.
2.	Punmia B. C., Jain A. K. and Jain A. K., "RCC Designs", Laxmi Publications (10th Edition). 2015
3.	Jain A. K., "Reinforced Concrete: Limit State Design", (7 th Edition). 2012

Reference Books

1.	Sinha N. C. and Roy S. K., "Fundamentals of Reinforced Concrete", S. Chand Publications (4th edition). 2013 (Unit 1,2,3,4,5,6)
2.	IS 456 - 2000: Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standard, New Delhi.
3.	IS 875 (all parts): Code of practice for Design Loads (other than earthquake) for buildings and structure.

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4.	Varghese P. C., "Limit State Design of Reinforced Concrete", Prentice - Hall of India Pvt. Ltd. (2 nd Edition). 2004 (Unit 1,2,3,4,5,6)
Useful Links	
1.	https://www.youtube.com/watch?v=ba3mZhOpsTM
2.	https://archive.nptel.ac.in/courses/105/105/105105105/
3.	https://onlinecourses.nptel.ac.in/noc22_ce65/preview

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	2	2	3	-	1	-	-	1	-	-	3	1	2
CO 2	1	3	1	-	1	-	-	1	-	-	3	1	2
CO 3	1	2	2	-	1	-	-	1	-	-	3	2	1
CO 4	1	1	2	-	1	-	-	1	-	-	3	2	2

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	20
Understand	5	4	-
Apply	5	4	10
Analyse	-	4	20
Evaluate	5	4	10
Create	-	-	-
TOTAL	20	20	60

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Third Year (Semester – VI) B. Tech. Civil Engineering.

CE3603 : Quantity Surveying and Valuation

Teaching Scheme		**Examination Scheme**	
Lectures	03 Hrs/week	MSE	20
Tutorials	00 Hrs/week	ISE	20
Total Credits	03	ESE	60
		Duration of ESE	02 Hrs 30 Min

Prerequisite: Basic Civil Engineering, Building Planning and Design, AutoCAD.

Course Outcomes (CO): Students will be able to

CO1	Prepare approximate and detailed estimate as per the prevailing standards.
CO2	Perform rate analysis of construction items.
CO3	introduced to the legal aspects of construction contracts
CO4	Explain about basic concepts of tender documents

	Course Contents	**CO**	**Hours**
Unit 1	**Introduction:** Purpose of quantity estimates, Role of a quantity surveyor in construction projects, Responsibilities and ethics in quantity surveying, Measurement rules and standard codes (IS 1200), various items to be included in estimates, types of estimates, introduction to DSR (District Schedule Rate) and SSR (State Schedule of Rate) CSR (common schedule of rates);	**CO1**	**(06)**
Unit 2	**Specifications:-** Purpose, basic principles and drafting of detailed specifications for materials, quality, workmanship, National Building Code; **Taking out the quantities**: Data required for detailed estimate, measurement sheet and abstract sheet, Long wall - short wall method and centre line method	**CO1**	**(07)**
Unit 3	**Approximate estimates**: Methods for buildings and other civil engineering works; **Detailed Estimates**: Buildings, R. C. C works including bar bending schedule, Determination of earthwork in road.	**CO2, CO3**	**(07)**
Unit 4	**Rate Analysis** : Introduction, Purpose and importance, Factors Affecting the Cost of an Item of Work, Material Quality, labour availability and Productivity, Tools, equipment, and plant usage, overheads and profit. Rate analysis of key construction items: - (earthwork, concrete, masonry, plastering, flooring, roofing, painting, etc.)	**CO3**	**(06)**
Unit 5	**Tenders:** Categories, tender notice, e - procurement, Green Procurement Practices in tendering, preparation and submission of tenders, tenders forms, Opening of tenders, Eligibility of contractors, acceptance of tenders, Work Order, running bills and final bills. **Contracts:** Purpose, Types of contracts namely lump-sum, item rate, percentage rate, cost plus, target, turnkey contracts, conditions of contracts. Introduction to Indian Contract Law and Building conditions. Transferable Developments Rights (TDR)	**CO4**	**(06)**
Unit 6	**Valuation:** Purpose, value, cost and price, different types of values, tenure of land, free hold and lease hold property, depreciation, straight line method, balance declining method and sinking fund method, capitalized value and annualized value of an old building, different methods of valuation, preparation of valuation report.	**CO4**	**(08)**

Text Books

1.	Rangwala S. C., "Elements of Estimating and Costing", Charotar Publishing House (41st Edition). 2019. (All Units)
2.	Dutta B. N., "Estimating and costing", Dhanpat Rai and Sons (28th Edition). 2016. (Unit 1 2 5)
3.	Bhasin P. L. and Chand S., "Quantity Surveying", (3rd Revised Edition). 1987.
4.	Patil B. S. "Civil Engineering Contracts and Estimates", Universities Press Pvt. Ltd. (4th Edition). 2015. (Unit

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	4,5,6)
5.	Birdie G. S., "Estimating and Costing", Dhanpat Rai and Sons (6th Edition). 2005. (Unit 1,2,4,5,6)
6.	Chakraborti M., "Estimating, Costing, Specification & Valuation in Civil Engineering including Computer Estimation", M. Chakraborti Publications (24th Edition). 2010. (All Units)
Reference Books	
1.	Standard specifications volumes I & II (PWD Maharashtra) Government of Maharashtra (GoM). (Unit2)
2	CPWD specifications. (Unit 2,4)
3.	CPWD schedules of rates. (Unit 2,4)
4.	PWD hand book, red book and standard schedule of rates. (Unit 4)
5.	National Building Code of India – Guidelines for regulating the building construction activities. (Unit 6)
Useful Links	
1.	https://www.youtube.com/watch?v=GGikveOcaJw&t=22s (Unit 1,2,4)
2.	https://www.youtube.com/watch?v=b3cG_gSO6gM (Unit 4,5,6)
3.	https://www.youtube.com/watch?v=ofkpm4lhJcg&list=PLWnoy5z_3BObBvFtBlowxM05D-q0VAWEs&index=7 (Unit 1,2,4,5,6)
4.	https://www.youtube.com/watch?v=VVpQSw2fy0Y&list=PLWnoy5z_3BObBvFtBlowxM05D-q0VAWEs&index=7 (Unit 1,2)

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	3	2	3	2	2	2	-	1	-	3	2	-	2
CO 2	3	3	2	2	3	2	-	-	2	2	1	1	-
CO 3	2	2	2	-	-	2	2	-	1	2	-	2	-
CO 4	1	2	2	1	1	2	2	1	-	3	2	2	-

Guideline for Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	20
Understand	5	4	-
Apply	5	4	10
Analyse	-	4	20
Evaluate	5	4	10
Create	-	-	-
TOTAL	20	20	60

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

CE3614 : (Program Elective 01) Advanced Engineering Geology

Teaching Scheme		Examination Scheme		
Lectures	3 Hrs/week	MSE		20
Tutorials	-	ISE		20
Total Credits	3	ESE		60
		Duration of ESE		02 Hrs 30 Min

Pre requisite: Geoscience

Course Outcomes (CO) : Students will be able to

CO1	Understand and apply the knowledge of tectonic and seismic activities in Deccan traps.
CO2	Acquire and apply knowledge of the preliminary geological investigations for civil engineering projects
CO3	Understand various rock mass prosperities for geological investigation of civil engineering sites.
CO4	Apply various rock mass indices for evaluating rock suitability for civil engineering projects

	Course Contents	CO	Hours
Unit 1	**Plate Tectonics and Seismicity** Introduction to the concept of plate tectonics collective explanation of seismic activity, volcanism and continental drift by plate tectonics. Seismic zones of India, seismic activity of Deccan trap region, Reservoir Induced Seismicity (RIS), Tectonic nature of seismic activity of Deccan trap region. RIS and Reservoir Triggered Seismicity (RTS) around Koyna region studies by Borehole Geophysics Research Laboratory (BGRL), Karad	**CO1**	**(07)**
Unit 2	**Groundwater in Relation to Engineering Works.** Systematic groundwater investigation. Occurrence of groundwater in Deccan trap region. Water Pumping Tests: approach and utility, influence of subsurface water in engineering constructions, case study on groundwater problems and its solution	**CO2**	**(05)**
Unit 3	**Application of Rock Mechanics in Engineering** Introduction, relevance of rock mechanics in evaluating rock and rock mass properties, measurement of strength of intact rock, elastic properties of rocks, measurement of stress in underground rocks, estimation of rock mass properties- Porosity, Density, Hydraulic permeability and conductivity, Strength, Slaking and durability, Sonic Velocity as an index to degree of fissuring.	**CO3**	**(07)**
Unit 4	**Rock Mass Classification** Introduction, Engineering rock mass classification: Terzaghi's rock mass classification, Rock quality designation index (RQD), Rock Structure Rating (RSR) Geomechanics Classification: Bieniawski Rock Mass Rating (RMR) system, Geological Strength Index (GSI). Rock Tunnelling Quality Index (Q Index)	**CO4**	**(07)**
Unit 5	**Site Investigation** Introduction, different stages of site investigation, aerial photography interpretation and satellite remote sensing, geophysical exploration, subsoil exploration and sampling of soils, methods of subsoil exploration, exploratory drilling in rocks. Engineering consideration of structural features	**CO2, CO4**	**(06)**
Unit 6	**Engineering Geology considerations for:** **Dam:** Influence of geomorphology and geology in the design of a dam, adverse effects of faults in dam Foundation and its treatment, causative factors of dam disasters, Preliminary investigation and selection of a dam site **Tunnel:** Geological appraisal for tunnels, Selection of options for method of execution - TBM, DBM, Geological inputs for DPR & Feasibility Reports, Design Philosophy for rock support.	**CO2, CO4**	**(08)**

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	Bridge: Supports and foundations of bridges, different aspects of engineering geological investigation of a bridge site, locating a bridge at different reaches of a river, bridge foundation in subsoil in relation to depth of scouring.		

Text Books	
1.	Parbin Singh, 'Engineering & General Geology' S.K.Kataria and Sons., 1997 (All Units)
2.	S. Gangopadhyay 'Engineering Geology' Oxford University Press, 2013 (Unit 1,2,4,5)
3.	N Chenna Kesavulu 'Textbook of Engineering Geology', Laxmi Publications, 2013 (All Units)
Reference Books	
1.	D.K. Todd, 'Groundwater Hydrology', John Wiley & Sons, 1993.(Unit 2)
2.	A. C Waltham, 'Foundations of Engineering Geology', Blackie Academic & Professional, Chapman & Hall, First Edition, 1997. (All Units)
3.	Krynine& Judd, 'Principles of Engineering Geology and Geotechnics', CBS Publishers and Distributors., 2003 (Unit 1,2,4,5)
4.	M.B.Billings, 'Structural Geology', Prentice Hall, INC , 1961 (Unit 1,4)
5.	Bhawani Singh and R.K. Goel, 'Engineering Rock Mass Classification-Tunnelling, Foundations and Landslides'Butterworth-Heinemann Publishers, 2016 ()Unit4
Useful Links	
1.	http://nptel.ac.in/courses/105105106/Dr. DebasisRoy IIT Kharagpur (All Units)
2.	http://nptel.ac.in/courses/105104152/Prof. Javed N. Malik IIT Kanpur (All Units)
3.	http://nptel.ac.in/courses/105104156/Prof. Javed N. Malik IIT Kanpur (All Units)

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	1	-	3	-	2	1	-	-	2	-	-	-	2
CO 2	-	3	1	-	-	-	-	-	-	-	-	1	-
CO 3	-	-	3	1	-	2	-	-	-	-	-	2	-
CO 4	-	1	2	1	-	-	-	-	1	-	-	2	-

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	20
Understand	5	4	-
Apply	5	4	10
Analyse	-	4	20
Evaluate	5	4	10
Create	-	-	-
TOTAL	20	20	60

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Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Civil Engineering				
CE3624: (Program Elective 01) Building Services				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Basic knowledge of plumbing, electrification, fire services.

Course Outcomes (CO): Students will be able to

CO1	Understand the fundamental principles and design of building services.
CO2	Learn about plumbing, electrical, HVAC, fire safety, and vertical transportation systems.
CO3	Analyse energy-efficient and sustainable building services.
CO4	Acquire knowledge about automation and smart building technology.

	Course Contents	CO	Hours
Unit 1	**Plumbing and Water Supply Systems:- Types of plumbing systems:** One pipe and two pipe systems, their advantages and applications. **Water distribution networks:** Pipe materials, jointing methods, water supply fixtures. **Fixtures and appliances:** Selection criteria, installation, and maintenance. **Rainwater harvesting and greywater reuse:** Collection systems, treatment methods, reuse applications. **Wastewater disposal and drainage systems:** Pipe slopes, traps, vent pipes, manholes. **Storm water management:** Drainage design, sustainable urban drainage systems (SUDS).	**CO1**	**(07)**
Unit 2	**Electrical Services:-Basics of electrical wiring:** Wiring systems, circuit components, cable selection. **Single-phase and three-phase systems:** Load balancing, phase considerations. **Electrical load calculations:** Power demand estimation, distribution boards. **Earthing and lightning protection:** Methods, importance in building safety. **Energy-efficient lighting systems:** LED, CFL, smart lighting control systems. **Automation and safety standards:** Smart grids, sensors, IoT-based monitoring.	**CO1** **CO4**	**(07)**
Unit 3	**Heating, Ventilation, and Air Conditioning (HVAC):-Fundamentals of HVAC systems:** Heating and cooling principles, ventilation needs. **Psychrometry:** Properties of air, psychrometric chart, **Types of air conditioning and ventilation systems:** Window, split, centralized, ductless systems. **Energy conservation techniques:** HVAC zoning, thermal insulation, automation.	**CO1** **CO2** **CO4**	**(06)**
Unit 4	**Fire Protection and Safety Systems:-Fire detection and alarm systems:** Smoke, heat, and gas detectors, alarm mechanisms. **Sprinkler systems and fire hydrants:** Design principles, components, water supply considerations. **Smoke control and ventilation systems:** Pressurization, compartmentalization. **Fire safety codes and standards:** NBC, NFPA, IS codes related to fire safety.	**CO1** **CO4**	**(06)**
Unit 5	**Vertical Transportation Systems:-Types of lifts and escalators:** Hydraulic, machine-room-less lifts, moving walkways.	**CO1** **CO3**	**(07)**

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	Design considerations: Capacity, speed, layout planning. **Maintenance and safety standards:** Regular inspections, common failures. **Smart transportation and automation:** IoT-enabled systems, predictive maintenance.	**CO4**	
Unit 6	**Sustainable and Smart Building Services:- Green buildings and rating systems:** LEED, GRIHA certification process **Smart building automation:** IoT-based monitoring, sensor-controlled systems. **Renewable energy integration:** Solar PV, wind energy, geothermal systems. **Case studies of sustainable buildings:** Examples from India and global initiatives.	**CO4**	**(07)**

Text Books	
1.	William H. Severns & Julian R. Fellows, "Heating, Ventilating and Air Conditioning," John Wiley & Sons. (Unit 3)
2.	Fred Hall & Roger Greeno, "Building Services Handbook," Routledge. (All Units)
3.	S. C. Rangwala, "Water Supply and Sanitary Engineering," Charotar Publishing House. (Unit 1)
4.	R. G. Hopkinson & J. D. Kay, "The Lighting of Buildings," Faber & Faber. (Unit 2)
Reference Books	
1.	A.F.C. Sherratt, "Air Conditioning and Energy Conservation," The Architectural Press. (Unit 3)
2.	David V. Chadderton, "Building Services Engineering," Routledge. (Unit 1,2,4)
3.	John Bird, "Electrical and Electronic Principles and Technology," Elsevier. (Unit 2)
4.	M. Kutz, "Handbook of Heating, Ventilation, and Air Conditioning," McGraw-Hill. (Unit 3)
Useful Links	
1.	https://youtu.be/0LNklcBhl_Q?si=8DrnuDQLHaTxfQL3 "HVAC Basics," YouTube (Unit 3)
2.	https://archive.nptel.ac.in/courses/105/102/105102176/ "NPTEL: Air Conditioning and Refrigeration," NPTEL (Unit 3)

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	1	2	2	3	3	1	-	1	-	2	-	3	2
CO 2	2	2	3	3	2	3	2	2	3	2	3	3	2
CO 3	3	1	2	1	-	1	2	3	3	1	-	2	1
CO 4	1	2	2	3	3	2	2	3	3	2	3	2	1

Guideline for Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	20
Understand	5	4	-
Apply	5	4	10
Analyse	-	4	20
Evaluate	5	4	10
Create	-	-	-
TOTAL	20	20	60

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Government College of Engineering, Karad				
Third Year (Semester – VI) B. Tech. Civil Engineering				
CE3634 : (Program Elective 01) Analysis of Indeterminate Structure				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	03 Hrs 00 Min

Prerequisite: Mechanics of Materials, Structural Analysis.

Course Outcomes (CO): Students will be able to

CO1	Analyse energy theorem for statically indeterminate beam, truss and parabolic arch.
CO2	Apply knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection, moment distribution method and Kani's method.
CO3	Determine the effect of support settlements for indeterminate structures.
CO4	Calculate the nodal displacements and member forces by using force and matrix methods.

	Course Contents	CO	Hours
Unit 1	**Energy Theorems:** Bettie's Law, Maxwell's reciprocal theorem, Castiglione's theorem and unit load method. Statically indeterminate beam, truss (lack of fit and temperature variation effect), two hinged parabolic arch with supports at same level.(Degree of S.I. ≤ 2)	**CO1**	**(06)**
Unit 2	**Displacement Method:** Slope deflection method, Modified slope deflection equation application to beams, sinking of supports, portal frames without sway, with sway.	**CO2, CO3**	**(07)**
Unit 3	**Displacement Method:** Moment distribution method: application to beam, sinking of supports, portal frames without sway and with sway	**CO2, CO3**	**(06)**
Unit 4	**Kani's Method:** Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway.	**CO2, CO3**	**(07)**
Unit 5	**Force method:** Clapeyeron's theorem of three moments in continuous beam, sinking of support, beam with different. flexural rigidity.	**CO4**	**(07)**
Unit 6	**Matrix Method:** Flexibility coefficients, development of flexibility matrix, analysis of beams and portals, Stiffness coefficients, development of stiffness matrix, analysis of beams and portals (Degree of S.I. < 2).	**CO4**	**(07)**

Text Books

1.	C. S. Reddy, Basic Structural Analysis, 3rd ed. New Delhi, India: Tata McGraw Hill, 2014.
2.	L. S. Negi and R. S. Jangid, Structural Analysis. New Delhi, India: Tata McGraw Hill.
3.	S. K. Hirde and M. Hedaoo, Theory of Structures. Pune, India: Techmax Publication.

Reference Books

1.	S. P. Timoshenko and D. H. Young, *Theory of Structures*, 2nd ed. New Delhi, India: Tata McGraw Hill, 1965.

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	(Unit- 1)
2.	C. H. Norris, J. B. Wilbur, and S. Utku, *Elementary Structural Analysis*, 1st ed. New Delhi, India: Tata McGraw Hill, 1948. (Unit -2,3)
3.	C. K. Wang, *Indeterminate Structural Analysis*. New Delhi, India: Tata McGraw Hill, 2014, ISBN: 007068135X. (Unit- 2,3,5)
4.	D. Menon, *Structural Analysis*. New Delhi, India: Narosa Publishing House, 2008, ISBN: 8173197504. (Unit- 4)
5.	D. Menon, *Advanced Structural Analysis*. New Delhi, India: Narosa Publishing House, 2009, ISBN: 1842654977. (Unit- 2)
6.	K. U. Muthu, I. Azmi, and M. Janadharn, *Basic Structural Analysis*. New Delhi, India: I. K. International Publishing House Pvt. Ltd., 2011. (Unit- 4)
7.	P. Pandit and S. P. Gupta, *Structural Analysis - Matrix Approach*, 2nd ed. New Delhi, India: McGraw Hill, 2005. (Unit- 5)
8.	J. M. Gere and W. Weaver, *Matrix Analysis of Structures*. Long Grove, IL, USA: Waveland Press, 1994, ISBN: 1577661435. (Unit- 6)
9.	S. B. Junnarkar and H. J. Shah, *Mechanics of Structures (Vol-II)*, 24th ed. Anand, India: Charotar Publishers, 2015. (Unit- 2,3)
10.	V. N. Vazirani and M. M. Ratwani, *Analysis of Structures: Vol. I & II*. New Delhi, India: Khanna Publishers, 2002, ISBN: 8174092056. (Unit- 1,2,3)
Useful Links	
1.	http://www.nptelvideos.in/2012/11/advanced-structural-analysis.html Prof. Devdas Menon
2.	http://www.nptelvideos.in/2012/11/structural-analysis-ii.html Prof. P. Bannerjee

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	3	2	2	-	-	-	-	-	-	-	-	1	1
CO 2	3	2	2	-	-	-	-	-	-	-	-	1	1
CO 3	3	2	2	-	-	-	-	-	-	-	-	1	1
CO 4	3	2	2	-	-	-	-	-	-	-	-	1	1

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	20
Evaluate	5	4	10
Create	-	4	10
TOTAL	20	20	60

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Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Civil Engineering				
CE3644: (Program Elective 01) Traffic Engineering				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Basic knowledge of traffic controlling devices and regulatory signs.

Course Outcomes (CO): Students will be able to

CO1	Illustrate the traffic and its components, factors affecting road traffic for traffic planning.
CO2	Design traffic intersections and signals considering traffic regulations.
CO3	Outline the basic principles behind the design and placement of traffic control devices for traffic management.
CO4	Suggest preventive measures to avoid road accidents by analyzing traffic conditions.

	Course Contents	CO	Hours
Unit 1	Traffic Planning and Characteristics: Road Characteristics-Road user characteristics, Objectives and scope of traffic engineering PIEV theory, Urban Traffic problems in India, Concepts of passenger car units for mixed traffic flow, Sustainable approach- land use & transport and modal integration.	**CO1**	**(07)**
Unit 2	Traffic Surveys: Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Origin Destination Survey, Level of service-Concept, applications and significance.	**CO1 CO4**	**(06)**
Unit 3	Traffic Design and Visual aids:- Intersection Design- Rotary intersection, Signal design, Grade separation, Traffic signs and road markings, Significant roles of traffic control personnel.	**CO1 CO2 CO4**	**(06)**
Unit 4	Traffic Management: Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Congestion and parking pricing, Intelligent Transport System for traffic management.	**CO1 CO4**	**(07)**
Unit 5	Road Environment and Arboriculture: Street Lighting: Methods of light distribution. Definitions- Luminaire, foot candle, Lumen, utilization and maintenance factors, Types of light sources, Arboriculture- Definition, objectives, factors affecting types of selection of trees, maintenance of trees- protection, care of road side trees.	**CO1 CO3 CO4**	**(07)**
Unit 6	Traffic Safety: Road accidents, Types, Causes, effect, Measures to prevent accidents, Reporting and recording of accidents, Collision and condition diagram, Legislation and law enforcement.	**CO4**	**(07)**

Text Books

1.	Kadiyali, L.R., Traffic Engineering & Transport Planning, Khanna Publishers, New Delhi (All Units)
2.	Jotin Khisty, S.C. and Kent Lall, B., Transportation Engineering - An Introduction, Prentice-Hall, NJ (Unit 1,2,3,4)
3.	S.C. Saxena Traffic Planning And Design. Dhanpat Rai Pub, New Delhi. (Unit 2,3,4)

Reference Books

1.	Hutchison, B.G., Introduction to Transportation Engineering, & Planning, McGraw Hill Book Co. (All Units)
2.	John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Pub. Co. (Unit 3,4,5,6)
3.	Vukan R. Vuchic, Urban Public Transportation System & Technology, Prentice Hall, Inc. (Unit 4,6)
4.	Papacostas, C.S., Fundamentals of Transportation System Analysis, PHI (Unit 1,2,3)

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5.	Jotin Khisty, C. and Kent Lall, B., Transportation Engineering - An Introduction, Prentice-Hall, NJ (All Units)
Useful Links	
1.	https://youtu.be/5zKC_aq4ypM?si=-ImKyn3bmj523EAG (Unit 1,2,5)
2.	https://youtu.be/YAEyLOCU-8I?si=cwOziTNqxgxtTJNr (Unit 3,4,5)
3.	https://archive.nptel.ac.in/courses/105/101/105101087/ (All units)

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	1	2	2	3	3	-	1	2	3	2	2	3	1
CO 2	2	2	1	1	2	2	-	1	-	2	-	1	2
CO 3	1	1	2	2	3	-	-	2	1	2	2	3	3
CO 4	3	3	-	-	1	2	1	2	3	2	2	3	1

Guideline for Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	20
Understand	5	4	-
Apply	5	4	10
Analyse	-	4	20
Evaluate	5	4	10
Create	-	-	-
TOTAL	20	20	60

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Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Civil Engineering				
CE3654 : (Program Elective 01) Structural Health monitoring				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Mechanics of Material, Strength of Material

Course Outcomes (CO): Students will be able to

CO1	Understanding Structural Health Monitoring (SHM)
CO2	Assessment of Structural Distress and Material Properties
CO3	Evaluation of Structural Damage Detection and Condition Assessment
CO4	Experimenting different Assessment Methods and Advanced Non-Destructive Testing (NDT) Techniques

	Course Contents	CO	Hours
Unit 1	Structural Health monitoring: Introduction-Necessity of monitoring health of civil engineering and marine structures- Challenges in implementation of SHM scheme in real time scale- various factors that influence the implementation- issues concerning concrete and steel structures.	**CO1**	**(06)**
Unit 2	Distress in load bearing, RCC, steel structures: Damage, source, cause, effects of damage, case studies. Effects of climate, temperature, Corrosion, Strength, Durability and Thermal properties of building materials.	**CO2**	**(06)**
Unit 3	Structural Damage Detection and Condition Assessment Damage detection methods: Model-based and data-driven approaches, Modal analysis and vibration-based damage detection, Life-cycle assessment and predictive maintenance strategies	**CO3**	**(07)**
Unit 4	Damage assessment and Evaluation methods: Damage testing methods, Non-destructive Testing Techniques (NDT), destructive testing method, Core samples.	**CO4**	**(07)**
Unit 5	Fundamental Non-Destructive Testing (NDT) Techniques Introduction to NDT and its role in civil engineering, Rebound Hammer Test, Ultrasonic Pulse Velocity (UPV),Infrared Thermography, Case studies of NDT applications in civil structures	**CO4**	**(07)**
Unit 6	Advanced NDT Techniques for Civil Structures Radiographic Testing (X-ray & Gamma-ray),Ground Penetrating Radar (GPR) for subsurface investigation, Acoustic Emission Testing, Impact-Echo and Spectral Analysis of Surface Waves (SASW), Digital Image Processing for crack detection.	**CO4**	**(07)**

Text Books

1. Phonge B. Doe, "Structural Health Monitoring and Non-Destructive Testing for Civil, Mechanical, and Aerospace Engineering Applications", MDPI Publications (Vol I). Jan2024
2. Magdalena Rucka, "Non-Destructive Testing of Structures", MDPI, 2021

Reference Books

1. Alten F. Grandt, "Fundamentals of Structural Integrity: Damage Tolerant Design and Nondestructive Evaluation", by Jr. Wiley Publishing, 2004 (Unit 1,2,3,4,5,6)
2. D. Huston, "Structural Sensing, Health Monitoring, and Performance Evaluation", Taylor & Francis, 2010 (Unit

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	1,2,3,4,6)
3.	Robert Ratay, "Forensic Structural Engineering Handbook", McGraw-Hill, 2009 (2nd Edition) (Unit 1,2,3)
Useful Links	
1.	https://archive.nptel.ac.in/courses/105/105/105105213/
2.	https://onlinecourses.nptel.ac.in/noc21_ce58/preview
3.	https://onlinecourses.nptel.ac.in/noc22_mm13/preview
4.	https://olsoninstruments.com/test-systems-for-platforms/spectral-analysis-of-surface-waves-s/
5.	https://www.sciencedirect.com/science/article/pii/S1110016817300236
6.	https://www.acuren.com/understanding-acoustic-emissions-testing-and-its-role-in-structural-safety/
7.	https://testbook.com/civil-engineering/ground-penetrating-radar
8.	https://www.asnt.org/what-is-nondestructive-testing/methods/radiographic-testing

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	2	2	3	-	-	-	-	-	-	-	-	1	2
CO 2	1	3	1	-	-	-	-	-	-	-	-	1	2
CO 3	1	2	2	-	-	-	-	-	-	-	-	2	1
CO 4	1	1	2	-	-	-	-	-	-	-	-	2	2

Guideline for Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	20
Understand	5	4	-
Apply	5	4	10
Analyse	-	4	20
Evaluate	5	4	10
Create	-	-	-
TOTAL	20	20	60

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Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Civil Engineering				
CE3605: Environmental Engineering				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basic Chemistry & Environmental Science

Course Outcomes (CO): Students will be able to

CO1	Understand water sources, quality parameters, and supply system components.
CO2	Design water treatment processes, including aeration, coagulation, sedimentation, filtration, and disinfection.
CO3	Analyze sewage characteristics, sewerage systems, and sewage treatment methods.
CO4	Evaluate advanced technologies in water and wastewater treatment

	Course Contents	CO	Hours
Unit 1	**Water Sources and Supply Systems** Sources of water, surface and groundwater sources, quantity and quality of water sources, types of intake works, water quality parameters and significance in water treatment, water quality standards (IS 10500), water demand for domestic and other purposes, factors affecting demand, fluctuations in demand, rate of water consumption, design period and population forecasting methods, components of a water supply system.	**CO1**	**(6)**
Unit 2	**Water Treatment – I** Concept of water treatment and flow diagram of a conventional treatment plant Aeration: Purpose, types of aerators, design of cascade aerator Coagulation & Flocculation: Theory, coagulants, dosing, jar test, flash mixer & mechanical flocculator design Sedimentation: Types of settling, sedimentation tank types, design principles & surface overflow rate. Tube & plate settlers: Concept and applications	**CO1, CO2**	**(7)**
Unit 3	**Water Treatment – II** Filtration: Objectives, filter media, types of filters (slow sand, rapid sand, pressure filters) Design of rapid and slow sand filters, under-drainage system. Disinfection: Objectives, factors affecting disinfection, methods (chlorination chemistry, breakpoint chlorination). Water Softening: Lime-soda process, ion exchange process. Fluoride control: Effect of fluoride, fluoridation & defluoridation techniques	**CO2**	**(7)**
Unit 4	**Sewage Characteristics & Conveyance** Domestic & stormwater: Dry Weather Flow (DWF) and Wet Weather Flow (WWF), Quantity of sewage, sewage flow variations, Characteristics of sewage (Physical, Chemical, Biological), Self-purification of water bodies, DO sag curve, Streeter-Phelps equation, Effluent standards for stream and land disposal (CPCB norms). Sewers: Shapes, design parameters, operation & maintenance, sewer pumping, Sewerage systems and appurtenances, design of sewerage networks.	**CO3**	**(7)**
Unit 5	**Sewage Treatment & Disposal**	**CO3**	**(7)**

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	Overview of sewage treatment plants; Primary Treatment: Screening, grit removal, oil & grease traps, primary settling tanks Secondary Treatment: Aerobic & anaerobic treatment (suspended & attached growth systems), secondary settling tank; Sludge Treatment: Characteristics, thickening, digestion, dewatering & disposal methods; Low-Cost Treatment Methods: Septic tanks, waste stabilization ponds, oxidation ponds, lagoons; Wastewater disposal & reuse strategies.		
Unit 6	**Advanced & Emerging Technologies in Water & Wastewater Treatment** Membrane Filtration: Reverse Osmosis (RO), Ultrafiltration (UF), Microfiltration (MF); Desalination Technologies: Thermal & membrane-based desalination, applications in water-scarce regions; Advanced Oxidation Processes (AOPs): UV/H_2O_2, Ozone, Electrochemical oxidation; Constructed Wetlands & Natural Treatment Systems: Phytoremediation, bio-filtration, green infrastructure solutions; Smart Water Management & IoT Applications: Real-time monitoring, leak detection, automation in treatment plants	**CO4**	**(6)**

Text Books	
1.	B. C. Punmia, A. K. Jain, and A. K. Jain, Environmental Engineering I, Water Supply Engineering, Laxmi Publications Pvt. Ltd., New Delhi, 2018.(unit 1,2,3)
2.	B. C. Punmia and A. K. Jain, Environmental Engineering II, Wastewater Engineering, Laxmi Publications Pvt. Ltd., New Delhi, 2018. (unit 4,5,6)
3.	S. K. Garg, Water Supply Engineering, Khanna Publishers, New Delhi, 2015. (unit 1,2,3)
Reference Books	
1.	Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi, 2014. (unit 4,5,6)
2.	H. S. Peavy, D. R. Rowe, and G. Tchobanoglous, Environmental Engineering, McGraw-Hill International Editions, New York, 1985. (unit 1,2,3)
3.	M. L. Davis and A. Cornwell, Introduction to Environmental Engineering, 5th ed., McGraw-Hill, New York, 2012. (unit 1,2,3)
4.	Ministry of Urban Development, Manual on Water Supply and Treatment, New Delhi, 2005.
5.	Central Public Health and Environmental Engineering Organization, Manual on Sewerage and Sewage Treatment Systems, Part A, B, and C, Ministry of Urban Development, New Delhi, 2010.
Useful Links	
1.	https://nptel.ac.in/courses/105/105/105105201/ NPTEL Course – Civil Engineering – Water Supply Engineering – By Prof. Manoj Kumar Tiwari, IIT Kharagpur
2.	https://nptel.ac.in/courses/105/105/105105048/ NPTEL Course – Civil Engineering – Wastewater Management – By Prof. M. M. Ghangrekar, IIT Kharagpur

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	-	1	-	-	1	2	1	-	2	-	1	3	3
CO 2	2	2	1	2	2	2	1	1	-	-	1	3	3
CO 3	2	2	3	2	-	-	-	1	-	1	2	3	3
CO 4	2	2	3	2	1	-	-	1	-	1	2	3	3

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	20
Understand	5	4	-
Apply	5	4	10
Analyse	-	4	20
Evaluate	5	4	10
Create	-	-	-
TOTAL	20	20	60

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Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Civil Engineering				
CE3606: (MDM IV) Building Services				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Basic Civil Engineering, Building Material and Building Planning and Design.

Course Outcomes (CO): Students will be able to

1.	Identify and draw various plumbing system components and electrical fitting components in buildings.
2.	Knowledge and their application of ventilation systems, thermal insulation and fire resistance system as per National Building Code (SP-7)
3.	Knowledge and their application of acoustics systems in buildings and sound insulation as per NBC (SP-7)
4.	Understand types of vertical circulation and paints in buildings and its suitability in public and residential building.

	Course Contents	Hours
Unit 1	**Plumbing and electrification in buildings** :Plumbing systems, material used for service pipes, valves- function and types, fitting and taps, sanitary fittings- water closet, flushing cistern, wash basin, sink, urinals, traps- types and requirements, rain water harvesting system. Concealed and open wiring, requirements and location of various points, accessories of electrical installation, concept of earthing.	**(05)**
Unit 2	**Ventilation:** - Definition and necessity of ventilation, functional requirement, various system and Selection criteria. Air conditioning: - purpose, classification, principles, systems and various components of the same.	**(05)**
Unit 3	**Fire protection in buildings:** Fire protection precautions, confining of fire, fire hazards, characteristics of fire resisting materials, building materials and their resistance to fire	**(04)**
Unit 4	**Acoustics and Sound Insulation in buildings:** Introduction to acoustics: Absorption of sound, various materials, conditions for good acoustics. Sound Insulation and methods of noise control.	**(04)**
Unit 5	**Thermal insulation and painting in buildings:** - General concept, materials, methods Paints: Different types and application methods.	**(04)**
Unit 6	**Vertical Circulation in the Building:** Stairs: Technical terms, requirements of a good stair, uses, types, ramps, lifts and escalator.	**(04)**

Text Books

1.	Building Design by Shah, Kale, Patki. Tata Mc-Graw Hill Publications. (Edition 2015) (All Units)
2.	Building Construction by B.C. Punmia (Edition 2015) (Unit 1,2,4,5,6)
3.	Building materials and construction by SS Bhavikatti. (All Units)

Reference Books

1.	National Building code SP-7.(Edition 2016) (All Units)
2.	Building Services Handbook by Fred Hall and Roger Greeno (Unit 1,2,4,5)

Useful Links

1.	https://ocw.mit.edu/courses/architecture/4-401-introduction-to-building-technology-spring-2006/lecture-notes/ (Unit 2,3)

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	1	-	-	-	-	1	1	-	1	-	-	2	2
CO 2	2	-	-	-	-	2	2	-	-	-	-	2	2
CO 3	2	-	-	-	-	2	2	-	2	-	-	2	2
CO 4	1	-	-	-	-	1	1	-	-	-	-	2	2

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	5	5	15
Apply	5	5	15
Analyse	-	-	-
Evaluate	-	-	-
Create	5	5	20
TOTAL	20	20	60

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Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Civil Engineering				
CE3607: Mini Project				
Teaching Scheme			**Examination Scheme**	
Practical	02 Hrs/week		ISE	50
Total Credits	01			

Prerequisite : Technical Knowledge

Course Outcomes (CO): Students will be able to

CO1	Perform detail literature survey on the project topic of work.
CO2	Evaluate and analyze impact of a project that focuses on community issues.
CO3	Develop communication and teamwork skills.
CO4	Possess presentation and technical report writing skills.

Course Contents

The main aim of this course is to demonstrate the important attributes like critical thinking, creativity, collaborative efforts and communication skills in students and also to make students aware with the process involved in making product from idea.

Project group consists of a minimum THREE and maximum FIVE students. The group is required to do literature survey, formulate the problem, propose and execute methodology.

The steps involved for completion of mini project includes, but not limited to:

1. Conceptualization of innovative idea through literature and market survey; site visits; interaction with community or industry, socio economic survey etc.
2. Design of product, processes, methods and systems using multidisciplinary knowledge.
3. Fabrication of product, development of software, measurement methods etc.
4. Deployment, implementation and demonstration of project.
5. Presentation of project.

Mini projects shall consist of followings but not limited to Mini experimental work of various techno social issues, computer based analysis and design, structural design, structural audit of various civil engineering works, health monitoring of structures, innovative civil engineering materials, Environmental impact assessment, design of small water supply schemes, irrigation schemes , smart transport system, smart cities, water harvesting, sewerage system, waste management system, etc. related to civil engineering.

Project Report Format

For standardization of the project reports the following format should be strictly followed.

1. Page Size: Trimmed A4
2. Top Margin: 1.00 Inch
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inch
6. Para Text: Times New Roman 12 Point Font
7. Line Spacing: 1.5 Lines
8. Page Numbers: Right Aligned at Footer. Font 12 Point. Times New Roman
9. Headings: Times New Roman, 14 Point Bold Face
10. Certificate: All students should attach standard format of Certificate as described by the department. Certificate

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should be awarded to batch and not to individual student. Certificate should have signatures of Guide, Head of Department and Principal/ Director.

11. Index of Report:

a. Title Sheet
b. Certificate
c. Acknowledgement
d. Table of Contents
e. List of Figures
f. List of Tables
g. List of abbreviations

12. References: References should have the following format
13. For Books: "Title of Book", Authors, Publisher, Edition
14. For Papers: "Title of Paper", Authors, Journal/Conference Details, Year

List of Submission

1. Working model of the project
2. Project Report
3. Presentation and demonstration of project in exhibition

Assessment Pattern

The assessment of the project will be done at the end of the semester by a committee consisting of three faculty members from the department along with Project Guide. The students will present their project work before the committee. The presentation of the project shall be of 45min followed by viva voce. The committee members will award the marks to the individual students depending on the group average awarded by the committee.

Each group will submit the copies of the completed project report. One copy will be kept in the departmental library.

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	2	3	1	3	2	1	-	2	2	1	3	3	3
CO 2	2	3	3	2	2	3	2	2	2	2	2	3	3
CO 3	1	2	2	1	1	2	-	3	3	2	2	2	2
CO 4	1	1	2	1	2	1	-	2	3	2	2	2	2

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	-	-
Understand	5	5
Apply	5	5
Analyse	5	5
Evaluate	5	5
Create	5	5
TOTAL	25	25

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Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Civil Engineering				
CE3608: Structural design and drawing I Lab				
Laboratory Scheme:			**Examination Scheme:**	
Practical	2 Hrs/week		**ISE**	**25**
Total Credits	**1**		**ESE**	**25**

Prerequisite: Building planning and drawing, Analysis of structure, Design of steel structure.

Course Outcomes (CO): Students will be able to

CO1	Calculate various loads on steel structures as per IS 800: 2007 and IS 875: 1987.
CO2	Apply different methods of analysis to work out reactive forces in structure.
CO3	Design structural components of buildings according to the response from analysis of structure.
CO4	Prepare working drawings in detail using advanced drafting tools.

Course Contents		CO
Experiment 1	**Design of industrial steel structure.**	
	a. Draw/Collect Architectural/Municipal drawing of industrial steel structure (Plan, Section and Elevation). b. **Load Calculations:** Dead load, Live Load, Wind Load and load combinations as per IS 800: 2007 and IS 875: 1987. Hand calculations of the loads on structural members like purlin, roof truss, gantry girder, column, beam, column base considered in Expt. No.1 a	**CO1** **CO2**
	c. Create a model using the software tool according to the architectural/municipal drawing.	**CO2**
	d. Creating and assigning material and section properties to the members in structure modelled.	**CO2**
	e. Apply loads on members of structure (calculated in Expt. 1b) as per IS 800: 2007 and IS 875: 1987.	**CO2**
	f. Analysis and design by performing Run Analysis command and execution of software and finalization of the design of structural members.	**CO2**
	g. Design of connections.	**CO3**
Experiment 2	Prepare drawings: 1. Structural drawings showing plan, all side elevations and sections reference to arch/municipal drawing. 2. Detailed drawing for purlin, truss, beams, column, column base and connections, one full imperial size drawing sheet. 3. Detailed drawing of Gantry girder and its connections.	**CO4**
Requirement	Computer lab, Structural design software StaadPro, drafting software like AutoCAD.	

List of Submission:	
1.	General arrangement drawing with all geometric details and design consideration.
2.	Design basis report.
3.	Minimum two drawing sheets shall be drawn manually and other drawing sheets shall be drawn by using any drafting software.

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2	2	1	1	3	1	1	2	1	-	3	2	2
CO2	3	3	3	3	3	-	1	2	-	-	2	2	2
CO3	3	3	3	3	3	1	1	2	-	-	2	2	2
CO4	3	3	2	1	3	1	1	3	2	1	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Avg.
Task I	05	05	05
Task II	10	10	10
Task III	10	10	10
ISE	25	25	25

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Government College of Engineering, Karad			
Third Year (Semester – VI) B. Tech. Civil Engineering			
CE3609: Quantity Surveying and Valuation Lab			
Laboratory Scheme:		**Examination Scheme:**	
Practical	2 Hrs/week	**ISE**	**25**
Total Credits	**1**	**ESE**	**25**

Prerequisite: Basic Civil Engineering, Building Planning and Design, AutoCAD, M.S Office.

Course Outcomes (CO): Students will be able to

CO1	prepare quantity estimates for buildings and other civil engineering works
CO2	Calculate the quantity of materials and carry out rate analysis.
CO3	Prepare tender document of construction projects.
CO4	Carry out valuation of immovable properties and rent fixation.

	Course Contents	CO
Assignment 1	Writing detailed specifications for items of work from various civil, engineering works. (each from buildings, roads, irrigation works, water supply and sanitation and sewer from buildings)	**CO1**
Assignment 2	Carry out approximate estimate for G + 1 building by any **two** methods of approximate estimate.	**CO1**
Assignment 3	Prepare a Detailed estimate of RCC G + 1 building and use **M.S. Excel** and **AutoCAD** software.	**CO1, CO2**
Assignment 4	Prepare detailed rate analysis for items of work from various civil engineering works. (At least 10 items).	**CO2**
Assignment 5	Preparation of schedule of reinforcement for RCC work: column and footing.	**CO2**
Assignment 6	Preparation of schedule of reinforcement for RCC work: beams and slabs.	**CO2**
Assignment 7	Preparation of schedule of reinforcement for RCC work: staircase.	**CO2**
Assignment 8	Preparing detailed estimate for civil structures other than building such as culvert, road, embankment, drainage system (any two).	**CO2, CO3**
Assignment 9	Preparing tender notice for construction of G + 1 building for which the detailed estimate is prepared.	**CO3**
Assignment 10	Carrying out valuation and preparing detailed valuation report for residential/ commercial/ industrial buildings using standard format.	**CO4**

List of Submission:

1. Minimum number of Experiments : 8

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	3	1	2	2	-	-	-	3	2	-	-
CO2	3	2	2	1	2	1	-	-	2	3	2	-	-
CO3	2	2	2	1	1	2	2	1	2	3	1	2	1
CO4	3	2	2	1	2	3	-	-	2	3	2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year 2025-26 GCE KARAD

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Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year 2025-26 GCE KARAD

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Department of Civil Engineering
Govt. College of Engineering, Karad.

Government College of Engineering, Karad				
Third Year (Sem –VI) B. Tech. Civil Engineering				
CE 3610 : (Program Elective 01 Lab) Advanced Engineering Geology Lab				
Laboratory Scheme:			**Examination Scheme:**	
Practical	2 Hrs/week		**ISE**	**25**
Total Credits	**1**			

Prerequisite : Geoscience

Course Outcomes (CO): Students will be able to

CO1	Identify the rocks on microscopic scale
CO2	Create subsurface models using geophysical and drilling techniques
CO3	Utilise various open-source software's for solving engineering geology problems
CO4	Understand ongoing research in the field of Engineering Geology

Course Contents		CO
Experiment 1	Optical Mineralogy: Identification of Common rock forming Minerals: Quartz, Orthoclase, Plagioclase Feldspar, Amphibole, Pyroxene, Olivine, Mica	**CO1**
Experiment 2	Optical Petrography: Microscopic Study of Igneous Rocks : Granite, Dolerite, Norite, Gabbro, Basalt	**CO1**
Experiment 3	Optical Petrography: Microscopic Study of Sedimentary Rocks: Sandstone, Limestone, Shale	**CO1**
Experiment 4	Optical Petrography: Microscopic Study of Metamorphic Rocks: Schist, Amphibolite, Gneiss, Quartzite etc	**CO1**
Experiment 5	Optical Petrography: Microscopic Study of Concrete thin sections to identify the reactive mineral phase leading to alkali aggregate reaction	**CO1**
Experiment 6	Borehole logging Problem solving and creating geological sections by LogPlot software or by using Borehole plugging in QGIS Software	**CO2, CO3**
Experiment 7	Electrical Resistivity Survey for hard rock/ groundwater estimation, analysis of data in 1x1D software.	**CO2, CO3**
Experiment 8	Rock Mass Strength Calculation using ORMAS software	**CO2, CO3**
Experiment 9	Slope Stability Analysis by HYRCAN 1.0 Software	**CO3**
Experiment 10	Tunnel Support Analysis by OTSA Software	**CO3**
Experiment 11	3D Structural & Probabilistic Geological Modelling using GemPy Software	**CO3**
Experiment 12	Educational Lab Visit at Borehole Geophysical Research Laboratory (BGRL), Karad	**CO4**

List of Submission:

1.	Minimum number of Experiments : 10

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2	2	-	2	2	1	-	-	1	-	-	1	1
CO2	2	2	-	2	2	-	-	-	-	-	-	1	1
CO3	2	1	-	2	2	2	-	-	2	-	-	1	1
CO4	-	1	-	2	2	-	-	-	-	-	-	1	1

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

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Government College of Engineering, Karad			
Third Year (Sem – VI) B. Tech. Civil Engineering			
CE3620 : (Program Elective 01 Lab) Building Services lab			
Laboratory Scheme:		**Examination Scheme:**	
Practical	2 Hrs/week	**ISE**	**25**
Total Credits	**1**		

Prerequisite : Basic knowledge of plumbing accessories, fixtures, firefighting system, electrical components in building

Course Outcomes (CO): Students will be able to

CO1	Draw plumbing layout for a building.
CO2	Operate fire extinguisher
CO3	Analyse water quality.
CO4	Select correct plumbing fixtures.

Course Contents		CO
Experiment 1	Study and demonstration of plumbing fixtures and layout.	**CO1**
Experiment 2	Analysis of water quality and flow measurement in pipelines.	**CO1**
Experiment 3	Electrical wiring and circuit testing in buildings.	**CO2**
Experiment 4	Performance testing of air conditioning units.	**CO2**
Experiment 5	Fire safety drill and demonstration of alarm systems.	**CO1, CO2**
Experiment 6	Demonstration of lift and escalator operation and safety.	**CO2**
Experiment 7	Energy audit and efficiency analysis of lighting systems.	**CO2**
Experiment 8	Study of building management systems (BMS) and automation.	**CO2, CO3**
Experiment 9	Visit to any public building to observe and understand the fire-fighting system.	**CO3**
Experiment 10	Visit to a public system to understand plumbing network, vertical circulation.	**CO3**

List of Submission:

1.	Minimum number of Experiments : 08

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	1	2	2	3	3	2	1	-	-	1	2	2	3
CO2	2	2	1	1	3	3	1	1	2	-	2	1	3
CO3	3	3	1	1	1	2	-	-	1	3	2	2	1
CO4	3	1	1	1	2	-	1	3	2	3	3	2	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

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Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

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Govt. College of Engineering, Karad.

Government College of Engineering, Karad				
Third Year (Semester – V) B. Tech. Civil Engineering				
CE3630 : (Program Elective 01 Lab) Analysis of Indeterminate Structure Lab				
Laboratory Scheme			**Examination Scheme**	
Practical	02 Hrs/week		**ISE**	**25**
Total Credits	**01**			

Prerequisite : Structural Mechanics, Analysis of Indeterminate structures.

Course Outcomes (CO): Students will be able to

CO1	Analyse energy theorem for statically indeterminate beam, truss and parabolic arch.
CO2	Apply knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection, moment distribution method and Kani's method.
CO3	Determine the effect of support settlements for indeterminate structures.
CO4	Calculate the nodal displacements and member forces by using force and matrix methods.

	Course Contents	CO
Experiment 1	Examples on Castiglione"s theorem and unit load method for statically indeterminate beam.	**CO1**
Experiment 2	Examples on analysis of truss (lack of fit and temperature variation effect) and two hinged parabolic arch with supports at same level.(Degree of S.I. ≤ 2).	**CO2, CO3**
Experiment 3	Examples on analysis of beams, sinking of supports, portal frames with sway and non sway by using slope deflection method.	**CO2, CO3**
Experiment 4	Examples on analysis of beams, sinking of supports, portal frames with sway and non sway by using modified slope deflection method	**CO2, CO3**
Experiment 5	Examples on analysis of beams, sinking of supports, portal frames with sway by using moment distributed method.	**CO2, CO3**
Experiment 6	Examples on analysis of beams, sinking of supports, portal frames with non sway by using moment distributed method.	**CO2, CO3**
Experiment 7	Examples on analysis of beams, sinking of supports, portal frames with sway by using Kani's Method.	**CO2, CO3**
Experiment 8	Examples on analysis of beams, sinking of supports, portal frames with non sway by using Kani's Method.	**CO2, CO3**
Experiment 9	Examples on analysis of beam, beam with different flexural rigidity by using Clapeyeron"s three moment theorem.	**CO4**
Experiment 10	Examples on analysis of beam with sinking of support by using Clapeyeron"s three moment theorem.	**CO4**
Experiment 11	Examples on to develop flexibility coefficient matrix, problems on analysis of beams and portal frames by using flexibility matrix method.	**CO4**
Experiment 12	Examples on to develop stiffness coefficient matrix, problems on analysis of beams and portal frames by using stiffness matrix method..	**CO4**

List of Submission:

1.	Total number of experiments:- 10

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO 1	3	3	2	-	-	-	-	-	-	-	-	1	1
CO 2	3	3	2	-	-	-	-	-	-	-	-	1	1
CO 3	3	3	2	-	-	-	-	-	-	-	-	1	1
CO 4	3	3	2	-	-	-	-	-	-	-	-	1	1

Guideline for Assessment Pattern (with revised Bloom's Taxonomy)

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25	25	25

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Government College of Engineering, Karad			
Third Year (Sem – VI) B. Tech. Civil Engineering			
CE3640 : (Program Elective 01 Lab) Traffic Engineering Lab			
Laboratory Scheme:		**Examination Scheme:**	
Practical	2 Hrs/week	**ISE**	**25**
Total Credits	**1**		

Prerequisite :

Course Outcomes (CO): Students will be able to

CO1	Analyse traffic volume count on at variable time.
CO2	Prepare the report on traffic pattern in specific area, working of traffic signals, causes of accidents in a specific area.
CO3	Suggest appropriate parking system
CO4	Draw collision diagram on accidents.

Course Contents		CO
Experiment 1	Measure the traffic volume in morning peak hour to analyze traffic composition on the road way.	**CO1**
Experiment 2	Measure the traffic volume in morning peak hour to analyze traffic composition at intersection.	**CO1**
Experiment 3	Measure the traffic volume in non-peak hours to analyze traffic composition at intersection.	**CO2**
Experiment 4	Prepare a report of trip generation and trip attraction between two zones on the basis of origin-destination study within area of your town/city.	**CO2**
Experiment 5	To suggest relevant vehicle parking system for your campus along with your recommendations if any in the form of a report.	**CO1, CO2**
Experiment 6	To prepare a report of a field visit to any major road intersection in your locality to identify the type, working of traffic signals along with your recommendations	**CO2**
Experiment 7	Draw the collision diagram for any case study of road accident.	**CO2**
Experiment 8	Prepare a report of a field visit to any road intersection in your locality to identify its type along with its sketch.	**CO2, CO3**
Experiment 9	Draw the collision diagram for any case study of road accident.	**CO3**
Experiment 10	Prepare the report on the causes of accident and preventive measures suggested by you for the situation in practical no. 10	**CO3**

List of Submission:

1.	Minimum number of Experiments : 08

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	1	-	2	2	2	3	-	-	2	3	3	2	1
CO2	3	4	-	-	2	3	2	1	-	2	2	2	3
CO3	2	3	4	-	-	2	2	3	3	2	1	-	2
CO4	3	2	1	-	-	2	1	-	2	2	2	3	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

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Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

DEPARTMENT OF CIVIL ENGINEERING
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Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Civil Engineering				
CE3650 : (Program Elective 01 Lab) Structural Health monitoring lab				
Laboratory Scheme:			**Examination Scheme:**	
Practical	2 Hrs/week		**ISE**	**25**
Total Credits	**1**			

Prerequisite : Mechanics of Material, Strength of Material

Course Outcomes (CO): Students will be able to

CO1	Understand and apply various Non-Destructive Testing (NDT) and Structural Health Monitoring (SHM) techniques for evaluating material and structural integrity.
CO2	Perform hands-on experiments to measure, analyses, and interpret data for detecting cracks, corrosion, and other structural defects.
CO3	Utilize advanced sensors and imaging technologies for damage detection and assessment in different structural components.
CO4	Develop technical reports and recommendations based on experimental findings for real-world structural health evaluation.

Course Contents		CO
Experiment 1	Introduction to NDT and SHM, Overview of NDT methods and SHM techniques Or Introduction of Basics of sensors, transducers, and data acquisition	**CO1**
Experiment 2	Introduction of Image-Based Monitoring for Experimental Analysis Or Use of drones and cameras for structural assessment	**CO1**
Experiment 3	Determine the compressive strength of any two structural elements such as column, beam, slab etc. for damaged or undamaged structure using Rebound Hammer.	**CO1**
Experiment 4	Determine the crack nature of any two structural elements such as column, beam, slab etc. for damaged or undamaged structure using Ultrasonic Pulse Velocity (UPV) Test	**CO2**
Experiment 5	Determine the bond strength of any one structural element such as column, beam, and slab etc. using pull out test.	**CO2**
Experiment 6	Determine the corrosion of reinforcing bar using Half-cell Potentiometer of any two structural elements such as column, beam, slab etc. for damaged or undamaged structure.	**CO1, CO2**
Experiment 7	Determine the size; depth and location of reinforcing bar using Rebar locator of any two structural elements such as column, beam, slab etc. for damaged or undamaged structure.	**CO2**
Experiment 8	Introduction to acoustic emission techniques and use of Acoustic Emission Testing for Crack Detection Or	**CO2**

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	Introduction to Ground Penetrating Radar (GPR) for subsurface investigation Acoustic Emission Testing	
Experiment 9	Determine the depth of carbonation of concrete using phenolphthalein indicator of any two structural elements such as column, beam, slab etc. for undamaged structure.	**CO2, CO3**
Experiment 10	Real-Time Data Collection and Analysis Using LVDT Sensors for Precision Displacement Monitoring	**CO3**
Experiment 11	Prepare a report on damage assessment of residential / non -residential structures such as dams, bridges, industrial buildings etc.	**CO4**
List of Submission:		
1.	Minimum number of Experiments : 06	

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2	2	1	2	2	2	1	-	1	1	1	1	1
CO2	2	2	1	2	2	2	1	-	3	1	1	1	1
CO3	2	1	1	2	2	2	1	-	3	1	1	1	1
CO4	-	1	1	2	2	2	1	-	1	1	1	1	1

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

DEPARTMENT OF CIVIL ENGINEERING ★ GCE KARAD ★ Board of Studies Year 2025-26

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Government College of Engineering, Karad			
Third Year (Sem – VI) B. Tech. Civil Engineering			
CE3611: Environmental Engineering Lab			
Laboratory Scheme:		**Examination Scheme:**	
Practical	2 Hrs/week	**ISE**	**25**
Total Credits	**1**		

Prerequisite : Basic Chemistry & Environmental Science

Course Outcomes (CO): Students will be able to

CO1	Analyze fundamental water quality parameters and assess their significance in water and wastewater treatment.
CO2	Evaluate physical, chemical, and biological characteristics of water and wastewater.
CO3	Apply laboratory techniques to determine treatment requirements and efficiency of water treatment processes.
CO4	Interpret real-world water and wastewater treatment practices through field observations and report findings.

Course Contents		CO
Experiment 1	Determination of pH of water and wastewater.	**CO1**
Experiment 2	Determination of Acidity of water and wastewater.	**CO1**
Experiment 3	Determination of Alkalinity of water and wastewater.	**CO1**
Experiment 4	Determination of Chlorides (Chloride content) of water.	**CO1**
Experiment 5	Determination of Hardness of water.	**CO1**
Experiment 6	Determination of solids: settable, suspended, dissolved, volatile and fixed solids of water and wastewater.	**CO2**
Experiment 7	Determination of optimum coagulant dose for turbidity removal by using jar test.	**CO3**
Experiment 8	Determination of DO of wastewater.	**CO2**
Experiment 9	Determination of BOD of wastewater.	**CO2**
Experiment 10	Determination of COD of wastewater	**CO2**
Experiment 11	Determination of chlorine.	**CO3**
Experiment 12	Prepare a report based on visit to water treatment plant and sewage treatment plant.	**CO4**

List of Submission:

1.	Any 08 (Eight) Experiments
2.	Write-ups of specified Experiments in standard formats
3.	Visit report with details and layout of Water and Wastewater Treatment Plant.

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	-	1	-	-	1	2	1	-	2	-	1	3	3
CO2	2	2	1	2	2	2	1	1	-	-	1	3	3
CO3	2	2	3	2	-	-	-	1	-	1	2	3	3
CO4	2	2	3	2	1	-	-	1	-	1	2	3	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

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Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

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