Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE 3801: Water Resource 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 : Fluid Mechanics

Course Outcomes (CO): Students will be able to

CO1	Understand basic hydrological processes and analysis of precipitation, evaporation, infiltration, and runoff.
CO2	Apply hydrometric methods, runoff modeling, hydrographs, and flood estimation techniques.
CO3	Understand and Evaluate groundwater occurrence and movement, aquifer characteristics, well hydraulics, irrigation practices to assess safe yield and water requirements of crops.
CO4	Analyze and interpret the planning concepts of dams, reservoirs, irrigation systems, hydraulic structures and hydropower systems.

	Course Contents	CO	Hours
Unit 1	**Surface Water Hydrology: Hydrological Process** Introduction to Hydrology, Hydrological cycle, and application of hydrology. Precipitation, Types of Precipitation, measurement, analysis of Precipitation data, mass rainfall curves, intensity-duration curves, and concept of depth area duration analysis, frequency analysis. Elementary concepts of evaporation, transpiration, evapo-transpiration, and infiltration.	**CO1**	**(07)**
Unit 2	**Surface Water Hydrology: Hydrometery** Selection of site, various methods of discharge measurements, Runoff- Factors affecting runoff, rainfall-runoff relationships, runoff hydrograph, unit hydrograph theory, S-curve hydrograph, synthetic unit hydrograph, use of unit hydrograph. **Floods-** Estimation of peak flow, rational formula and other methods, flood frequency analysis, concepts & steps of Gumbells method design floods.	**CO2**	**(07)**
Unit 3	**Ground water hydrology:** Occurrence and distribution of ground water, specific yield of aquifers, movements of ground water, Darcy's law, permeability, safe yield of basin. Hydraulics of well under steady flow condition in confined and unconfined aquifers, specific capacity of a well, well irrigation: tube wells, open wells.	**CO3**	**(06)**
Unit 4	**Irrigation Engineering:** Definition, functions, advantages, and necessity. Water requirement of crops, Soil classification, soil moisture and crop water relationship, factors governing consumptive use of water, principal Indian crops, their season and water requirement, agriculture practices. Cropping pattern, Determination of canal capacities, concept and steps of canal design, Causes of water logging, preventive and curative measures, Lift irrigation schemes - Various components and their design principles (Only concepts).	**CO3**	**(06)**
Unit 5	**Dams and Reservoirs:** Types of dams, selection of site for dams, selection of type of dam, Storage Calculations using mass curves, Area elevation curve & Elevation capacity curve, Control levels, Silting of reservoirs, Control of Losses in reservoirs, Classification of reservoir.	**CO4**	**(07)**
Unit 6	**Introduction to Hydraulic structures:** Types of spillway, energy dissipaters, weirs and barrages, Cross drainage works: need, types, design considerations, General features of Hydro-power, general layouts of different types, Assessment of power potential, main components of Hydro-power schemes.	**CO4**	**(07)**

Submission: Any One

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1.	Assignments
2.	Site visit & report on Meteorological station/Dam/Lift Irrigation.

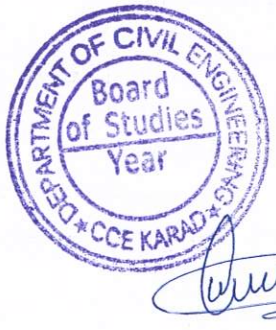
Text Books	
1.	Garg S. K.'Irrigation Engineering and Hydraulic Structures', Khanna Publishers, Delhi 38th Edition Volume -I&II. (Unit 1-6)
2.	Subramanya K. 'Engineering Hydrology', Tata McGraw Hill, New Delhi 3rd Edition. (Unit 1-3)
3.	Raghunath H. M. 'Engineering Hydrology', New Age International Publishers 2nd Edition. (Unit 1-3)
4.	Bansal R. K. 'Fluid Mechanics and Hydraulic Machines' Laxmi Publications 9th Edition. (Unit 6)
Reference Books	
1.	Modi P. N.'Irrigation, Water Resources and Water power Engineering', Standard book house 20th Edition.(Unit 1-6)
2.	Majumdar D. K. , 'Irrigation Water Management (Principles and Practices)' Prentice Hall of India(P),Ltd 2nd Edition. (Unit 1-6)
3.	Asawa G. L. 'Irrigation Engineering' New Age International Publishers 2nd Edition. (Unit 1-4)
4.	Ven Te Chow, 'Applied Hydrology' Tata McGraw Hill, New Delhi.1st Edition.
5.	Dr. Murtaza Ali, 'Land Soil and Water Resources' Koros Press Ltd. 1st Edition. (Unit 1-3)
6.	P. Jaya Rami Reddy, 'Hydrology' Firewall Media 3rd Edition. (Unit 1-3)
7.	Ojha C. S. P., Berndtsson R., and Bhunya P., 'Engineering Hydrology' Oxford 2nd Edition. (Unit 1-3)
8.	Streeter and Wylie, 'Fluid Mechanics' McGraw-Hill International book Co; Auckland 6th Edition. (Unit 6)
9.	Murthy J.V.S., 'Watershed Management in India', Wiley Eastern Publications, Delhi 2nd Editions. (Unit 3-6)
Useful Links	
1.	https://www.youtube.com/watch?v=fx1uUek3Iqg&list=PL2BD2DA229B513E12 NPTEL Course- Civil Engineering- IIT Kanpur-Water Resources Engineering by Prof. R. Srivastav
2.	https://www.youtube.com/watch?v=wkPu4LwRKro&list=PLbMVogVj5nJR5Q4bxVz7ps0O5AVQnuLFT NPTEL Course- Civil Engineering- IIT Bombay-Watershed Management by T. I. Eldho
3.	https://www.youtube.com/watch?v=IphCId7mkhk&list=PLwdnzlV3ogoU-zxx2wMFG_FSDsGKVQ93g Department of Civil Engineering Indian Institute of Technology Guwahati - Prof. Sreeja Pekkat

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	2	2	2	2	1	1	1	1	2	2
CO 2	3	3	3	3	2	2	-	-	1	1	1	2	2
CO 3	3	3	3	3	1	2	-	1	-	2	1	2	2
CO 4	3	2	2	2	1	1	1	-	-	-	1	2	2

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

Knowledge Level	MSE	ISE	ESE
Remember	4	2	15
Understand	4	2	15
Apply	3	3	08
Analyse	3	5	08
Evaluate	3	5	08
Create	3	3	06
TOTAL	20	20	60



Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3802: Design of RCC and pre-stressed 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 : Mechanics of Material, Strength of Mechanics

Course Outcomes (CO): Students will be able to

CO1	Apply limit state design principles to continuous beams, including the concept of moment redistribution.
CO2	Analyze the torsional behavior of RC members and design sections subjected to combined bending, shear, and torsion.
CO3	Design circular and rectangular water tanks using Working Stress Method by interpreting relevant IS code provisions.
CO4	Develop prestressed members for flexure under limit state conditions by applying fundamental concepts of prestressed concrete.

	Course Contents	CO	Hours
Unit 1	Limit State of Collapse: torsion behavior of R.C. rectangular sections subjected to torsion, design of sections subjected to combined bending and torsion, combined shear and torsion	**CO1**	**(07)**
Unit 2	Limit state design of two span continuous beams and three span continuous beams using IS coefficient, concept of moment redistribution	**CO2**	**(06)**
Unit 3	Design of water tank: Introduction to working stress method for water tank design, design criteria, permissible stresses, design of water tank resting on ground using IS code method – (i) circular water tanks with flexible and rigid joint between wall and floor, (ii) rectangular water tanks, introduction to limit state method (LSM), IS 3370	**CO3**	**(07)**
Unit 4	Basic concepts of pre-stressing, historical development, types and systems of pre-stressing, losses of pre-stress in pre tensioned and post tensioned member, flexural strength of pre-stressed concrete sections, introduction to end blocks	**CO4**	**(06)**
Unit 5	Analysis of pre-stressed rectangular and symmetrical I sections, different cable profiles	**CO4**	**(07)**
Unit 6	Design of pre-stressed concrete: rectangular and Symmetrical I sections for following criteria: (i)Design of section for flexure (ii) Design of section for the limit state of collapse in flexure.	**CO4**	**(07)**

Text Books

1.	Shah, V. L.,Karve, S.R.,(2014). Limit State Theory and Design of Reinforced Concrete(8th ed.). Pune: Structures publication. (Unit 1,2)
2.	Punmia B.C. Jain, A.K. Jain, R.C.C. Design (Unit1,2,3)
3.	Sinha, N.C., Roy, S.K., (2013). Fundamentals of Reinforced Concrete (4th ed.). New Delhi: S.Chand publications. (Unit 3)
4.	Jain, A. K.,(2012). Reinforced Concrete: Limit State Design (7th ed.). New Delhi: Nem Chand & brother"s Publication (Unit1,2,3)
5.	Prestressed Concrete, N. Krishna Raju, Mc Graw Hill (Unit 4,5,6)

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Reference Books	
1.	Varghese, P.C.,(2004). Limit State Design of reinforced concrete(2nd ed.). New Delhi:Prentice Hall Publications.
2.	IS 456-2000: Plain and reinforced concrete – code of practice.
3.	IS 875 (part 1): code of practice for design loads (other than earthquake) for buildings and structures. part 1: dead loads-unit weights of building materials and stored materials (second revision).
4.	IS 875 (part 2): code of practice for design loads (other than earthquake) for buildings and structures. part 2: imposed loads (second revision)
5.	IS 1343: 1980,code of practice for pre-stressed concrete.
6.	IS 3370: code of practice concrete structures for the storage of liquids
7.	SP34: 1987,handbook on concrete reinforcement and detailing
Useful Links	
1.	https://www.youtube.com/watch?v=YvNrtgk5jgM, DR. S. Surya Prakash, Department of civil Engineering, IIT Hydrabad
2.	https://www.youtube.com/watch?v=ul45MVUH9bA, Mr Amey R Khedikar Civil Engineering Department, Tulsiramji Gaikwad-Patil College of Engineering and Technology
3.	https://www.youtube.com/watch?v=lrS8b2cCE8Q, Ms. C.G. Konapure Assistant Professor, Civil Engineering Department Walchand Institute of Technology, Solapur
4.	https://www.youtube.com/watch?v=4KYPltsNAWs, Dr. A. K. Segangupta, IIT Madars

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	3	2	1	1	1	-	1	2	3	2
CO 2	3	3	3	3	2	1	-	-	-	1	2	3	2
CO 3	3	2	3	3	2	1	1	1	-	1	2	3	2
CO 4	3	3	3	3	2	1	-	-	-	1	2	3	2

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

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	4	-
Apply	5	4	10
Analyse	2	4	20
Evaluate	3	4	10
Create	5	4	20
TOTAL	20	20	60

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
RM3803: Research Methodology				
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 understanding of core concepts, mathematics, statistics, critical/scientific thinking skills

Course Outcomes (CO): Students will be able to

CO1	Understand fundamentals of research, research process, methods, and methodology.
CO2	Apply research design and problem formulation techniques to solve research problem.
CO3	Analyse data using statistical tools and methods. (use of latest data processing tools)
CO4	Prepare reports, research papers/ following research ethics and publish research in various forms.

	Course Contents	CO	Hours
Unit 1	**Introduction:** Meaning and objective of research, motivations in research, characteristics components of research work, criteria of good research, Research process, type of research, fundamental, pure or Theoretical research, Applied Research, Descriptive Research, Evaluation Research, Experimental research, Survey Research, Qualitative Research, Quantitative Research, interdisciplinary Research.	**CO1**	**(08)**
Unit 2	**Research Design:** Research design, definition, essentials of research design, Research problem steps in research design, good research design, important concepts. Literature review -purpose, sources, and importance, research gap, Objectives – problem statement, Hypothesis,	**CO2**	**(08)**
Unit 3	**Data collection and Analysis:** Sources of data collection, Library sources, E-sources, primary data, secondary data, data collection methods, interviews, questionnaire schedule. Measurement, sampling, scaling - sample design, types of sample design, different scales, sampling error, Normal distribution.	**CO3**	**(06)**
Unit 4	**Data Analysis and tools:** Data processing, Classification, Statistical series, Qualitative vs Quantitative data analyses, Interpretation of data, Hypothesis testing, Measures of central tendency and dispersion, mean, media, mode, range, variance, standard deviation.	**CO3**	**(06)**
Unit 5	**Research Report Writing:** Research report, Different types, contents of report, executive summary, chapterization – contents of chapter, report writing, different report formats, bibliography/references, **Research and publication ethics:** significance of research ethics Ethics, Citation, plagiarism, publishing process journal publication, journal metrics. Use of AI tools in writing research articles. Use of AI Tools	**CO4**	**(07)**
Unit 6	**IPR: Meaning**, nature and scope of Intellectual property (IP), Importance of IPR in engineering, patents, copyrights, trademarks.	**CO4**	**(05)**

List of Submission: Assignment questions on every unit shall be given to students.

Text Books

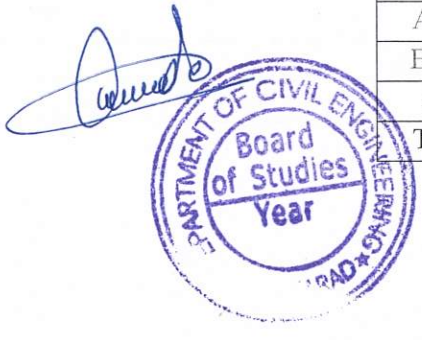
1.	Kothari, C. R., & Garg, G. Research Methodology: Methods and Techniques, 4th ed., New Age International Publishers, New Delhi, 2019. (Units 1, 2, 3 and 4)
2.	Panneerselvam, R. Research Methodology, 2nd ed., PHI Learning Pvt. Ltd., New Delhi, 2013. (Units 1, 2 and 3)
3	Kumar, R. Research Methodology: A Step-by-Step Guide for Beginners, 4th ed., Pearson Education India, New Delhi, 2019. (Units 1 and 2)
4	Malhotra, N. K. Research Methodology: An Applied Orientation, 7th ed., Pearson Education India, New Delhi, 2020. (Units 3 and 4)
5	Pavithra, R. H. Research Methodology and Techniques of Data Analysis, Current Publications, New Delhi, 2023. (Unit 3)
6	Bhandari, M. K. Intellectual Property Rights, 4th ed., Central Law Publications, Allahabad, 2024. (Unit 6)
Reference Books	
1.	B. L. Garg, R. Kavdia, S. Agrawal, and U. K. Agarwal, Research Methodology. Jaipur, India: RBSA Publishers, 2019. (Unit 1 and 2)
2.	D. Deb, R. Dey, and V. E. Balas, Engineering Research Methodology. Singapore: Springer, 2019. (Unit 2)
3.	J. P. Lal, S. Bishla, and D. Singh, Research Methodology and Data Analysis. New Delhi, India: Publishing House, 2023. (Unit 3 and 4)
4	D. Chawla and N. Sondhi, Research Methodology. New Delhi, India: Vikas Publishing House, 2011. (Unit 1, 3 and 4)
5	P. K. Praveena and R. P. Thevannoor, Research Report Writing. New Delhi, India: Bharti Publications, Sept. 24, 2021. (Unit 5)
6	M. Vidhya Sree, M. K. Singh, P. Bisht, and Z. Beevi, Research Methodology and IPR Strategies. New Delhi, India: Technical Publications, 2022. (Unit 6)
Useful Links	
1.	https://youtu.be/1vf8ZvADxfY "Research methodology" by Dr Devika Bhatnagar
2.	https://www.youtube.com/watch?v=lfWlbjl1zzU "Research Methodology" by Prof. Edamana Prasad, Prof. Prathap Haridoss,IIT Madras.
3.	https://www.youtube.com/watch?v=E2gGF1rburw "Research Methodology in Natural Sciences" by Prof. Soumitro Banerjee, Department of Physical Sciences, IISER Kolkata.

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	1	1	1	2	1	1	-	1	1	1	2
CO 2	2	3	2	3	2	2	-	-	1	1	1	1	2
CO 3	2	3	2	3	3	2	-	1	-	2	2	1	1
CO 4	3	2	3	2	3	2	-	-	2	3	2	2	2

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

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



Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3814: Safety Engineering (Program Elective – 02)				
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: Construction materials and methods, awareness of common construction site activities

Course Outcomes (CO): Students will be able to

CO1	Describe basic safety terms, accident causes, and safety regulations.
CO2	Explain site safety programs and safety practices in construction activities.
CO3	Apply safe operating procedures for equipment, materials, and common site hazards.
CO4	Analyze basic risk assessment methods, disaster preparedness measures, and modern safety tools used in construction.

	Course Contents	CO	Hours
Unit 1	**Introduction:** Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents, types of accidents, Domino theory & Human factor theory of accident causation. Safety organization, Safety policy.	**CO1**	**(04)**
Unit 2	**Safety Budget & Safety Regulations:** Planning for safety budget, components of safety budget (PPE, equipment, insurance), cost of accident (direct & indirect), safety culture, introduction to OSHA regulations, role of stakeholders in safety, safety codes related to construction work.	**CO1**	**(04)**
Unit 3	**Site safety programs:** Job hazard analysis, accident investigation and accident indices-violation, penalty, Safety Training and Skill Development Programs, Site Safety Inspections and Safety Checklists, Roles and responsibilities of Safety Officer on site	**CO2**	**(04)**
Unit 4	**Safety in Construction:** Introduction to construction industry and safety issues in construction, Safety in various construction operations, familiarization with relevant Indian Standards and the National Building Code provisions on construction safety, Ergonomics Hazards, occupational hazards	**CO2**	**(05)**
Unit 5	**SoP's (Safe Operating Procedures):** Construction equipment, materials handling-disposal and hand tools, other hazards - fire, confined spaces, Traffic management at construction sites, Chemical and hazardous material handling, electrical safety; BIM and safety	**CO3**	**(04)**
Unit 6	**Risk Assessment, Disaster Preparedness & Modern Safety Practices:** Hazard identification and risk assessment (HIRA), Safety audits and checklists, Disaster preparedness and emergency response, Modern safety technologies: sensors, drones, monitoring apps, IoT-based safety.	**CO4**	**(04)**

List of Submissions:- Assignments & case study

Text Books

1. Jain, R. K., & Rao, S. S., "Industrial Safety, Health and Environment Management Systems", Khanna Publishers, 2000. (Unit 1, 2 and 5)

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2.	Paul, S. V., "Safety Management System and Documentation Training Programme Handbook", *CBS* Publications, 2019. (Unit 3 and 5)
3.	Krishnan, N.V. "Safety management in Industry", Jaico Publishing House, New Delhi, 1997. (Unit 1 and 4)
4.	Kumamoto, H., "Probabilistic Risk Assessment and Management for Engineers and Scientists", IEEE Press, 2000. (Unit 6)
5.	Melissa A. Bailey, et.al. "Occupational Safety and Health Law Handbook" (2nd ed.), Government Institutes An imprint of The Scarecrow Press, Inc, 2008. (Unit 2)
6.	Dan Petersen, "Techniques of Safety Management: A Systems Approach", American Society of Safety Engineers, 2003. (Unit 3,4 and 6).
Reference Books	
1.	Sharma, S. C., & Kumar, V. Safety, "Occupational Health and Environmental Management in Construction" Khanna Publishers, 2nd Edition, 2013. (Unit 1, 2 and 5)
2.	Lingard, H., & Rowlinson, S. M., "Occupational Health and Safety in construction project management" UK Taylor & Francis, 2005. (Unit 1, 3, 4 and 5)
3.	Reese, C. D., & Eidson, J. V., "Handbook of OSHA Construction Safety and Health" CRC Taylor & Francis Group, 2nd Edition, 2004. (Unit 2, 3, 5 and 6)
List of IS codes	
1.	IS: 1641-1982, "Indian Standard Code of Practice for Fire Safety of Building (General): General Principles of Fire Grading and Classification".
2.	IS: 1643-1988, "Indian Standard Code of Practice for Fire Safety of Buildings (General): Exposure Hazard"
3.	IS: 1644-1988, "Indian Standard Code of Practice For. Fire Safety of Buildings (General): Exit Requirements and Personal Hazard"
4.	IS: 1646-1988. "Indian Standard Code of Practice for Fire Safety of Buildings (General): Electrical Installations"
5.	IS 2171: 1999, "Indian Standard Code of Portable Fire Extinguishers, Dry Powder (Cartridge Type) — Specification"
6.	IS: 12349 – 1988, "Indian Standard Code of Fire Protection - Safety Signs"
Useful Links	
1.	https://www.youtube.com/watch?v=WxyfKNQkj8g,"Safety in construction" by Prof.Uma Maheshwari, Department of Civil Engineering, IIT Delhi.
2.	https://www.youtube.com/watch?v=jFDWlKayrTc, "Industrial Safety Engineering" by Prof.J. Maiti, Department of Industry and systems engineering, IIT Kharagpur.
3.	https://www.youtube.com/watch?v=Bq4hVTJpvKk&t=1s,"Chemical Process Safety" by Prof. Shishir Sinha, Department of Chemical Engineering, IIT Roorkee.

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	-	3	-	-	1	1	1	2	1
CO 2	2	2	2	-	1	3	1	2	-	-	1	3	2
CO 3	2	2	3	2	2	3	-	-	-	2	1	3	3
CO 4	2	3	3	3	2	3	1	-	2	2	2	3	3

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

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

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech. Civil Engineering				
CE3824: Sustainable Engineering (Program Elective – 02)				
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 : Building Material, Transportation Engineering, Environmental Engineering

Course Outcomes (CO): Students will be able to

CO1	Employ principles of sustainable development and the role of civil engineers in sustainable infrastructure.
CO2	Analyse sustainable construction materials and practices based on durability, energy and carbon impact.
CO3	Evaluate sustainable water, energy and transportation systems in the built environment.
CO4	Assess sustainability using policy guidelines and rating systems for infrastructure projects.

	Course Contents	CO	Hours
Unit 1	**Fundamentals of Sustainable Engineering:** Introduction to Sustainability, Evolution of Sustainable Development, Triple Bottom Line: Environmental, Social, Economic, Sustainable Development Goals in Indian Context, Need for Sustainability in Civil Engineering, Ethics, and Long-term Responsibility.	**CO1**	**(04)**
Unit 2	**Sustainable Materials:** Alternative Building Materials (Fly Ash Bricks, AAC Blocks, Bamboo, SMB), Recycled Concrete and Recycled Aggregates, Green Materials (Geopolymers, SCMs), Durability Aspects of Sustainable Materials.	**CO2**	**(04)**
Unit 3	**Energy and Carbon in the Built Environment:** Climate-Responsive Architecture, Passive Solar Design Techniques, Basics of Building Energy Simulation, Net-Zero Energy and Net-Zero Carbon Building Concepts.	**CO3**	**(04)**
Unit 4	**Water Resource Sustainability:** Sustainable Urban Drainage Systems (SuDS), Rainwater Harvesting: Principles and Design, Greywater Recycling Techniques, Decentralised Wastewater Treatment.	**CO3**	**(04)**
Unit 5	**Sustainable Transportation:** Introduction to Sustainable Mobility, Pavement Life Cycle Assessment, Use of Waste Materials in Roads (Plastic, Rubber, Recycled Aggregates), Green Highway Corridor Construction & Maintenance Practices,	**CO3**	**(04)**
Unit 6	**Policy, Economics & Sustainable Rating Systems:** Sustainability-Related National and International Policies, Basics of Environmental Economics – Externalities, Carbon Pricing and Valuation, Cost–Benefit Analysis for Green Projects, Overview of Rating Systems – GRIHA, IGBC, LEED, Comparative Analysis and Suitability for Indian Infrastructure	**CO4**	**(05)**

Submission

Assignments, case study

Text Books

1.	Kibert, C. J., 'Sustainable Construction: Green Building Design and Delivery', John Wiley & Sons, USA. 4th Edition (Unit1,2,3,6)
2.	Aswathanarayana, U., 'Principles of Sustainable Development', CRC Press, Taylor & Francis Group. 1st Edition (Unit1,6)
3.	Cabeza, L. F. (Ed.), 'Life Cycle Assessment (LCA) and Life Cycle Energy Analysis of Buildings and the Built Environment', Woodhead Publishing. 1st Edition (Unit 2,3,5)
4.	Twidell, J. & Weir, T., ,Renewable Energy Resources, Routledge, Taylor & Francis'. 3rd Edition (Unit 3)

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5.	Garber, N. J. & Hoel, L. A., 'Traffic and Highway Engineering, Cengage Learning'. 5th Edition (Unit 5)
6.	Mays, L. W., 'Water Resources Engineering, John Wiley & Sons'. 2nd Edition (Unit 4)
Reference Books	
1.	International Organisation for Standardisation, 'ISO 14040 Environmental management Life cycle assessment Principles and framework' ISO; Geneva 2nd Edition
2.	International Organisation for Standardisation, 'ISO 14044 Environmental management Life cycle assessment Requirements and guidelines' ISO; Geneva 1st Edition
3.	Intergovernmental Panel on Climate Change, 'Climate Change Assessment Reports' IPCC; Geneva 6th Assessment Report
4.	Szokolay S. V., 'Introduction to Architectural Science: The Basis of Sustainable Design' Architectural Press, Elsevier; Oxford 3rd Edition
5.	Field B. C. and Field M. K., 'Environmental Economics: An Introduction' McGraw-Hill Education; New York 7th Edition
6.	Bureau of Energy Efficiency, 'Energy Conservation Building Code (ECBC)' Ministry of Power, Government of India; New Delhi 2017 Edition
7.	Field B. C. and Field M. K., 'Environmental Economics: An Introduction' McGraw-Hill Education; New York 7th Edition
Useful Links	
1.	http://nptel.ac.in/courses/105/104/105104103/ NPTEL Course-Civil Engineering-IIT Kanpur-Water Resources Engineering by Prof. R. Srivastav
2.	https://onlinecourses.nptel.ac.in/noc21_ce74/preview NPTEL Course-Sustainable Transportation Systems by Prof. Bhola Ram Gurjar-IIT Roorkee (Environmental and Sustainability aspects of transportation)
3.	https://onlinecourses.nptel.ac.in/noc21_ce47/preview NPTEL Course-Sustainable Engineering Concepts and Life Cycle Analysis (Fundamentals of industrial and environmental sustainability)
4.	https://onlinecourses.swayam2.ac.in/arp19_ap75/preview SWAYAM Course-Sustainable Construction Materials and Techniques (Sustainability in construction materials & green building systems)
5.	https://onlinecourses.nptel.ac.in/noc25_ce131/preview NPTEL Course-Sustainable Groundwater Management (Sustainability of water resources systems)
6.	https://onlinecourses.nptel.ac.in/noc26_ce11/preview NPTEL Course-Smart Cities (Sustainable infrastructure, mobility, energy, and urban systems)
7.	https://www.coursera.org/specializations/sustainableinfrastructure Coursera Specialization-Sustainable Infrastructure (Development and sustainability in infrastructure projects)
8.	https://www.asce.org/education-and-events/explore-education/on-demand-courses/engineering-for-a-sustainable-future ASCE On-Demand Course-Engineering for a Sustainable Future (Professional course on sustainable engineering principles and practice)

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	2	1	-	2	2	1	-	1	2	2	1
CO 2	2	2	2	1	2	3	-	-	-	1	1	2	2
CO 3	2	1	3	1	2	2	1	-	1	1	1	2	2
CO 4	1	2	2	-	1	3	-	1	-	2	2	1	2

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

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

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3834: Advanced Design of Concrete Structures (Program Elective – 02)				
Teaching Scheme			**Examination Scheme**	
Lectures	02Hrs/week		ISE	20
Tutorials	-		MSE	20
Total Credits	02		ESE	60
			Duration of ESE	03 Hrs

Prerequisite: Strength of Material, Design of Concrete Structures.

Course Outcomes (CO): Student will be able to:

1.	Apply the basic knowledge of limit state design of RC and structural analysis for design of structural elements.
2.	Design the flat slab and deep beam with codal recommendations.
3.	Formulate appropriate designed sections for chimney and overhead water tanks.
4.	Interpretation of design practices for bunker, silos and box culvert.

	Course Contents	CO	Hours
Unit 1	**Design of Flat Slabs:** Analysis and design of flat slab, Direct design method, Equivalent frame method, detailing of reinforcement as per Codal provisions.	**CO1, CO2**	**(05)**
Unit 2	**Analysis of Deep Beams:** Design of simply supported and continuous deep beam as per Codal provision.	**CO1, CO2**	**(04)**
Unit 3	**Design of Chimney:** Analysis of stresses in RCC chimney- uncracked and cracked sections, Codal provisions, design of chimney.	**CO1, CO3**	**(05)**
Unit 4	**Design of Overhead Water Tanks:** Rectangular and circular water tank with flat bottom, rectangular and circular base slab, flat and dome shaped tank roof, design based on IS 3370.	**CO1, CO3**	**(05)**
Unit 5	**Bunkers and Silos:** Introduction, Design of rectangular bunkers, circular bunkers and silos.	**CO1, CO4**	**(04)**
Unit 6	**Box Culvert:** Introduction to Culvert, difference between bridge and culvert, pressure distribution diagram, types, design of box culvert.	**CO1, CO4**	**(05)**

List of Submission

1.	Minimum one assignment on each unit.

Text Books

1.	V. L. Shah and S.R. Karve, "Limit State Theory and Design", Structures publications,8th edition, 2014 (Unit 1 to 3)
2.	N Krishna Raju, "Advanced Reinforced Concrete Design", CBS publishers and distributors, 2nd edition, 2010 (Unit 1 to 4)
3.	Ramamrutham, "Design of Reinforced Concrete Structures", Dhanpatrai & son's publication,9th edition, 1981 (Unit 3 to 6)

Reference Books

1.	P Purushothaman, "Reinforced Concrete Structural Elements", Mc-Grawhill publishing co.,3 rd. edition, 2004
2.	A. K. Jain, "Reinforced Concrete: Limit State Design",Nem Chand & bros. publications, 7 th edition, 2012
3.	Taylor C Pere, "Reinforced Concrete Chimneys",Laxmi publications,7 th edition, New Delhi
4.	Jones L L & Thomas and Hudson, "Yield Line Analysis of Slabs", Chatto & windus Publisher, London, 1967
6.	Code of practice IS 456-2000, Plain and reinforced concrete
7.	IS 3370: code of practice concrete structures for the storage of liquids.

Useful Links

1.	https://nptel.ac.in/courses/105105104 Prof. J.N. Bandopadhyay, IIT Kharagpur
2.	https://nptel.ac.in/courses/105106224 Prof. S. Suriya Prakash IIT Hydrabad.

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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	1	1
CO 2	3	3	2	1	-	-	-	1	-	-	1	1	1
CO 3	3	3	2	-	1	-	-	1	-	-	1	1	1
CO 4	3	3	2	-	1	-	-	-	-	-	1	1	1

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

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

DEPARTMENT OF CIVIL ENGINEERING
Board of Studies
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CCE KARAD

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3844: Advanced Construction Practices (Program Elective – 02)				
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 : Basics of Civil Engineering, Building Planning and Design, Concrete Technology

Course Outcomes (CO): Students will be able to

CO1	Comprehend the principles and methods of concrete construction, formwork system and energy efficient building practices used in engineering projects.
CO2	Implement appropriate prefabricated construction techniques, ground improvement methods and dewatering for varying site and project conditions.
CO3	Examine composite construction system and advanced formwork techniques with respect to structural performance, constructability, cost and sustainability.
CO4	Assess advanced construction practices and technologies to determine optimal solutions for engineering projects considering safety, economy, environmental impact and energy efficiency.

	Course Contents	CO	Hours
Unit 1	**Concrete construction for Engineering projects:** Selection of equipment's for batching , mixing, transporting, placing and compacting for various types of jobs, safety measures during concreting, special concretes and mortars, concreting under water	**CO1,4**	**(04)**
Unit 2	**Prefabricated Construction:** Planning for pre-casting, Types, Sizes and Economy, Fabrication techniques, selection of equipment for fabrication, transport and erection, quality measures, safety measure during erection.	**CO2,4**	**(04)**
Unit 3	**Ground Improvement and Dewatering Techniques :** Necessity of engineered ground improvement, Reclaimed Soils, soil reinforcement, Grouting Methods, pumping, well points, bored wells, electro-osmosis, vibro-flotation	**CO2,3**	**(04)**
Unit 4	**Composite Construction:** Composite v/s Non Composite Action; Composite Steel-Concrete Construction, types of composite construction, Materials used in composite construction	**CO3,4**	**(04)**
Unit 5	**Temporary Works:** Formwork for R.C.C. wall, slab, beam and column, design features for temporary works, Slip formwork, False work for bridges, Specialty form work- tunnel formwork, table formwork, case studies.	**CO1,3**	**(04)**
Unit 6	**Energy Efficient Buildings:** Introduction, Typical energy flow in buildings, Determining a building's energy performance, energy efficiency measures for buildings, passive solar architecture, HVAC	**CO1,4**	**(04)**

Text Books

1.	Peurifoy R. L, "Construction, Planning, Equipment and methods", McGraw hill book corp., New Delhi 2016. (Unit 1,2)
2.	S.P. Arora & S.P. Bindra, "A Text Book of Building Construction", Dhanpat Rai & Sons, New Delhi 2017. (Unit 1,2)
3.	B.C. Punamia, "Building Construction", Laxmi Publications, New Delhi 2000. (Unit 1,2)
4.	John Newman & Ban Seng Choo, "Advanced Concrete Technology", Elseviern, 1st Edition, 2003 (Unit 1,2)
5.	Dr. P. Purushothamma Raj, "Ground Improvement Techniques", Laxmi Publications (Unit 3)
6.	P. P. Raj,"Ground Improvement Techniques", Laxmi Publications, 2nd Edition, 2016 (Unit 3)
7.	S.K. Duggal "Building Materials", New Age International Publications 2006. (Unit 4,5)
8.	K. N. Jha, "Formwork for Concrete Structures", McGraw-Hill, 1st Edition, 2004 (Unit 5)
9.	Joseph W. Lstiburek, "Building Science and Energy-Efficient Buildings", Building Science Press (Unit 6)

Reference Books

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1.	Edward G. Nawy, "Concrete Construction Engineering Handbook", Edited by CRC Press, 2nd Edition, 2011 (Unit 1,2)
2.	Perry Daneshgari & Heather Moore, "Prefabrication Handbook", MCA-Soft/Construction publishers, 2019 (Unit 2)
3.	Stubbs, handbook of heavy Construction (Unit 1,2)
4.	Edited by John H. (et al.), "Principles and Practice of Ground Improvement", Wiley, 1st Edition, 2015 (Unit 3)
5.	Composite Construction Manual (Unit 4)
6.	"Handbook of Green Building Design and Construction", Sam Kubba (Ed.), Butterworth-Heinemann, 2nd Edition, 2012 (Unit 6)
Useful Links	
1.	https://nptel.ac.in/courses/105106176 Advanced Concrete Technology- by Prof Manu Santhanam, IIT Madras
2.	https://nptel.ac.in/courses/124105013 Building Materials and Composites (NPTEL) - by Prof Sumana Gupta, IIT Kharagpur
3.	https://nptel.ac.in/courses/105108075 Ground Improvement Techniques, IISc Bangalore Dr. G.L. Sivakumar Babu
4.	https://nptel.ac.in/courses/105102195 Sustainable Materials and Green Buildings, IIT Delhi Prof. B Bhattacharjee

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	2	2	-	-	-	2	2	3	3
CO 2	3	3	2	3	2	2	-	-	1	2	2	3	3
CO 3	3	3	3	3	2	3	-	1	-	3	3	3	3
CO 4	3	3	3	3	2	3	-	1	1	3	3	3	3

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 Board of Studies Year CCE KARAD

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech. Civil Engineering				
CE3854 : Advanced Structural Analysis (Program Elective – 02)				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	03 Hrs 00 Min

Prerequisite : Mechanics of Materials, Structural Mechanics

Course Outcomes (CO): Students will be able to

CO1	Analyze the two hinged arches.
CO2	Formulate flexibility and stiffness matrix and analyze the beams by matrix methods.
CO3	Solve statically indeterminate beams and frames using plastic analysis approach.
CO4	Practice SF and BM diagrams for indeterminate structures and understand finite element analysis.

	Course Contents	CO	Hours
Unit 1	**Two Hinged Arches** Introduction – Classification of Two hinged Arches – Analysis of two hinged parabolic arches – Secondary stresses in two hinged arches due to temperature and elastic shortening.	**CO1**	**(05)**
Unit 2	**Flexibility Matrix Method** Basic concepts of flexibility, conditions of equilibrium, indeterminacy of beams and frames, Analysis of beams and frames with 03 unknowns using flexibility matrix method.	**CO2**	**(04)**
Unit 3	**Stiffness Matrix Methods** Introduction to Stiffness matrix methods of analyses using 'system approach' up-to three degree of indeterminacy– Analysis of continuous beams including settlement of supports.	**CO2**	**(05)**
Unit 4	**Plastic Analysis of Structures** Basics of Plastic Analysis, Applications of Static and Kinematic Theorems, Plastic Analysis of Beams and Single-Storey Frames, Mechanism Methods for Determining Collapse Loads.	**CO3**	**(05)**
Unit 5	**Influence Lines for Indeterminate Beams** Introduction – influence line diagram for shear force and bending moment for two span continuous beam with constant and different moments of inertia and propped cantilever beams.	**CO4**	**(04)**
Unit 6	**Finite Element Analysis** Definition of FEM, discretization of materials, 1-D 2-D 3-D elements, CST, LST, analysis of cantilever and simply supported beams using central finite difference method considering five nodes.	**CO4**	**(05)**

List of Submission

1.	Minimum one assignment on each unit.

Text Books

1.	Vazarani and Ratwani, "Structural Analysis" Vol –I &II, Khanna Publishers (Unit 1 to 4)
2.	G.S. Pandit S.P. Gupta, "Structural Analysis" Vol –I &II, Tata McGraw Hill Education Pvt. Ltd(Unit 1 to 4)
3.	K.U. Muthu, "Indeterminate Structural Analysis", I.K. International Publishing House Pvt. Ltd (Unit 5-6)
4.	R. C. Hibbeler, "Structural Analysis", Pearson Education.(Unit 4 to 6)

Reference Books

1.	T. S Thandavamoorthy, "Structural analysis", Oxford university Press.
2.	H. J. Shah and S.B. Junnarkar, "Mechanics of Structures" Vol –II, Charotar Publishing House Pvt. Ltd.
3.	C.S.Reddy, "Basic Structural Analysis", Tata McGraw Hill Publishers.
4.	A.K. Jain, "Advanced Structural Analysis", Nem Chand & Bros.
5.	Steel Construction Manual, AISC, (15th Edition). 2017.

Useful Links

1.	http://nptel.ac.in/courses/105106112/ Prof. Satish Kumar, IIT Madras
2.	http://nptel.ac.in/courses/105106113/ Prof. Satish Kumar, IIT Madras

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

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	1	-	1	1	1
CO 2	3	3	2	1	-	-	-	-	-	-	1	1	1
CO 3	3	3	2	-	1	-	1	2	1	-	1	1	1
CO 4	3	3	2	-	1	-	-	-	-	-	1	1	1

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

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

DEPARTMENT OF CIVIL ENGINEERING
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Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3805: Multi-disciplinary Minor - 05 - Smart Building - II				
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: Building planning and Design, Building Construction Material, Advanced Construction Techniques

Course Outcomes (CO): Students will be able to

CO1	Understand the Definition, Significance, and History of Smart Buildings.
CO2	Apply Knowledge of Smart Materials in Smart Building Design.
CO3	Analyse and implement energy-efficient building envelope designs to minimise energy consumption and enhance building performance.
CO4	Examine Real-World Applications and Case Studies.

	Course Contents	CO	Hours
Unit 1	**Introduction to Smart Buildings** Definition and significance of smart buildings, History, importance and need, merits and demerits of smart building materials. Smart Structure system, Components, Importance of smart structures.	**CO1**	**(4)**
Unit 2	**Smart Building Material** Fundamentals of Smart Materials Types and characteristics of smart materials Property-changing materials- Thermo-chromic, Photochromic, Energy-exchanging materials Piezoelectric, Thermoelectric, Miscellaneous Materials: Shape Memory alloy, optical fiber, Construction chemicals, Sealants etc. Review of material, effect, working principle, advantages and disadvantages, application in Smart Structures, Use of alternative materials for structural steels and rebars.	**CO2**	**(5)**
Unit 3	**Connectivity and IoT in Smart Buildings.** Internet of Things (IoT) in the context of smart buildings, Wireless connectivity and network infrastructure, Interoperability and standardization in smart building systems, Data integration and management in IoT-enabled buildings, Cybersecurity and privacy considerations in connected buildings.	**CO3**	**(4)**
Unit 4	**Sustainable Design Principles in Smart Buildings.** Energy-efficient building envelope design, Passive design strategies for thermal comfort and day lighting, Water conservation and efficient resource management, Sustainable materials and life-cycle assessment in smart building design, Indoor environmental quality and occupant well-being in sustainable buildings.	**CO3**	**(5)**
Unit 5	**Case Studies and Real-world Applications** Examples of successful smart building projects, Innovative technologies and design approaches in practice, Lessons learned and best practices from real-world implementations, Economic and financial considerations for smart building investments, Social and environmental impacts of smart buildings.	**CO4**	**(5)**
Unit 6	**Challenges and Future Trends** Evolving technologies and their impact on smart building design, Regulatory and policy considerations for advancing smart buildings, Resilience and disaster preparedness in smart building design, Human-centred design and occupant engagement in smart buildings, Emerging trends in sustainable and intelligent building design.	**CO4**	**(5)**

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List of Submission: Assignments and case study	
Text Books	
1.	Kibert, C. J., 'Sustainable Construction: Green Building Design and Delivery', John Wiley & Sons, USA. 4th Edition (Unit 1, 4, 5, 6)
2.	Sinopoli, J., 'Smart Building Systems for Architects, Owners and Builders', Butterworth-Heinemann (Elsevier), UK. 2nd Edition (Unit 1, 3, 5)
3.	Sinopoli, J., 'Advanced Technology for Smart Buildings', Artech House, Boston. 1st Edition (Unit 3, 5, 6)
4.	Jadhav, N. Y., 'Green and Smart Buildings: Advanced Technology Options', Springer Nature, Singapore. 1st Edition (Unit 2, 4, 5)
5.	Arora, S. P., Bindra, S. P., 'Building Construction: Materials and Techniques', Dhanpat Rai & Co., New Delhi. Revised Edition (Unit 1, 2)
6.	Duggal, S. K., 'Building Materials', New Age International Publishers, New Delhi. 4th Edition (Unit 2, 4)
7.	Jain, A. K., 'Smart Infrastructure and Sustainable Construction', PHI Learning Pvt. Ltd., New Delhi. 1st Edition (Unit 1, 3, 6)
Reference Books	
1.	Wadhawan, V. K., 'Smart Structures: Blurring the Distinction between the Living and the Nonliving', Oxford University Press, Oxford. 1st Edition
2.	Addington, D. M., Schodek, D. L., 'Smart Materials and New Technologies for Architecture and Design Professions', Architectural Press, Elsevier, UK. 1st Edition
3.	Reddy, B. V. V., Jagadish, K. S., 'Sustainable Building Technologies', Universities Press, Hyderabad, India. 1st Edition
4.	Sinopoli, J., 'Advanced Technology for Smart Buildings', Artech House, Boston. 1st Edition
5.	Kibert, C. J., 'Sustainable Construction: Green Building Design and Delivery', John Wiley & Sons, USA. 4th Edition
6.	O'Donnell, J. T., Maile, T., Rose, C., 'Model-based design and performance optimisation of smart buildings', *Energy and Buildings,* Elsevier
7.	Jain, A., Garg, V., Mathur, J., 'Performance assessment of smart and energy-efficient buildings under Indian climatic conditions', *Energy and Buildings*, Elsevier
8.	Ascione, F., Bianco, N., De Masi, R. F., Vanoli, G. P., 'Energy refurbishment of existing buildings through the use of smart technologies', *Applied Energy*, Elsevier
Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc19_ce40/preview NPTEL Course-Sustainable Materials and Green Buildings
2.	https://onlinecourses.nptel.ac.in/noc25_ar13/preview NPTEL Course-Sustainable Architecture
3.	https://www.wbdg.org/ce/doe/bto/sbtt Smart Building Technology Training Series by US government building technologies office
4.	https://www.coursera.org/specializations/sustainable-design-practices-in-building-design Coursera Specialization-Sustainable Design Practices in Building Design
5.	https://www.coursera.org/learn/green-building-assessment--certification Coursera Course-Green Building Assessment & Certification
6.	https://en.wikipedia.org/wiki/GreenCE GreenCE Online Education Platform for Green Building Courses and Webinars

Mapping of COs and PO

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	1	-	1	-	1	-	-	1	1	2
CO 2	1	3	1	1	-	-	2	-	-	1	2	1	1
CO 3	1	2	2	3	1	-	1	-	-	1	2	2	1
CO 4	1	1	2	2	2	1	-	2	2	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	10
Apply	5	4	10
Analyse	5	4	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3816: Environmental auditing and management system (Program Elective- 03)				
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 : Environmental Engineering

Course Outcomes (CO): Students will be able to

CO1	Explain the concepts, objectives, scope, and regulatory framework of environmental auditing and environmental management systems.
CO2	Interpret and apply environmental management tools such as Environmental Impact Assessment (EIA), Life Cycle Assessment (LCA), and ISO 14001 standards for environmental decision-making.
CO3	Conduct basic environmental audits, analyze environmental performance, and prepare audit reports with appropriate corrective and preventive actions.
CO4	Evaluate sustainable environmental management practices

	Course Contents	CO	Hours
Unit 1	**Introduction to Environmental Auditing:** Introduction, need, and objectives of environmental auditing; benefits and limitations; types of audits—compliance, waste, and risk-based; steps of auditing (pre-audit, on-site, post-audit); role of auditors; overview of Indian environmental legislation—Environmental Protection Act 1986, Water and Air Acts; role of MoEF&CC, CPCB, and SPCB in audits.	**CO1, CO3**	**(06)**
Unit 2	**Environmental Audit Methodology and Reporting:** Audit planning and checklist preparation; data collection and inspection; evaluation of findings; preparation of audit reports; environmental performance indicators; Environmental Statement (Form V); MoEF&CC and CPCB guidelines for audit; follow-up and corrective actions.	**CO2**	**(06)**
Unit 3	**Environmental Impact Assessment (EIA):** Concept, need, and objectives of EIA; stages of EIA—screening, scoping, baseline data, impact prediction, mitigation, and reporting; Environmental Management Plan (EMP); EIA Notification 2006—overview; comparison between EIA and EA; simple case studies from construction and industry.	**CO2**	**(06)**
Unit 4	**Life Cycle Assessment (LCA):** Concept and importance of LCA; stages—goal and scope, inventory, impact assessment, interpretation; applications of LCA in product and process design; benefits and limitations; introduction to ISO 14040 and ISO 14044 standards; simple example of a building material or process LCA.	**CO2, CO3**	**(06)**
Unit 5	**Environmental Management Systems (EMS) and ISO 14001:** Concept and elements of EMS; ISO 14000 family of standards; ISO 14001 structure—policy, planning, implementation, checking, management review; PDCA (Plan–Do–Check–Act) cycle; certification process; integration with ISO 9001 and ISO 45001; internal auditing and continual improvement.	**CO3**	**(06)**
Unit 6	**Sustainable Environmental Management and Case Studies:** Cleaner production, pollution prevention, and waste minimization; Corporate Environmental Responsibility (CER) and Corporate Social Responsibility (CSR); basics of ESG (Environmental, Social, Governance); introduction to sustainability reporting (GRI framework); short case studies of ISO 14001-certified industries and green campus initiatives.	**CO4**	**(06)**

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List of Submission: Assignment and case study	
Text Books	
1.	C. S. Rao, Environmental Pollution Control Engineering, 2nd ed., New Delhi, India: New Age International Publishers, 2006. (Unit 1,2,3)
2.	R. D. Tripathi, Introduction to Environmental Audit, New Delhi, India: Alfa Publications, 2012. (Unit 1,2)
3.	C. Sheldon and M. Yoxon, Environmental Auditing: A Practical Guide to ISO 14000 and EMAS, London, U.K.: Earthscan Publications, 2007. (Unit 2,5,6)
4.	International Organization for Standardization (ISO), ISO 14001:2015 Environmental Management Systems – Requirements with Guidance for Use, Geneva, Switzerland: ISO, 2015. (Unit 5,6)
Reference Books	
1.	Ministry of Environment, Forest and Climate Change (MoEF&CC), Environmental Audit and EIA Guidelines, Government of India, New Delhi, 2018. (Units 2, 3)
2.	G. Woodside and P. Aurrichio, ISO 14001 Auditing Manual, New York, NY, USA: McGraw-Hill, 1999. (Units 2, 5)
3.	G. Gyani and A. Lunia, Planning and Implementation of ISO 14001: Environmental Management System, Jaipur, India: Raj Publishing House, 2000. (Unit 5)
4.	N. L. Nemerow, Industrial Waste Treatment: Contemporary Practice and Vision, Burlington, MA, USA: Elsevier, 2007. (Units 1, 6)
5.	International Organization for Standardization (ISO), ISO 14040:2006 – Environmental Management – Life Cycle Assessment: Principles and Framework, Geneva, Switzerland: ISO, 2006. (Unit 4)
6.	International Organization for Standardization (ISO), ISO 14044:2006 – Environmental Management – Life Cycle Assessment: Requirements and Guidelines, Geneva, Switzerland: ISO, 2006. (Unit 4)
7.	S. Jain, Environmental Management System (NRE133 Course Material), New Delhi, India: Indian Institute of Technology Delhi, 2021. (Units 1, 5, 6)
8.	Department of Civil Engineering, ESO501 – Environmental Management System and Auditing, Kanpur, India: Indian Institute of Technology Kanpur, 2021. (Units 2, 5, 6)
Useful Links	
1.	https://moef.gov.in MoEF&CC – Environmental Audit & EIA
2.	https://cpcb.nic.in Central Pollution Control Board (CPCB)
3.	https://www.iso.org/standards.html ISO Standards Overview (ISO 14001, 14040, 14044)

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	-	-	-	2	2	-	-	-	-	1	-
CO 2	3	2	1	2	2	2	-	-	-	-	-	2	1
CO 3	2	3	2	3	2	-	-	-	-	1	1	3	2
CO 4	1	2	2	-	-	3	3	2	1	2	-	2	2

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

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

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech. Civil Engineering				
CE3826: Disaster Management (Program Elective- 03)				
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: Economics of engineering, engineering materials.

Course Outcomes (CO): Students will be able to

CO1	Describe disaster management concepts, classifications, and global/national frameworks.
CO2	Analyze structural failures and disaster impacts on infrastructure.
CO3	Apply GIS and remote sensing for disaster risk assessment and mitigation.
CO4	Develop disaster preparedness strategies through case studies and simulations.

	Course Contents	CO	Hours
Unit 1	**Introduction to Disaster Management** Concepts, definitions, and scope of disaster management. Classification of disasters into natural and man-made. Overview of disaster risk reduction (DRR) and resilience-building approaches.	**CO1**	**(06)**
Unit 2	**Disaster Risk Reduction Frameworks** International policies and frameworks, including the Sendai Framework and UNDRR guidelines. National disaster management policies and institutional frameworks. Role of government and non-governmental organizations in disaster risk reduction.	**CO1**	**(06)**
Unit 3	**Engineering Approaches for Disaster Resilience** Structural and non-structural mitigation measures, advanced construction materials and techniques, retrofitting and strengthening of existing infrastructure, role of smart technologies in disaster resilience, case studies on resilient infrastructure projects.	**CO2**	**(06)**
Unit 4	**Infrastructure Resilience and Risk Management** Definition and attributes of resilient infrastructure, vulnerability assessment of critical infrastructure, use of GIS and remote sensing in disaster response, design strategies for resilient infrastructure, resilience indicators and performance metrics.	**CO3**	**(06)**
Unit 5	**Policy Frameworks and Sustainable Development** Global and national policies on DRR and resilient infrastructure, integration of sustainability in infrastructure planning, impact of climate change on disaster frequency, introduction of disaster management act 2005, role of public-private partnerships.	**CO3, CO4**	**(06)**
Unit 6	**Case Studies and Lessons from Past Disasters** Analysis of major global and national disasters, their causes, impacts, and response strategies. Discussion on ethical, social, and economic implications of disaster management.	**CO2, CO4**	**(06)**

Text Books

1. B. C. Bhandari, Disaster Education and Management: A Joyride for Students, Teachers, and Disaster Managers, Springer, 2014. (Unit 1,2,4)
2. R. Subramanian, Disaster Management, Vikas Publishing House, 2018. (Unit 3,5,6)
3. T. Ahmed, Disaster Management: Through the New Millennium, Random Publications, 2013. (Unit 1,3,4,5)

Reference Books

1. D. S. Alexander, Principles of Emergency Planning and Management, Oxford University Press, 2015.

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2.	I. Kelman, Disaster by Choice: How Our Actions Turn Natural Hazards into Catastrophes, Oxford University Press, 2020.
3.	P. R. Smith, Environmental Hazards: Assessing Risk and Reducing Disaster, Routledge, 2018.
4.	S. Cutter, Hazards, Vulnerability and Environmental Justice, Routledge, 2012.

Useful Links

1.	https://www.undrr.org/implementing-sendai-framework United Nations Office for Disaster Risk Reduction (UNDRR), "Sendai Framework for Disaster Risk Reduction 2015–2030,"
2.	https://ndma.gov.in/ National Disaster Management Authority (NDMA) India, "National Disaster Management Plan (NDMP),"
3.	https://www.esri.com/en-us/industries/safety-security/geospatial-disaster-management ESRI, "GIS for Disaster Management,"
4.	https://appliedsciences.nasa.gov/what-we-do/disasters NASA, "Remote Sensing for Natural Disasters,"

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	1	3	2	1	1	1	2	2	3	3
CO 2	1	2	2	1	1	2	-	1	-	1	2	1	2
CO 3	2	2	1	2	1	2	2	-	-	2	1	2	1
CO 4	2	1	1	1	2	2	-	-	2	3	2	2	2

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

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

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3836: Remote Sensing and GIS (Program Elective- 03)				
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: Surveying

Course Outcomes (CO): Students will be able to

CO1	Understand the basic principles of remote sensing, EMR interaction, and different types of sensors.
CO2	Explain image errors, corrections, and fundamentals of digital image processing.
CO3	Apply GIS concepts, data types, spatial analysis, and GIS operations.
CO4	Analyze real-world applications of Remote Sensing and GIS in disaster management, water resources, transportation, and urban planning.

	Course Contents	CO	Hours
Unit 1	**Introduction to Remote Sensing**: Concept and definition of Remote Sensing, EMR spectrum, passive and active remote sensing, airborne and space born sensors, energy sources and radiation principles, energy interactions in the atmosphere, energy interactions with earth.	**CO1**	**(06)**
Unit 2	**Error corrections in satellite image:** Factors affecting remote sensing, Bidirectional Reflection Distribution Function (BRDF), Concept of DN. **Sources of Error and respective corrections:** Atmospheric, Geometric, Topography, Radiometric, Material Property and Field of View (FoV).	**CO2**	**(06)**
Unit 3	**Digital Image Processing:** Image enhancement - contrast stretching (linear and non-linear), filtering techniques, edge enhancement, density slicing, thresholding, Vegetation indices (NDVI), NDWI, NDSI, Infrared Index. **Image Classification:** Supervised and Unsupervised Classification, Clustering techniques.	**CO2**	**(06)**
Unit 4	**Geographical Information System (GIS):** Difference between GIS and conventional mapping, Spatial data & non-spatial data (attributes), Raster and Vector data, Database and Database Management, Geo-referencing fundamentals.	**CO3**	**(06)**
Unit 5	**Spatial Data Analysis and GIS Operations:** Buffering, overlay Analysis, clipping, merging, Network Analysis, Terrain and Surface Analysis, land use/land cover mapping, Reclassification. **DEM and GIS Analysis:** Digital Elevation Models and different types of resolutions, quality assessment.	**CO3**	**(06)**
Unit 6	**Applications of Remote Sensing and GIS**: Applications in Natural Disaster- landslides, flood, drought, volcanic hazards, Applications in Transportation Engineering, application in Surface water & watershed studies, applications in Urban planning & infrastructure development.	**CO4**	**(06)**

List of Submission: Assignment and case study

Text Books

1.	Campbell, J. B., & Wynne, R. H. "Introduction to remote sensing" (5th ed.). The Guilford Press,2011. (Unit 1 and 2)

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2.	Lillesand, T., Kiefer, R. W., & Champati Ray, D. P. K., "Remote Sensing and Image Interpretation", Wiley Publisher, 7th Edition, 2022. (Unit 1, 2, 3 and 6)
3.	K.-T. Chang, "Introduction to Geographic Information Systems", 9th ed. New Delhi, India: Tata McGraw-Hill Education, 2018. (Unit 4 and 5)
4.	C. P. Lo and A. K. W. Yeung, "Concepts and Techniques of Geographic Information Systems", 2nd ed. New Delhi, India: Prentice Hall India Pvt. Ltd., 2016. (Unit 4 and 5)
5.	P. R. Vyas, "Remote Sensing and Geographical Information Systems: Basics and Applications", Jaipur, India: Rawat Publications, 2014. (Unit 6)
6.	M. A. Reddy, "Textbook of Remote Sensing and Geographical Information Systems", Hyderabad, India: BS Publications, 2012. (Unit 3 and 6)
Reference Books	
1.	B. Bhatta, "Remote Sensing and GIS", 2nd ed. New Delhi, India: Oxford University Press, 2011. (Unit 1, 2, 3, 4, 5 and 6)
2.	B. C. Panda, "Remote Sensing: Principles and Applications", New Delhi, India: VIVA Books Private Limited, 2014. (Unit 1, 2, 3 and 6)
3.	P. A. Burrough, "Principles of GIS for Land Resource Assessment", Oxford, U.K.: Oxford Publications, 2005. (Unit 4)
4.	D. P. Paine and J. D. Kiser, "Aerial Photography and Image Interpretation". Hoboken, NJ, USA: John Wiley & Sons, Inc., 2012. (Unit 6)
Useful Links	
1.	https://www.youtube.com/watch?v=-4D1-eSEWXw, "Remote sensing & GIS" by Rishikesh Bharti, Department of Civil Engineering, IIT Guwahati.
2.	https://www.youtube.com/watch?v=4Rn0M39HOPU, "Remote Sensing Essentials" by Prof.Arun K. Saraf, Department of Earth Sciences, IIT Roorkee.
3.	https://www.youtube.com/watch?v=ugtEyoggSjM&t=11s, "Basics of Remote sensing, GIS & GNSS technology and their applications" by Dr. Poonam Tiwari, Indian Institute of Remote Sensing, ISRO.

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	-	1	2	1	-	1	1	-	1	3	2
CO 2	2	3	-	2	3	-	1	-	1	1	2	2	2
CO 3	3	3	2	2	3	2	-	1	1	-	2	3	3
CO 4	2	3	3	2	3	3	1	2	2	2	3	3	3

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

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

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

Government College of Engineering, Karad

Final Year (Sem – VIII) B. Tech Civil Engineering

CE3846: Earthquake Engineering (Program Elective- 03)

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 30min

Prerequisite : Mechanics of Material, Strength of Mechanics

Course Outcomes (CO): Students will be able to

CO1	Identify and analyze the fundamentals of structural vibrations and its response on SDOF systems.
CO2	Interpret and evaluate earthquake response spectra and compute design lateral loads for multistory buildings as per standard codes.
CO3	Apply and assess conceptual earthquake-resistant design principles and selection of suitable structural systems.
CO4	Design and detail earthquake-resistant RC and masonry structures as per codal provisions, and recommend appropriate modern seismic protection techniques.

	Course Contents	CO	Hours
Unit 1	Fundamentals of Theory of Vibrations: Free and forced vibrations of single degree of freedom systems (SDOF). Undamped and viscously damped vibrations, equations of motion and solutions.	**CO1**	**(06)**
Unit 2	Response Spectrum Theory: Earthquake response spectrum, tripartite spectrum, construction of design response spectrum, evaluation of lateral loads due to earthquake on multistory buildings as per IS 1893-2002 Part I.	**CO2**	**(06)**
Unit 3	Conceptual design: Planning aspect, load path, stiffness and strength distribution, different structural system, liquefaction and settlement	**CO3**	**(06)**
Unit 4	Earthquake resistant design principles: Design philosophy, behavior of RC building, ductility and ductile detailing of beam and columns using IS 13920.	**CO3**	**(06)**
Unit 5	Masonry Structures: Behavior of unreinforced masonry and reinforced masonry, RC bands, vertical reinforcement, openings, Provisions of IS 4326. Repair and strengthening of masonry and RC members.	**CO4**	**(06)**
Unit 6	Introduction to Earthquake resistant modern techniques: Base Isolation-Elastomeric, sliding, combined. Seismic dampers: Friction dampers, Tuned mass damper (TMD), Visco-elastic dampers.	**CO4**	**(06)**

Text Books

1.	"Earthquake resistant design of structures", Agarwal, Pankaj shrikhande, Manish, PHI Publication (Unit1,2,3)
2.	"Earthquake resistant design of structures", S. K. Duggal, Oxford Publication. (Unit1,2,3,5,6)
3.	Paz, M.,(2004). Structural Dynamics(2nd ed.). New Delhi: CBS Publication. (Unit1,2)
4.	Hosur, V.,(2013).Earthquake Resistance Design of Building Structures(1st ed.). New Delhi: Wiley India Pvt. Ltd. Publication. (Unit 4)
5.	"Earthquake Engineering", C. S. Prakash Rao, PHI (Unit 5)

Reference Books

1.	Chopra, A. K., (2020).Dynamics of Structures(5th ed.). New Delhi:Prentice Hall Publications
2.	Dowrick, D. J.,(2009). Earthquake Resistant Design and Risk Reduction(2nd ed.). New Delhi:John Wiley Publication.
3.	IS 1893-2016 Part I, IS 13920, IS 4326 Bureau of Indian Standards, New Delhi.

Useful Links

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1.	https://www.youtube.com/watch?v=GhmTtLGxPrY, Prof. Manish Kumar, IIT Bombay.
2.	https://www.youtube.com/watch?v=ZqTEz_6dR6s, Dr. Ramnchrala Kumar, IIT Bombay.
3.	https://www.youtube.com/watch?v=XpKAiBAO0Sc, Dr. Ashok Gupta & Dr. T.K. Datta, Department of Civil Engineering, IIT Delhi.

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	1	1	1	1	1	3	3	3
CO 2	3	3	3	3	3	-	1	1	-	1	3	3	3
CO 3	3	2	3	3	3	1	1	1	1	1	3	3	3
CO 4	3	3	3	2	3	-	1	1	-	1	3	3	3

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

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

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

Government College of Engineering, Karad

Final Year (Sem – VIII) B. Tech Civil Engineering

CE3856 : Repair and Rehabilitation of Structures (Program Elective- 03)

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 : Concrete Technology, Building Materials.

Course Outcomes (CO): Students will be able to

CO1	Illustrate fundamentals of maintenance, repair strategies, and causes of deterioration.
CO2	Compute the concrete structure cracks and deteriorations according to essential parameters.
CO3	Identify appropriate repair, rehabilitation, and retrofitting techniques based on structural conditions.
CO4	Comply recent approaches for repairs to special structures and seismic retrofitting of structures.

	Course Contents	CO	Hours
Unit 1	**Introduction** Introduction to Maintenance, repair and rehabilitation, Repair Management, causes of deterioration and durability aspects, Hsolistic Model of Deterioration of RCC: Model I, Model II, Model III, Intrinsic & extrinsic causes and stages of distress, Permeability and Durability aspects of concrete.	**CO1**	**(06)**
Unit 2	**Condition Survey & Non-Destructive Evaluation** Condition survey: objective, stages, flow chart, preliminary inspection, planning stage, visual inspection, field/laboratory testing, principle test methods, considerations for repair strategy.	**CO2**	**(06)**
Unit 3	**Repair Materials** Essential parameters for repair materials, materials for surface preparation, premixed cement concrete/mortars (modified with non-polymeric admixtures/additives), polymer modified mortars and concrete, epoxies and epoxy systems including epoxy mortars/concretes, surface coatings.	**CO3**	**(06)**
Unit 4	**Rehabilitation and Retrofitting Methods** Grouting & crack repair, patch repair, replacement of structurally weak concrete, replacement of spalled and/or delaminated concrete, replacement of carbonated concrete surrounding steel reinforcement, shotcrete, concrete replacement epoxy bonded concrete, silica fume concrete, polymer concrete system.	**CO3**	**(06)**
Unit 5	**Repairs to Special Structures and Special Repairing Techniques** Repairs to Concrete Structures under water, Repairs to Bridges, Repairs to Water Tanks, Repairs to Dams.	**CO4**	**(06)**
Unit 6	**Seismic Retrofitting of Structures** Retrofit of Reinforced Concrete Buildings and Steel Buildings - Retrofit of Foundations - Base Isolation and Energy Dissipation.	**CO4**	**(06)**

List of Submission

1. Visit to a small RCC structure and conduct field test to determine current situation, advise repair and rehabilitation work for degraded elements, and prepare report.
2. Minimum one assignment on each unit.

Text Books

1. P.K. Guha, "Maintenance and Repairs of Buildings", New Central book Agencies Publications, 5th Edition, 2015. (Unit 1, 2, 3)
2. Nayak B. S., "Maintenance Engineering For Civil Engineers" Khanna Publication, 2nd Edition, 2011. (Unit 1, 2, 3)
3. Hutchin B. D., "Maintenance and Repairs of Buildings", Newnes Butterworth Publications, 6th edition, 1975. (Unit 4, 5, 6)
4. Allen R. T. and Edwards S. C., Repair of Concrete Structures, Blakie and Sons, UK, 1987. (Unit 5, 6)

Reference Books

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1.	Raikar R. N., Learning from Failures Deficiencies in Design, Construction and Service - R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
2.	Campbell D., Allen and Roper H., Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991.
3.	Santhakumar A. R., Training Course notes on Damage Assessment and Repair in Low Cost Housing , RHDC-NBO, Anna University, July 1992.
4.	CPWD hand book on Repairs and Rehabilitation of RCC buildings published by DG (Works), CPWD, Government of India (Nirman Bhawan),
Useful Links	
1.	https://nptel.ac.in/courses/105106202 Prof. Radhakrishna G. Pillai IIT Madras.
2.	https://iitb.vlabs.co.in/discipline.html?discipline=Civil_Engineering Virtual Labs IIT Bombay.
3.	https://nptel.ac.in/courses/105105213 Prof. Swati Maitra, Prof. Sriman Bhattacharya, 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	3	3	2	1	-	1	-	1	1	1	1	1	1
CO 2	3	3	2	1	-	1	-	1	1	1	1	1	1
CO 3	3	3	2	-	2	1	1	2	1	2	1	1	1
CO 4	3	3	2	-	2	1	1	2	1	2	1	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

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech. Civil Engineering				
CE3866: Industrial practices in civil engineering (Industry Elective)				
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 :

Course Outcomes (CO): Students will be able to

CO1	Understand project initiation procedures including tendering processes, licensing requirements, project types, and estimation techniques used in construction projects.
CO2	Apply principles of site mobilization, resource planning, and logistics management for effective execution of construction projects.
CO3	Analyze project execution and monitoring activities including planning, scheduling, quality control, billing, supervision, and safety practices.
CO4	Evaluate project completion processes and emerging trends in the construction industry including handover procedures, maintenance practices, RERA, and modern construction technologies.

	Course Contents	CO	Hours
Unit 1	**Paper to ground :** Tendering Process to Bid Awarded, Initial Licensing in case of private work, Types of Project - EPC & FFED	**CO1**	**(06)**
Unit 2	**Block estimation:** preliminary checking and estimation	**CO1**	**(06)**
Unit 3	**Site Mobilization Process** - Layout to labour camp installation, Equipment planning and resource allocation, Site logistics management, Temporary works planning	**CO2**	**(06)**
Unit 4	**Execution & Monitoring :** Checking, Planning & Scheduling, Billing & Measurements & RA Learning, QC & Supervision, Safety	**CO2, CO3**	**(06)**
Unit 5	**Handover & AMC Phase** : Snag list Making, Testing & Commissioning, DLP Period, AMC of agencies	**CO3, CO4**	**(06)**
Unit 6	**Trends In Construction Industry:** Types of Project & Project Funding Strategies, New Software's, New Technology, 3D printing, Private Project Documentation & RERA, Carrier Opportunities	**CO4**	**(06)**

Text Books

1.	**Construction Planning and Management** – P. S. Gahlot and B. M. Dhir, New Age International Publishers.
2.	**Construction Project Management: Theory and Practice** – Kumar Neeraj Jha, Pearson Education.
3.	**Construction Management and Planning** – Sengupta and Guha, Tata McGraw Hill.
4.	**Project Planning and Control with PERT and CPM** – B. C. Punmia and K. K. Khandelwal.

Reference Books

1.	**Project Management: A Systems Approach to Planning, Scheduling and Controlling** – Harold Kerzner.
2.	**Construction Project Management** – Frederick Gould and Nancy Joyce, Pearson Education.
3.	**Construction Management and Economics** – Danny Myers.
4.	**Building Construction** – B. C. Punmia, Laxmi Publications.
5.	**Project Management Body of Knowledge (PMBOK Guide)** – Project Management Institute.
6.	**Estimating and Costing in Civil Engineering** – B. N. Dutta.

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

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	2	1	2	3	-	-	-	1	1	2	2
CO 2	1	2	2	-	1	3	-	1	-	2	2	1	2
CO 3	2	1	2	1	-	2	2	1	-	1	2	2	1
CO 4	2	1	3	1	2	2	1	-	1	1	1	2	2

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

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

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3807 : Structural Design and Drawing II				
Teaching Scheme			Examination Scheme	
Practical	02 Hrs/week		ISE	25
Total Credits	01		ESE	25

Prerequisite : Design of Concrete Structure	
Course Outcomes (CO): Students will be able to	
CO1	Apply the basic knowledge of limit state design of RC and structural analysis for design of structural elements.
CO2	Design and provide detailing of RCC beams columns, slabs, footings and stairs.
CO3	Create design detailing of retaining wall, combined footing and water tank.
CO4	Interpretation of design practices for RC building using software.

	Course Contents
Experiment 1	Design of RC building for gravity loads only, covering all types of structural elements of building, including estimation of steel and concrete quantities. (Maximum two students in a group).
Experiment 2	Design of Any one of following: 1. Retaining wall (cantilever or counter fort type) 2. Design of combined footing 3. Design of water tank resting on ground.
Experiment 3	Design of multistoried RC buildings using software such as STAAD.Pro, STRUD, ETABS, etc

List of Submission:	
1.	1. Required drawing sheets indicating all detailing of structural members. 2. At least one drawing sheet for 2 and 3 experiment each.

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	1	1	-	1	1	1
CO 2	3	3	2	1	-	-	1	1	1	-	1	1	1
CO 3	3	3	2	-	1	-	1	2	1	-	1	1	1
CO 4	3	3	2	-	1	-	1	2	1	-	1	1	1

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

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Avg
Task I	15	15	15	15
Task II	05	05	05	05
Task III	05	05	05	05
ISE	25	25	25	25

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3818: Environmental Auditing and Management Systems Lab (Program Elective- 03 Lab)				
Laboratory Scheme:			Examination Scheme:	
Practical	2 Hrs/week			
Total Credits	**1**		SA	50

Prerequisite : Environmental Science, Sustainability concept,

Course Outcomes (CO): Students will be able to

CO1	Understand regulatory requirements and audit concepts through checklists and compliance reviews.
CO2	Apply EIA, LCA, and ISO 14001 tools in simplified practical contexts.
CO3	Conduct basic environmental audits and prepare structured audit reports.
CO4	Evaluate sustainable environmental management practices using case studies and indicators.

Course Contents

Implementation of following concepts

Guidelines for Experimentation, Presentation, and Report Preparation

1. Pre-Lab Preparation

i. Students shall study the assigned **environmental auditing / EMS / EIA / LCA / sustainability** topic and understand its relevance to:

- a. Environmental compliance and statutory requirements (EPA 1986, Water Act, Air Act)
- b. Environmental auditing objectives, scope, and performance evaluation
- c. Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP)
- d. Life Cycle Assessment (LCA) methodology and applications in civil engineering
- e. Environmental Management Systems (EMS) and ISO 14001 framework
- f. Sustainable environmental management, cleaner production, CSR and ESG concepts

ii. Prepare a list of **key observations, data requirements, indicators, and analysis methods** relevant to each experiment.

iii. Familiarize yourself with applicable **standards, formats, and guidelines**, such as:

- ISO 14001, ISO 14040 & ISO 14044
- CPCB / SPCB audit guidelines
- EIA Notification 2006
- Environmental Statement (Form V)

iv. Ensure adherence to **safety precautions, ethical use of environmental data**, and professional conduct during lab work.

2. Lab Experiment Conduct

i. Follow the **structured methodology** prescribed for each experiment.

ii. Collect, observe, and record data related to:

- Water, air, waste, noise, and energy aspects
- Environmental performance indicators

iii. Apply relevant **environmental management and sustainability frameworks** such as:

- ISO standards
- EIA guidelines
- LCA stages and interpretation

iv. Perform necessary **calculations, assessments, and evaluations** as applicable.

v. Participate actively in discussions with faculty regarding **practical implementation, compliance issues, and real-world challenges**.

vi. Maintain **integrity, transparency, and accuracy** in recording and analyzing data.

3. Presentation Guidelines

i. Each experiment or case study presentation shall include:

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- a. Introduction to the topic and objectives of the experiment
- b. Methodology adopted
- c. Key observations, findings, and interpretation
- d. Environmental implications and compliance status
- e. Recommendations for improvement and sustainability

ii. Use appropriate **visual tools** such as:

- Tables, graphs, flowcharts
- Audit checklists and EMS diagrams

iii. Ensure content is **clear, concise, technically accurate, and logically structured**.

iv. Highlight **practical relevance and applications** in civil engineering and environmental management.

4. Report Writing Guidelines

i. **Introduction**

Brief background of the experiment, objectives, and relevance to environmental auditing and management systems.

ii. **Methodology**

Detailed description of procedures, tools, standards, and frameworks used.

iii. **Observations / Data**

Tabulated data, checklists, indicators, and supporting information.

iv. **Analysis and Discussion**

Interpretation of findings with respect to:

- Legal compliance
- Environmental performance
- Sustainability and best practices

v. **Conclusion and Recommendations**

Summary of results and suggested corrective / preventive actions or sustainability measures.

vi. **References**

Relevant acts, rules, ISO standards, CPCB / MoEF&CC guidelines, and textbooks.

5. Case Study Analysis Guidelines

i. Students shall analyze **one real-world case study** related to:

- a. Environmental audit of an industry or construction project
- b. ISO 14001 certified organization
- c. EIA of infrastructure or industrial projects
- d. Sustainable campus or cleaner production initiative

ii. The case study shall include:

- Organizational profile
- Environmental aspects and impacts
- Compliance and management practices
- Sustainability initiatives and outcomes

iii. Critically evaluate **challenges, effectiveness, gaps, and future improvement measures**.

List of Submission:	
1.	ESG report
2.	Case Study Analysis

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	2	1	1	-	-	2	2	1
CO2	2	2	1	-	1	1	1	1	-	1	2	2	2
CO3	1	2	2	1	2	1	-	1	1	1	2	3	3
CO4	1	2	2	1	2	1	-	1	1	1	2	3	3

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

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech. Civil Engineering				
CE3828: Disaster Management Lab (Program Elective- 03 Lab)				
Laboratory Scheme:			Examination Scheme:	
Practical	2 Hrs/week		ISE	25
Total Credits	1			

Prerequisite: Risk management, health hazard

Course Outcomes (CO): Students will be able to

CO1	Apply disaster management concepts to real-world scenarios
CO2	Analyze disaster risks and infrastructure vulnerability
CO3	Use GIS, mapping, and analytical tools for disaster assessment
CO4	Develop preparedness, mitigation, and resilience strategies

Course Contents		CO
Assignment 1	To study classification of disasters and analyze their impacts on life, property, and infrastructure.	**CO 1**
Assignment 2	To assess disaster risk using hazard identification and vulnerability analysis.	**CO 1**
Assignment 3	To analyze global disaster risk reduction frameworks.	**CO 2**
Assignment 4	To understand national and state-level disaster management mechanisms.	**CO 2, CO3**
Assignment 5	To study engineering solutions for disaster mitigation.	**CO3**
Assignment 6	To understand non-structural approaches in disaster mitigation.	**CO3, CO4**
Assignment 7	To evaluate vulnerability of lifeline infrastructure systems.	**CO3, CO4**
Assignment 8	To introduce GIS and remote sensing tools for disaster analysis.	**CO3**
Assignment 9	To study the role of climate change in disaster occurrence and mitigation.	**CO3**
Assignment 10	To develop disaster response and emergency action plans.	**CO4**
Assignment 11	To analyze real-life disaster events/case studies and extract lessons learned.	**CO4**
Assignment 12	Field visit to a disaster affected area.	**CO4**

List of Submission:

1.	Minimum number of assignments: 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	1	2	-	1	2	1	1	1	1	2	2
CO2	3	2	1	2	1	2	1	2	-	1	1	2	2
CO3	1	3	3	2	1	1	3	3	1	1	1	3	2
CO4	1	3	3	1	1	2	1	1	3	1	2	2	3

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

Guideline for Assessment Pattern:

Skill Level (as per CAS Sheet)	Assi 1	Assi 2	Assi 3	Assi 4	Assi 5	Assi 6	Assi 7	Assi 8	Assi 9	Assi 10	Assi 11	Assi 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

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3838: Remote sensing and GIS Lab (Program Elective- 03 Lab)				
Laboratory Scheme:			Examination Scheme:	
Practical	2 Hrs/week		**ISE**	**25**
Total Credits	**1**			

Prerequisite: Remote Sensing Fundamentals, GIS Fundamentals

Course Outcomes (CO): Students will be able to

CO1	Acquire pre-process satellite data from open-source platforms.
CO2	Explain the fundamental principles of remote sensing, satellite systems, and GIS concepts.
CO3	Apply GIS techniques to create, manage, and analyse spatial and attribute data.
CO4	Perform basic image processing operations such as enhancement, geo-referencing, and classification.

Course Contents		**CO**
Experiment 1	Introduction to Satellite Data. Data browsing on various platforms (Bhuvan/ USGS Explorer etc.)	CO1, CO2
Experiment 2	Create point, line, and polygon layers; basic attribute table creation and editing.	CO3
Experiment 3	Import and export data GIS software to the Auto-CAD or Revit software and mention All the necessary steps used.	CO3
Experiment 4	Geo-reference scanned maps or satellite images using ground control points (GCPs).	CO4
Experiment 5	Digitize the given part of toposheet using software & attribute (Name, area, length, as Per requirements).	CO3
Experiment 6	Generation of thematic maps (contour, drainage, road etc.) in software.	CO3
Experiment 7	Image rectification and Registration	CO4
Experiment 8	Visual image interpretation from aerial photos and/or satellite images.	CO2
Experiment 9	Unsupervised Classification	CO4
Experiment 10	Supervised Classification	CO4
Experiment 11	Preparation of DEM to study geomorphological features and nature of slope.	CO3
Requirement Tools :	Q- GIS Software/ GRASS Software/ ArcGIS Software/ Erdas Imagine Software	

List of Submission:

2.	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	1	-	1	3	-	-	-	-	1	2	2	2
CO2	3	2	-	-	2	1	1	-	-	-	2	3	2
CO3	3	3	2	2	3	2	1	1	1	-	2	3	3
CO4	3	3	2	3	3	2	-	1	1	2	2	3	3

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	Avg
Task I	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
Task III	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

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Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3848 : Earthquake Engineering Lab (Program Elective- 03 Lab)				
Laboratory Scheme:			Examination Scheme:	
Practical	2 Hrs/week		**ISE**	**25**
Total Credits	**1**		**ESE**	-

Prerequisite : Engineering Mechanics

Course Outcomes (CO): Students will be able to

CO1	Understand the dynamic behavior of building frame models under seismic effects.
CO2	Analyze the response of beams and single-story structures subjected to base motion
CO3	Evaluate earthquake induced phenomena such as wave propagation, liquefaction and soil structure interaction.
CO4	Apply software tools to analyze the seismic response of multi-story buildings.

Course Contents		CO
Experiment 1	Experimental studies on three-story shear building frame by model making.	**CO1**
Experiment 2	Dynamics of a one-storied building frame with planar asymmetry subjected to harmonic base motions.	**CO2**
Experiment 3	Dynamics of one-span and two-span beams.	**CO3**
Experiment 4	Earthquake induced waves in rectangular water tanks	**CO3,**
Experiment 5	Seismic wave amplification, liquefaction and soil-structure interactions	**CO3**
Experiment 6	Earthquake analysis of 5 story by using any software. (Etabs, STAAD pro)	**CO4**

List of Submission:

1.	Minimum number of Experiments : 04

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	1	1	-	1	1	1
CO 2	3	3	2	1	-	-	1	1	1	-	1	1	1
CO 3	3	3	2	-	1	-	1	2	1	-	1	1	1
CO 4	3	3	2	-	1	-	1	2	1	-	1	1	1

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

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	Avg
Task I	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year CCE KARAD

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3858: Repair and Rehabilitation of structures Lab (Program Elective- 03 Lab)				
Laboratory Scheme:			Examination Scheme:	
Practical	2 Hrs/week		**ISE**	**25**
Total Credits	**1**		**ESE**	-

Prerequisite : Building Materials and Construction, Strength of Materials

Course Outcomes (CO): Students will be able to

CO1	Identify and document wall cracks and prepare material check lists for repair.
CO2	Analyze damage in non-residential structures and prepare material checklists for building components.
CO3	Apply repair technics and prepare material checklists for building components.
CO4	Estimate repair costs and evaluate the strength of repaired structural members.

Course Contents		CO
Experiment 1	Prepare a list of material requirements and check list for repair of wall cracks as per the damages found.	**CO1**
Experiment 2	Prepare a report on damage assessment of non -residential structures such as dams, bridges, industrial buildings etc.	**CO2**
Experiment 3	Prepare a check list for repair and material requirement for flooring of given structure.	**CO1**
Experiment 4	Prepare a check list for materials required and resources for repair of sanitary unit of the building	**CO1**
Experiment 5	Repair the cracks for a damaged plane concrete member of size of 100 × 100 × 500 mm or 150 × 150 × 750 mm.	**CO3**
Experiment 6	Prepare a budget estimation considering materials, task force, equipment's and methodology for the given damaged structure.	**CO4**
Experiment 7	Determine the flexural strength of repaired beam from Practical No.5.	**CO3**

List of Submission:

1.	Minimum number of Experiments: 05

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	1	1	-	1	1	1
CO 2	3	3	2	1	-	-	1	1	1	-	1	1	1
CO 3	3	3	2	-	1	-	1	2	1	-	1	1	1
CO 4	3	3	2	-	1	-	1	2	1	-	1	1	1

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

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	Avg
Task I	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25

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Government College of Engineering, Karad					
Final Year (Sem – VIII) B. Tech. Civil Engineering					
CE3868: Industrial practices in civil 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	Understand and implement construction documentation, tendering procedures, surveying practices, and layout preparation techniques.
CO2	Apply pre-mobilization planning concepts, resource allocation, and feasibility checking for construction activities.
CO3	Analyze construction execution processes including inspection, monitoring, billing, measurements, and project compliance requirements.
CO4	Evaluate professional practices in the construction industry including RERA documentation, negotiation skills, and development management models.

Course Contents		CO
Experiment 1	To learn and implement documentation and tendering process	**CO 1**
Experiment 2	Practical demonstration of line-out procedures in construction surveying.	**CO 1**
Experiment 3	Conduct survey field work and prepare a site layout drawing.	**CO 1**
Experiment 4	Pre-mobilization planning of construction activities and equipment; checking design feasibility.	**CO 2**
Experiment 5	Inspection and monitoring of activities during pre-execution, execution, and post-execution phases.	**CO3**
Experiment 6	To learn and understand billing and measurement process for government and private clients; subcontractors and suppliers	**CO3**
Experiment 7	To study and understand RERA documentation and regulatory compliance for private projects.	**CO3**
Experiment 8	To learn professional negotiation skills applicable to the construction industry.	**CO4**
Experiment 9	Practical understanding and implementation of development management models for landowners and developers.	**CO4**

List of Submission:	
1.	Minimum number of Experiments: 6

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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	1	2	3	-	-	-	1	1	2	2
CO2	1	2	2	-	1	3	-	1	-	2	2	1	2
CO3	2	1	2	1	-	2	2	1	-	1	2	2	1
CO4	2	1	3	1	2	2	1	-	1	1	1	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	Avg
Task I	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3809: Major Project				
Teaching Scheme			Examination Scheme	
Practical	08 Hrs/week		ISE	100
			ESE	100
Total Credits	04			

Prerequisite : industrial training, mini project

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 THREE students. The group is required to do literature survey, formulate the problem, propose and execute methodology.

The steps involved for completion of 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.

Projects shall consist of followings but not limited to 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.
11. Certificate should be awarded to batch and not to individual student. Certificate should have signatures of Guide, Head of Department and Principal/ Director.

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12. 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

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

List of Submission

1. Working model of the project (if any)
2. Project Report
3. Research paper / Conference paper
4. Presentation and demonstration of project in exhibition
5. Project diary (mandatory): hardcopy diary maintained groupwise with weekly activities record signed by the guide. Need to be presented during the End Semester Examination (ESE)

Assessment Pattern

The internal 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	20	20
Apply	20	20
Analyse	20	20
Evaluate	20	20
Create	20	20
TOTAL	100	100

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Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3811: MOOC I				
Teaching Scheme			Examination Scheme	
Lectures	-		MSE	-
Tutorials	-		ISE	-
Total Credits	3		ESE	100
			Duration of ESE	

Guidelines

- Students must enroll **only in approved MOOC** available on **SWAYAM/NPTEL** platforms.
- The department will provide a **list of eligible and recommended courses** for **8th semester.**
- **Prior approval from the BoS Chairman/ HOD** is mandatory before course enrollment.
- The **final list of enrolled MOOC** will be approved and recorded by the department **before course commencement**.
- Each MOOC must have a **duration of 8–12 weeks**.
- Students may select any **one specialization area** from the following but not limited to:
  Structural Engineering
  Transportation Engineering
  Geotechnical Engineering
  Water Resource Engineering
  Environmental Engineering

- **Students must:**

Attend/view all lecture videos regularly.
Complete and submit all assignments and quizzes on time
Appear for and pass the **final proctored examination** conducted by the MOOC platform.

- **Upon completion**

Submit the **MOOC completion certificate** to the Departmental Coordinator.
The Coordinator will **verify authenticity** and maintain semester-wise records.
Verified certificates will be **forwarded to the Controller of Examinations (COE), GCE Karad.**

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Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3812: MOOC II				
Teaching Scheme			Examination Scheme	
Lectures	-		MSE	-
Tutorials	-		ISE	-
Total Credits	3		ESE	100
			Duration of ESE	

Guidelines

- Students must enroll **only in approved MOOC** available on **SWAYAM/NPTEL** platforms.
- The department will provide a **list of eligible and recommended courses** for **8th semester.**
- **Prior approval from the BoS Chairman/ HOD** is mandatory before course enrollment.
- The **final list of enrolled MOOC** will be approved and recorded by the department **before course commencement**.
- Each MOOC must have a **duration of 8–12 weeks**.
- Students may select any **one specialization area** from the following but not limited to:
  Structural Engineering
  Transportation Engineering
  Geotechnical Engineering
  Water Resource Engineering
  Environmental Engineering

- **Students must:**

Attend/view all lecture videos regularly.
Complete and submit all assignments and quizzes on time
Appear for and pass the **final proctored examination** conducted by the MOOC platform.

- **Upon completion**

Submit the **MOOC completion certificate** to the Departmental Coordinator.
The Coordinator will **verify authenticity** and maintain semester-wise records.
Verified certificates will be **forwarded to the Controller of Examinations (COE), GCE Karad.**

DEPARTMENT OF CIVIL ENGINEERING Board of Studies Year *CCE KARAD*

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech Civil Engineering				
CE3813: Internship (Mode-1)				
Teaching Scheme			Examination Scheme	
Lectures	-		MSE	-
Tutorials	-		ISE	250
Total Credits	12		ESE	250
			Duration of ESE	

Course Outcomes (CO): Students will be able to	
CO1	Apply theoretical and technical knowledge to solve practical problems encountered in industry or research environments.
CO2	Analyze professional challenges and implement appropriate engineering solutions.
CO3	Develop effective teamwork, communication, and project management skills through hands-on experience.
CO4	Demonstrate professional ethics, discipline, and adaptability in real-world engineering contexts.

Guidelines for Semester VII (Mode–2 Internship)

The internship under **Mode–1** is applicable to students opting for a **six-month internship during Semester VIII** of the B. Tech program. This provision facilitates **early industry or research engagement** immediately after the completion of the VII semester. Students must choose either **Mode–1** or **Mode–2** at the beginning of the semester.

The internship shall be of **six months (one full semester) duration**. Students can undertake their internship at:

- **Recognized industries or Organizations** relevant to their specialization.
- **Research institutions or government organizations** such as CSIR, DRDO, ISRO, BARC, CDAC, or reputed universities.
- **Start-ups and innovation centers**.
- **Authorized training centers or industrial partners** having a Memorandum of Understanding (MoU) with the institute.

All internships shall be undertaken **with prior approval** as per the **Institution's Internship Policy**. The internship is **mandatory** and shall be treated as a **head of passing** for the award of the B.Tech degree. It aims to provide **experiential learning, professional exposure, and practical application of theoretical knowledge** to real-world scenarios.

Mode of Internship

a) Research Internship

- **Location:** Reputed research Organizations, R&D laboratories, Centers of Excellence, or Incubation Centers.
- **Objective:** To gain exposure to research methodologies, advanced tools, and analytical techniques.
- **Expected Outcome:** Development of analytical reasoning, experimental proficiency, and technical writing skills for higher research or academic progression.

b) Industry Internship

- **Location:** Recognized industries, MSMEs, start-ups, or technology-driven companies.
- **Objective:** To gain hands-on experience in industrial environments and apply engineering knowledge to solve professional challenges.
- **Expected Outcome:** Strengthened professional competencies, teamwork, adaptability, and real-world problem-solving abilities.

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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	-	3	2	2	-	-	-	-	-	-	3	2
CO 2	-	3	2	2	-	-	-	-	-	-	-	2	3
CO 3	-	-	2	-	-	-	-	2	3	3	2	2	2
CO 4	-	1	-	-	-	2	3	3	-	2	2	-	-

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

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

Knowledge Level	ISE	ESE
Remember	25	25
Understand	50	75
Apply	75	75
Analyse	75	75
Evaluate	25	-
Create	-	-
TOTAL	250	250

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