



Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure

Final Year B. Tech

(Department of Civil Engineering)

With effect from Year 2026-27

(RCP23 NEP Scheme)



**Shahada Road, Near Nimzari Naka Shirpur Maharashtra 425405 Ph:
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Final Year B. Tech Civil Engineering - Semester- VII/VIII (w. e. f. 2026-27)

S. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit	
				L	T	P	Continuous Assessment				ESE			
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2)				
1	PC	RCP23VCPC701	Geotechnical Engineering	3	-	-	25	15	15	15	60	100	3	4
		RCP23VLPC701	Geotechnical Engineering Laboratory			2	25	-	-	-	25	50	1	
2	PC	RCP23VCPC702	Construction Safety & Quality control	3	-	-	25	15	15	15	60	100	3	3
3#	PE	RCP23VCPE711	Integrated Watershed Management	3	-	-	25	15	15	15	60	100	3	3
		RCP23VCPE712	Construction Economics and Finance											
		RCP23VCPE713	Planning for Sustainable development											
		RCP23VCPE714	Numerical Method for Civil Engineering											
4	MD	RCP23VCMD701	Public Health Engineering	3	-	-	25	15	15	15	60	100	3	4
		RCP23VLMD701	Public Health Engineering Laboratory			2	25	-	-	-	25	50	1	
5	HS	RCP23ICHSX09	Disaster Management and Preparedness	2	-	-	-	-	-	-	-	-	A	A
6	EL	RCP23ITELX08	Research Ecosystem	-	1		50					50	2	2
7	EL	RCP23IPEL701	Project Stage -II		-	8	50				50	100	4	4
8	SC	RCP23VCSC701	Construction Finance	1	-	-	40		-		-	40	1	1
Total				15	1	12	290	60	60	60	340	690	21	21

TA-Teacher Assessment, ESE- End Semester Examination

Prepared by

Dean Academic/Dy. Director

Checked by

C.O.E



BOS Chairman

Director

Final Year B. Tech Civil Engineering - Semester-VII/VIII (w. e. f. 2026-27)

S. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total		Credit	
				L	T	P	Continuous Assessment (CA)				ESE				
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2)					
												[A]			[B]
1	PE	RCP23VCPE811	Structural Audit*	3	-	-	25	15	15	15	60	100	3	3	
		RCP23VCPE812	Solid Waste Management*												
		RCP23VCPE813	Coastal Engineering*												
		RCP23VCPE814	Data Analytics in Civil Engineering*												
		RCP23VCPE815	Metro Construction Technology*												
			NPTEL/SWAYAM Course #												
2	INT	RCP23IPELX10	Internship (OJT) Cum Project			36	200				200	400	18	18	
3	SC	RCP23VSC801	Generative AI For Sustainability	1			40					40	1	1	
TOTAL				4	-	36	265	15	15	15	260	540	22	22	

TA-Teacher Assessment, ESE- End Semester Examination

@ Any 1 Programme Elective Course

- * Program Elective Courses offered by institute for the students doing Internship (OJT).
- # Program Elective Courses offered by NPTEL/SWAYAM for the students doing Internship (OJT). These courses are to be studied in self-study mode using NPTEL/SWAYAM platform. Students doing Internship (OJT) shall submit certificates of NPTEL examination OR they have to Appear examinations conducted by institute like TT1, TT2 and ESE. Students undergoing Internship (OJT) have the option to appear for both the NPTEL examination and End Semester Examination (ESE) conducted by institute for respective course. In such cases, the better of the two scores (NPTEL or ESE) shall be considered for final grading. List of NPTEL courses will be declared by concerned BOS at the beginning of semester.


Prepared by


Dean Academic/Dy. Director


Checked by


C.O.E




BOS Chairman


Director

Program : Civil Engineering	Final Year B Tech	Semester: VII
Geotechnical Engineering (RCP23VCPC701)		
Geotechnical Engineering Laboratory (RCP23VLPC701)		

Pre-requisite –

Engineering mechanics, strength of mechanic's fluid mechanics and engineering geology.

Course Objectives

1. To provide students with basic understanding of physical and mechanical properties of soil, together with knowledge of basic engineering procedures.
2. To identify factors controlling soil behavior and methods to determine soil properties.
3. Students will acquire basic knowledge in engineering design of geotechnical systems

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To apply the knowledge of science, mathematics and engineering with the context of applications in geotechnical engineering.	3	Learn
CO2	Explain origin and classification of the different soils and to determine engineering properties of soil.	4	Analyze
CO3	Compute geostatic stresses in soils and Describe compaction and soil stabilization.	3	Understand
CO4	Analyze consolidation using Terzaghi's theory.	2	Analyze

Unit- I Introduction of Soil and Geotechnical Properties

08 Hrs

Soil as engineering material, soils of India, geotechnical problems, three phase system, definitions and functional relationships.

Geotechnical properties, engineering properties, volume weight relationships. Atterberg's limits, sieve analysis, identification of soil, I.S. classification system

Unit-II Flow through Soil, Compaction and Consolidation

08 Hrs.

Flow of water through soils, soil water, capillarity, Darcy's law laboratory measurement of permeability.

Soil compaction, M.D.D. and O.M.C., standard Proctors test heavy compaction test, concept of stabilization, different methods of stabilization

Consolidation Theory, Terzaghi theory, consolidation test, time fitting curves, rate of settlements, Normal consolidated and over consolidated deposits, Pre consolidation pressure.

Unit-III Shear Resistance and Shear Strength of soil

07 Hrs.

Shear resistance in soil, pore pressure and effective stresses failure theories, Mohr - Coulomb's law of shear strength direct shear test, triaxial test, unconfined compression test, vane shear test, drained loading, and factors affecting the shear strength.

Unit-IV Soil Investigation and Bearing Capacity of Soil

07 Hrs.

Soil exploration, subsurface exploration, trial pits, representative and undisturbed samples, bore hole sampling, laboratory evaluation of foundation parameters, field testing, penetration tests, plate load test, bore hole tests.

Bearing capacity of soil, load settlement curve, local and general shear, Terzaghi's bearing capacity analysis, bearing capacity factors, Mayorhoff equations, rectangular, square and round footings, effects of water table and depth, bearing capacity of layered soils, effect of eccentricity.

Unit-V Elastic Settlement and Special Foundation.

07Hrs

Elastic settlement, contact pressure, elastic stresses and strains, pressure bulb, elastic settlement, empirical relation for settlement of busses, total and differential settlement, tolerable settlement, I.S. criteria, effect of lowering water table.

Introduction of pile foundation, purpose of piles, pile classification, Foundation on black cotton soils, characteristics of black cotton soil, problems, swelling potential, under-reamed piles, design principles and construction techniques.

Text Books:

1. Basic and Applied Soil Mechanics by Gopal Ranjan and Rao, New Age International Publishers.
2. Principles of foundation engineering by B. M. Das, Cengage Learning (Thompson)
3. Soil Mechanics and foundation Engineering, Dr.K.R.Arora, Standard Publishers Distributors

Reference Books:

1. Soil Mechanics and Foundations, Muni Budhu, John Wiley and Sons Inc
2. Foundation Analysis and Design, J.E.Bowles, McGraw Hill International
3. Foundation Design Manual, Dhanpat Rai Publication, N. V. Nayak
4. Design aids in soil mechanics and foundation engineering, Kaniraj S.R., Tata McGraw Hill Publishing Company Ltd.
5. Foundation Design and Construction, M.J.Tomlinson, ELBS Publication

Geotechnical Engineering Laboratory (RCP23VPC401L)

Lab course work shall consist of Following experiment complete any 07 from list

List of Experiments:

1. Field density by core cutter method, and Sand replacement method.
2. Sieve analysis and particle size determination or hydrometer analysis.
3. Specific gravity determination by voluminometer / pycnometer.
4. Determination of liquid limit and plastic limit.
5. Determination of shrinkage limit.
6. Determination of co-efficient of permeability by constant head or by variable head permeameter.
7. Direct shear test.
8. Unconfined compression test.
9. Vane shear test.
10. Standard Proctor's test (MDD / OMC)
11. Modified Proctor's test (MDD / OMC)

Program : Civil Engineering	Final Year B Tech	Semester: VII
Construction Safety & Quality Control (RCP23VCPC702)		

Course Objectives

1. Introduce students to the importance of safety and hazard identification in construction sites
2. Understanding the importance of quality control and quality assurance principles in construction projects
3. To familiarize students with government safety policies, regulations, and compliance requirements in construction industry

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Students will understand construction site hazards and apply safety measures using Personal Protective Equipment (PPE) and emergency preparedness protocols	1,4	Understand, Apply
CO2	Students will apply safety practices during excavation, scaffolding, formwork, concreting, and demolition activities in construction projects	4,	Apply
CO3	Students will analyze quality control standards (ISO 9001, IS codes) and apply quality assurance procedures in construction project monitoring	3,4	Analyze, Apply

Course Content

Unit 1 Introduction to Construction Safety Policy

6 Hours

Basics of construction site hazards, include physical hazards (Material & Person falls,), health hazards (chemicals, noise), environmental hazards weather, and ergonomic hazards (heavy lifting) types of accidents, causes and prevention, and safety. Government policies include Building Workers Act 1996 and Factories Act 1948. Use of Personal Protective Equipment (PPE). Emergency preparedness and fire safety. Site awareness requires safety meetings, signage, training, and worker participation programs.

Unit 2 Safety in Construction & Demolition Practices

6 Hours

Safety measures during excavation, scaffolding, formwork, concreting, working at heights, Demolition of different methods as per Structure and select suitable method for dismantling. Safety practices systematically protect workers across construction activities, ensuring compliance and productivity. Reuse of Demolished material, Environmental impacts.

Unit 3 Introduction to Quality Control and Assurance

7 Hours

Define quality concepts, standards (ISO 9001,) and the difference between quality control (QC) and quality assurance (QA) in construction and Importance and stages of (QC) in construction projects. IS codes, quality policies, and documentation procedures and Quality Reports.

Unit 4 Real time Monitoring of Important Construction Projects

7 Hours

Introduction to Emerging trends in construction Project using AI & IOT Internet of Things based sensors and devices for continuous monitoring of construction quality parameters including temperature, humidity, and structural integrity its impact of technology in construction projects. Real-time data acquisition systems and wireless sensor networks for automated record keeping of quality control in construction sites.

Unit 5 Quality Audits

7 Hours

Principles of Construction quality audits, checklists, and Third Party Technical Audit Importance, Case studies, and construction failures and lessons learned.

Reference Books:

1. Griffith, A. and Howarth, T. 2001. Construction Health and Safety Management, Longman Scientific & Technical, London.
2. Burke, R. 2013. Project Management Planning and Control Techniques, John Wiley & Sons, Chichester.

Text Books:

1. Construction safety and Management by Kumar neeraj Jha/Dilip patel Publisher Perason ISBN **978-9356060449**
2. Construction safety by R. K. Mishra Publisher AITBS India. ISBN **937473494X**
3. Quality control in Civil Engineering by A,K,Watal & Mahesh Sharma standard publication India
4. Quality assurance and quality control by VVN Prabhakar rao Mahi Publication India.

Program: Civil Engineering Professional Elective course -III	Final Year B Tech	Semester: VII
Course : Integrated Watershed Management (RCP23VCPE711)		

Course Objectives

1. To learn the various management strategies through different soil and water conservation approaches.
2. To provide a comprehensive treatise on the engineering practices of watershed management for realizing the higher benefits of watershed management.
3. To understand land use classification and impact of land use changes on hydrological cycle parameters.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Students will able to learn the different soil and water conservation approaches	3	Learn
CO2	Students will able to analyze degradation of soil and water resources	4	Analyze
CO3	Students will able to understand watershed Area	3	Understand
CO4	Students will have a thorough knowledge on watershed planning, development	2	Design
CO5	Students will able to Suggest drought control measures, water conservation structures	2	Prepare

Unit- I Introduction

06 Hrs.

Watershed – Definition - concept - Objectives – watershed behavior, effects of land use and its change on hydrological cycle components, Land capability and suitability classification

Unit-II Watershed Planning Hrs.

08

Planning principles – collection of data – present land use - Preparation of watershed development plan - Estimation of costs and benefits - Financial plan – selection of implementation agency - Monitoring and evaluation system.

Unit-III Watershed management

06 Hrs.

Participatory watershed Management - run off management - Factors affecting runoff - Temporary & Permanent gully control measures - Water conservation practices in irrigated lands - Soil and moisture conservation practices in dry lands, Erosion process. Control measures for soil erosion.

Unit-IV Water conservation practices

8 Hrs.

In-situ & Ex-situ moisture conservation principle and practices - Afforestation principle - Micro catchment water harvesting - Ground water recharge – percolation ponds -Water harvesting - Farm pond - Supplemental irrigation - Evaporation suppression - Seepage reduction

Unit-V Watershed Development Programme

8 Hrs

Drought and its management-causes and impacts, definition, management objectives and strategy-short term and long term measures. National Watershed Development Programme. Watershed based rural development – infrastructure development - Use of Aerial photography and remote sensing in watershed management - Role of NGOs in watershed development.

Reference Books:

1. Gurmel Singh et al. 2004. Manual of soil and water conservation practices. Oxford & IBH publishing Co. New Delhi.
2. Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi.
3. Tripathi R.P. and H.P.Singh 2002, Soil erosion and conservation, Willey Eastern Ltd., New Delhi
4. Murthy, V.V.N. 2005, Land and water management, Kalyani publishing, New Delhi.
5. Tideman, E.M., “Watershed Management”, Omega Scientific Publishers, New Delhi, 1996.
6. Sharda V.N., Sikka A.K. and Juyal G.P. (2006) Participatory Integrated Watershed Management: A Field Manual, Central Soil and Water Conservation Research and Training Institute, 218, Kaulagarh Road, Dehradun.
7. Tideman E.M. (1999) Watershed Management–Guidelines for Indian Conditions, Omega Scientific Publishers, New Delhi.

Text Books:

1. Suresh, R. 2005. Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi.
2. Ghanashyam Das, “Hydrology and Soil Conservation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2000. Limit state theory and Design – Dr. V. L. Shah and Dr. S. R, Structures publications, Pune

Program: Civil Engineering Professional Elective course -III	Final Year B Tech	Semester: VII
Course : Construction Economics & Finance (RCP23VCPE712)		

Course Objectives

1. Adopt as per principles of economics and financing
2. Analyse available alternatives and propose best suitable among them
3. Apply various models of financial management and accounting

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Students will able to learn the principles of economics and financing	3	Learn
CO2	Students will able to analyse available alternatives	4	Analyze
CO3	Students will able to Apply various models of financial management	3	Apply

Course Content

Unit- I Engineering Economics 08 Hrs.

Engineering Economics, Time Value of Money, Cash Flow diagram, Nominal and effective interest – continuous interest, Single Payment Compound Amount Factor, Uniform series of Payments, comparing alternatives, Present worth Analysis, Annual worth Analysis, Future worth Analysis, Rate of Return Analysis, Break Even Analysis, Benefit/Cost Analysis

Unit –II Economics of Project Parameters 08 Hrs.

Economics of Project Parameters, Equipment Economics, Operating Costs, Buy, Rent and Lease Options, Replacement Analysis, Cost Estimates, Type of Estimates, Parametric Estimate, Management Accounting, Financial accounting principles, basic concepts, Financial statements, accounting ratios

Unit –III Investment Evaluation 06 Hrs.

Investment Evaluation and Financing Projects, Taxation, Depreciation, switching between different depreciation methods, Inflation, Sources of finance, equity, debit, securities, borrowings, debentures, Working capital requirement, financial institutes

Unit –IV Financial Management 06 Hrs.

Financial Management, Introduction, Charts of Accounts, Balance Sheet, Financial Ratios, Working Capital Management, Budgeting and budgetary control, Performance budgeting. Profit & Loss, statement, Ratio analysis, Appraisal through financial statements, International finance forward

Unit –V Projects Public Private 06 Hrs.

PPP in Projects Public Private Participation in Projects- PPP Models, BOOT, BOT, Joint Ventures, BOOT, BOT, Annuity, DBFO, External Commercial Borrowings, International Finance, FIDIC.

Text Books

1. Blank, L.T., and Tarquin, A. J., (1988). Engineering Economy, Mc-Graw Hill Book Co.
2. Collier C. and Gla Gola C. (1998). Engineering Economics & Cost Analysis, Addison Wesley Education Publishers,
3. Patel, B. M., (2000). Project management- strategic Financial Planning, Evaluation and Control, Vikas Publishing House Pvt. Ltd. New Delhi,
4. Shrivastava, U. K., (2000). Construction Planning and Management, Galgotia Publications Pvt. Ltd. New Delhi.

References

1. Van Horne, J.C. (1990). Financial Management and Policy, Prentice-Hall of India Ltd.
2. Taylor, G.A. (1968). Managerial and Engineering Economy. East-West Edition.
3. Thuesen, H.G. (1959). Engineering Economy, Prentice-Hall, Inc.

Program: Civil Engineering Professional Elective course -III	Final Year B Tech	Semester: VII
Course : Planning for Sustainable development (RCP23VCPE713)		

Course Objectives

1. Understand the basic concept of Sustainable Development (SD), the environmental, social and economic dimensions
2. In depth learning and analysis of factors that support to achieve sustainability and resilience in an individual level and in a community
3. Develop an encompassing understanding of sustainability issues.
4. Understand the embedment of sustainability issues in environmental, societal, and economic systems, and the relevance of the conditions, interrelations, and dynamics of these systems.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Students will able to learn the principles of Sustainable development	3	Learn
CO2	Students will able to analyse the available alternatives for SD	4	Analyse
CO3	Students will able to Understand the case study of village	3	Apply

Unit- I

06 Hrs.

Sustainable Development-explains and critically evaluates the concept of sustainable development, Environmental degradation and poverty Sustainable development: its main principles, the evolution of ideas about sustainability,

Unit- II

06 Hrs.

Dimensions to Sustainable Development - society, environment, culture and economy; current challenges - natural, political, socio-economic imbalance; sustainable development initiatives and policies of various countries: global, regional, national, local; needs of present and future generation - political, economic, environmental. Examine some important current issues and areas of debate in relation to sustainable development.

Unit-III

06 Hrs

Innovation for sustainable development- Environmental management and innovation strategies. Frameworks of Sustainability - Analytical frameworks in sustainability studies, sustainability Metrics: criteria and indicators; the significance of quantitative and qualitative assessments of sustainability; current metrics and limitations; metrics for mapping and measuring Sustainable development; application of the metrics in real scenarios Innovation for sustainable development- Environmental management and innovation strategies.

Unit – IV

06 Hrs

Critical Perspectives on Sustainable Development: Resource management and implications on sustainable development - implications for valuation, risk assessment; integrated decision-making processes: requirements of information, information flow, data analytics, learning from historical data, multicriteria decisions, multi-level decisions, participatory decisions ; translating impact chains to information flows - impact of governance and policies

Unit –V

06 Hrs

Case Studies & Projects on Rural Sustainable Development (Indian village perspectives) - Village resources (broad perspectives); current challenges and thematic areas; village social hierarchy; village economy; needs of present and future generation; conflicts - sustainability and rural culture & tradition; road to achieving sustainable development goals. Governance for sustainable development. Policy responses to environmental degradation.

Text Book

1. Franco, I.B. and Tracey, J. (2019), "Community capacity-building for sustainable development: Effectively striving towards achieving local community sustainability targets", *International Journal of Sustainability in Higher Education*, Vol. 20 No. 4, pp. 691-725
2. *Our Common Journey: A Transition Toward Sustainability*. National Academy Press, Washington D.C. Soubotina, T. P. 2004.
3. Elliott, Jennifer. 2012. *An Introduction to Sustainable Development*. 4th Ed. Routledge, London.
4. Rogers, Peter P., Kazi F. Jalal, and John A. Boyd. "An introduction to sustainable development." (2012).
5. Sachs, J. D. 2015. *The Age of Sustainable Development*. Columbia University Press, New York.
6. Soubotina, Tatyana P. 2004. *Beyond Economic Growth: An Introduction to Sustainable Development*. WBI learning resources series. Washington DC ; World Bank.
7. Kerr, Julie. *Introduction to energy and climate: Developing a sustainable environment*. CRC Press, 2017.
8. Saito, Osamu. *Sharing Ecosystem Services*. Springer Singapore, 2020.

Program: Civil Engineering Professional Elective course -III	Final Year B Tech	Semester: VII
Course : Numerical Method for Civil Engineering (RCP23VCPE714)		

Course Objectives

1. To develop a sound understanding of the various numerical techniques, principles and their application to Civil engineering problems.
2. To apply Numerical analysis which has enormous application in the field of Civil Engineering.
3. To calculate and interpret errors in numerical method.
4. To provide exposure to various numerical methods for performing task such as interpolation, differentiation, integration, solution of linear and nonlinear equations, solution of differential and integral equations
5. To facilitate numerical computing.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To develop a sound understanding of the various numerical techniques, principles and their application to Civil engineering problems.	Level 2	Understanding
CO2	To apply Numerical analysis which has enormous application in the field of Civil Engineering.	Level 3	Applying
CO3	To calculate and interpret errors in numerical method	Level 5	Evaluating
CO4	To provide exposure to various numerical methods for performing task such as interpolation, differentiation, integration, solution of linear and nonlinear equations, solution of differential and integral equations	Level 4	Analyzing
CO5	To facilitate numerical computing.	Level 4	Analyzing

Course Content

Unit- I**08 Hrs.**

Basis of Computations, Errors in Numerical Computation, Matrix Operations on Computer, Multiplication and Inversion, Solution of Simultaneous Equations, Gauss Elimination Method, Jordan and Gauss Seidal Methods.

UNIT-II**06 Hrs.**

Roots of Equation by Bisection, False Position Method, Newton Rapson Method, Linear Programming Problem (L.P.P.) - Introduction, Assumptions, Applications, Limitations, General mathematical model, formulation, Simplex method.

Unit-III**06 Hrs.**

Interpolation with Lagrange's Polynomial, Newton's Divided Differences, Forward and Backward Differences, Least Square Method, Regression Analysis: Linear, Parabolic, Curve Fitting

Unit-IV**06 Hrs.**

Numerical Integration: Trapezoidal Rule, Simpon's Rules, Gauss Quadrature Rules. Introduction to initial value and boundary value problem, Finite Difference Method for solution of one dimensional wave equation, two dimensional equation. (Parabolic and Elliptic)

Unit –V**06 Hrs.**

Solution of Ordinary Differential Equation, Euler's Method, Modified Euler's Method and Runge Kutta Methods, Predictor Corrector Method.

Reference Books:

1. Balaguruswami E., "Numerical Methods", Tata Mc-Graw Hill
2. Scheid F, "Numerical Analysis (Schaum's series)", Tata Mc-Graw Hill
3. Chapra. S. C. and Canale R. P., "Numerical Methods for Engineers", by, Tata Mc-Graw Hill
4. Shantha Kumar M , "Computer Based Numerical Analysis", Khanna Publication
5. Grewal B.S. and Grewal J.S., "Numerical Methods in Engineering and Science", Khanna Publication, N. Delhi
6. Sastry, S.S., "Introductory Methods of Numerical Analysis", Printice Hall of India, New Delhi

Program: Civil Engineering	Final Year B Tech	Semester: VII
Course : Public Health Engineering (RCP23VCMD701)		
Course : Public Health Engineering Laboratory (RCP23VCMD701L)		

Course Objectives

1. To apply knowledge of mathematics, physics, chemistry, and microbiology to solve and analyze engineering problems related to water and wastewater collection, transport, quality and treatment.
2. To understand the sources, effects, prevention and control measures of water pollution and its legislative aspects.
3. Recognize public health and environmental objectives related to water supply and wastewater disposal.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Relate the relations between the environment and ecology, estimating water requirement for public water supply scheme.	1, 2	Remember, Understand
CO2	Ascertain the quality of water as per BIS and select the appropriate treatment method required for the water source.	3, 4	Apply, Analyze
CO3	Learn how to characterize source water, and the best available technologies (BAT) for physical and chemical treatment of drinking water.	3, 5	Analyze, Evaluate
CO4	Learn how to characterize wastewater, and the BAT for physical, chemical and microbiological treatment of wastewater.	4	Analyze
CO5	Understand selected contemporary global water and wastewater issues such as water shortage, wastewater reuse and emerging contaminants.	2, 4	Understand, Analyze

Course Content

Unit- I Introduction to Water quality

06 Hrs.

a) Water quality parameters, Water quality standards; conventional contaminants and emerging contaminants; Water treatment: Source selection process, selection of treatment chain, plant siting, and Treatability studies. Water intake structures: intake structures, such as river intake, canal and reservoir intake

General considerations for source of drinking water; Water demand, Population forecasting: arithmetical increase method geometrical increases method, incremental increase method

Unit-II Introduction to Principles of Water Treatment process

06 Hrs.

Principles of Water Treatment process: Historical overview of water treatment, Considerations for layout of treatment plant, Sedimentation, Coagulation & Flocculation processes, Disinfection/ Chlorination, Water Softening, Filtration, removal of Dissolved Solids, Fluoride, Iron and Manganese etc. Aeration tank, Sedimentation tank.

Unit-III Water Treatment process

08 Hrs.

A. Filtration: theory of filtration, mechanism of filtration, filter materials, types of filters, rapid Sand Filter, Slow Sand Filter, multimedia and dual media filters, components- under drainage system, working and cleaning of filters. Operational troubles, design of filters-RSF and SSF. Design of under drainage system.

B: Disinfection- objectives, theory, types of disinfection, chlorination.

C: Water Softening - lime soda, zeolite, and ion exchange processes, Quantity estimation of lime soda process, re-carbonization. Demineralization methods

Unit-IV Sewage Treatment

08 Hrs.

Definition of sewage, Necessity of sewage treatment, Requirement of a sewage management system. Composition of sewage, Characteristics of sewage – Physical (Colour, Odour, Solids and Temperature), Chemical (Organic - Carbohydrates, Fats, Oil and Grease, Pesticides, Phenols, Proteins, Surfactants. Inorganic – Alkalinity, Chlorides, Heavy Metal, Nitrogen, pH, Phosphorous, Sulphur, Toxic Compounds, Gases – Hydrogen Sulfide, Methane, Oxygen), Biological Characteristics

Unit-V Preliminary & Secondary Treatment of Sewage

8 Hrs

Preliminary & Secondary Treatment of Sewage – Screening – Purpose, Classification, Types, Cleaning, Design Consideration & Management of screenings material Comminutors – Purpose and types Grit Removal – Purpose, Quality and quantity of grit, Types Biological Treatment of Sewage – Objective and classification.

Reference Books:

1. E W Steel and Terence J McGhee : Water supply and Sewerage” Tata McGraw Hill Publishing Co.
2. Water supply and Sanitary Engineering by J S Birdie, Dhanpat Rai and Sons Publication, New Delhi
3. Physico-chemical processes for water quality control by Walter J Weber, Wiley Inter-science Publications.
4. Manual on Water Supply & Treatment, Central Public Health & Environmental Engineering, Organization, Ministry of Urban Affairs, Government of India
5. Benergee & Jain, “Handbook of Technical Analysis”, Jain Brothers New Delhi.
6. Laboratory Manual for Environmental Quality Testing, Environmental Protection Research Foundation, Sangli.

Text Books:

1. Environmental Modelling: Finding Simplicity in Complexity by John Wainwright and Mark Mulligan, John Wiley & Sons, Ltd.
2. Building Environmental Models: A Primer on Simplifying Complexity by Mulligan, M. and Wainwright, J., John Wiley & Sons, Ltd, Chichester.
3. Earth-system science, in Blackwell Companion to Environmental Geography by Wainwright, J., Blackwell, Oxford.
4. Water and Wastewater Treatment by Schroeder E D., McGraw-Hill.

Public Health Engineering Laboratory (RCP23VMD404L)

Lab course work shall consist of Following experiment complete any 05 from list

List of Experiments

Term work shall consist of performing experimental sets from the list below.

1. Determination of pH in given water & waste water samples.
2. Determination of turbidity and optimum dose of coagulant.
3. Determination of alkalinity and acidity of given sample (water & waste water samples)
4. Determination of carbonate and non-carbonate hardness of water waste water samples.
5. Determination of chlorine demand and residual chlorine of water
6. Determination of dissolved oxygen present in the given water samples
7. **A complete report on site visit to a Municipal Water & waste water Treatment Plant.**

Program: Civil Engineering	Final Year B Tech	Semester: VII
Course : Disaster Management and Preparedness (RCP23ICHSX09)		

Course Objectives:

1. To provide basic understanding of hazards, disasters and various types and categories of disaster occurring around the world.
2. To identify extent and damaging capacity of a disaster.
3. To study and understand the means of losses and methods to overcome /minimize it.
4. To understand roles and responsibilities of individual and various organizations during and after disaster.
5. To appreciate the significance of GIS, GPS in the field of disaster management.
6. To understand the emergency government response structures before, during and after disaster.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply disaster management principles & guidelines.	3	Apply
CO2	Conduct risk assessments and develop community awareness & participation	4	Analyze
CO3	Utilize Science & Technology tools (GIS, GPS). And Prepare disaster management plans.	4	Analyze,

Unit- I Understanding Disasters & Hazards 07Hrs

Definition and types of disasters: Natural, Man-made and hybrid disasters, **Study of Natural disasters:** Flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion etc. **Study of Human/Technology Induced Disasters:** Chemical, Industrial and Nuclear disasters, internally displaced persons, road and train accidents Fire Hazards, terrorism, militancy, Hazard & Vulnerability profiles of India (seismic zones, flood-prone areas). India's vulnerability to disasters, and the impact of disasters on National development

Unit- II Disaster Risk Reduction (DRR) & Mitigation 07Hrs

Disaster Management Cycle: Prevention, Mitigation, Preparedness, Response, Recovery. Need for disaster prevention and mitigation, mitigation guiding principles, challenging areas, structural and non-structural measures for disaster risk reduction.

Risk Assessment & Vulnerability Analysis.

Science & Technology: Use of information management, Geo informatics like RS, GIS, GPS and remote sensing mitigation measure

Unit- III Disaster Preparedness & Response: 07Hrs

Preparedness Planning, Early Warning Systems (EWS), & Communication. Emergency Response: Search & Rescue, Logistics, Medical Aid.

Psychological Response & Management (Trauma, Stress). Role of IT, Media, Govt., NGOs, & Community.

Unit- IV Recovery, Rehabilitation & Reconstruction 07Hrs

Post-disaster damage assessment.

Rehabilitation, Reconstruction, & Livelihood Restoration. Sanitation, Hygiene, & Waste Management.

Unit- V Policy, Governance & Capacity Building: 07Hrs

National Disaster Management Authority (NDMA) & Legislation. Institutional Mechanisms & Community Mobilization. Non-Structural Mitigation:

Community based disaster preparedness, capacity development and training, awareness and education, contingency plans.

Case studies on disaster (National /International):

Case study discussion of National Disasters: Tsunami (2004), Bhopal gas tragedy, Kerala and Uttarakhand flood disaster, 26th July 2005 Mumbai flood. Case study discussion of International Disasters: Hiroshima – Nagasaki (Japan), Cyclone Phailin (2013), Fukushima, Daiichi nuclear disaster (2011), Chernobyl meltdown.

Reference Books and Reports:

1. Disaster Management, by Harsh K. Gupta, Universities Press Publications (2003).
2. Disaster Management: An Appraisal of Institutional Mechanisms in India, by O. S. Dagur, published by Centre for land warfare studies, New Delhi, 2011.
3. Introduction to International Disaster Management, by Damon Copolla, Butterworth Heinemann Elsevier Publications (2015).
4. Disaster Management Handbook, by Jack Pinkowski, CRC Press, Taylor and Francis group (2008).
5. Disaster management & rehabilitation, by Rajdeep Dasgupta, Mittal Publications, New Delhi (2007).

Program: Civil Engineering	Final Year B Tech	Semester: VII
Course : Research Ecosystem (RCP23ITELX08)		

Pre-requisites:

1. Basic understanding of Engineering concepts and problem-solving techniques.
2. Fundamental knowledge of project-based learning, data analysis, and domain-specific tools.
3. Basic exposure to project development, technical report writing, and emerging technologies.

Objectives:

1. To understand and identify complex engineering, societal, and industrial problems suitable for research through structured analysis of literature, patents, and real-world needs.
2. To learn and apply advanced research methodologies—including experimental, simulation-based, and data-driven approaches—for designing and validating engineering solutions.
3. To gain proficiency in selecting and using appropriate tools, software, and platforms (AI/ML, simulation, CAD, IoT, etc.) for experiment design, data acquisition, and performance evaluation.
4. To transform research insights into innovative prototypes, products, or startup concepts by engaging with innovation ecosystems, TRLs, and funding mechanisms.
5. To analyze socio-technical systems, ethics, and sustainability implications of engineering solutions, ensuring responsible and impactful outcomes.
6. To integrate systems thinking, multidisciplinary perspectives, policy awareness, future technology trends, and technical documentation skills to develop comprehensive research proposals and outputs (papers, patents, reports).

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze complex engineering and societal problems to evaluate literature and patents and formulate clear research gaps.	4	Analyze
CO2	Design and apply advanced research methods and tools to acquire data and evaluate solution performance.	3	Apply
CO3	Transform research insights into prototypes or startup concepts using innovation frameworks and Technology Readiness Levels.	3	Apply,
CO4	Evaluate ethical, socio-technical, and sustainability issues and create responsible engineering solutions.	5	Evaluate

Unit- I	Research Gap Identification & Advanced Problem Formulation	07Hrs
- Identifying high-impact problems from: - Industry and Society - Emerging technologies (AI, IoT used in Construction industry , sustainability , Smart material , Environment, GPS survey , different software's used in designs etc.) - Research gap identification techniques: - Systematic Literature Review (SLR) - Patent analysis - Defining objectives, scope, constraints, and feasibility of the identified problem Writing problem statement for: - Research paper - Product/Startup idea Activities: - Convert Industry/ Societal problem into research problem. Analyze research articles and extract research gaps		
Unit- II	Experimental Design, Tools & Validation Techniques	07Hrs
- Advanced research methodologies: - Experimental, simulation, data-driven, design thinking - Tool selection: - Computational tools and software, simulation and analysis platforms, system prototyping and testing platforms - Data acquisition: - Data collection interfaces, Principles of data cleaning and organization (primary / secondary data) - Validation techniques: - Accuracy and performance metrics - Benchmarking with existing solutions - Result interpretation & visualization Activities: - Selection of Research Design for final year project. Apply evaluation metrics (e.g., ML model accuracy, system efficiency)		
Unit- III	Research to Innovation, Product & Startup Ecosystem	07Hrs
- Research → Prototype → Product → Startup lifecycle - Intellectual Property Rights (IPR), patents, copyrights - Technology readiness levels (TRL) - Case studies: - AI startups, EV ecosystem, Smart Cities - Industry-academia collaboration models - Funding opportunities (grants, incubation, government schemes - Anusandhan National Research Foundation (ANRF)) Activities: - Convert project into startup idea or product pitch. Analyze failure of a technology/product.		
Unit- IV	Socio-Technical Systems, Ethics & Sustainability	07Hrs
- Socio-technical systems: Interaction of people, technology and environment - Ethical issues: - Plagiarism, AI bias, data privacy - Sustainability in Engineering: - Green practices, resource optimization and lifecycle considerations		

- Impact assessment:
 - Social, economic, environmental
- Policies and governance (data protection laws, standards and compliance requirements)

Unit- V Integrated Research, Policy and Future Engineering Challenges

07Hrs

- Systems thinking and holistic analysis, Multidisciplinary problem solving:
 - Healthcare tech, climate tech, smart mobility
- Writing research proposals:
 - Problem → Methodology → Expected outcomes
- Future trends:
- AI ethics, Quantum computing, Industry 5.0 / 6.0 Scaling solutions from lab to society

Activities:

- *Capstone Task:*
 - Identify real-world problem. , Apply research methodology.
 - Propose:
 - Technical solution, Societal impact Possible commercialization.

Term Work Guidelines:

The Term Work (TW) shall consist of continuous assessment based on tutorials activities and a final group presentation.

a) Part A (25 Marks):

Each student shall complete a minimum of five tutorials based on the syllabus topics during the semester. The tutorials may include activities such as research gap identification, literature survey, case study analysis, tool-based experimentation, impact analysis, technical report writing, and innovation-oriented problem solving.

b) Part B (25 Marks):

Students shall work in groups and select a project/research topic based on emerging engineering, industrial, or societal challenges. The group presentation shall include:

- Identification of a real-world problem
- Application of appropriate research methodology
- Proposed technical solution
- Analysis of societal impact
- Possible commercialization/startup opportunities

Reference Books:

- Kothari, C. R., Research Methodology: Methods and Techniques, New Age International Publishers, New Delhi, 2023.
- Booth, W. C., Colomb, G. G., Williams, J. M., Bizup, J., & FitzGerald, W. T., The Craft of Research, University of Chicago Press, Chicago, 2024.
- Montgomery, D. C., Design and Analysis of Experiments, Wiley, New York, 2020.
- Singh, Pooja, Katiyar, Aman, Rawat, Shalini, Dhuri, Archana, Research Methodology and IPR, RK Publications, India, 2025.

Web References:

- Research Methodology: Quantitative Methods and Computer Application (https://onlinecourses.swayam2.ac.in/e-learning/preview/ini26_ma02)
- Research Methodology and IPR (https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr26_ed28)
- Research and Publication Ethics (https://onlinecourses.swayam2.ac.in/e-learning/preview/nou26_ge46)

Program: Civil Engineering	B Tech	Semester: VII
Project Stage-II (RCP23IPEL701)		

Course Objectives

- To implement the solution as per the problem statement.
- To develop the team building, writing, logical reasoning and management skills.
- To provide the connections between the designs and concepts across different disciplinary Boundaries.
- To encourage students to become independent personnel, critical thinkers and lifelong learners

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply engineering knowledge to produce solution of a problem considering cultural, social, environmental, and economic factors using appropriate tool and method.	L4	Analyze
CO2	Demonstrate project based learning that allows students to transfer existing ideas into new applications.	L2	Understand
CO3	Develop an ability to work in teams and manage the conduct of the research study.	L3	Apply
CO4	Integrate different perspectives from relevant disciplines which help them to get internships, jobs and admission for higher studies.	L3	Apply
CO5	Present the research in the form of technical writing, understand what constitutes to plagiarism and how to use proper referencing styles.	L2	Understand

Syllabus:

Project-I work done in VI semester shall be continued as Major Project- in semester VII.

Students should complete remaining implementation of ideas given in synopsis/Abstract of Semester VII.

Students / group must plan their execution of project, so that project work should be completed Before end of semester.

Major Project involves fabrication, design, experimentation, data analysis within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and Sustainability. The stage also includes testing, possible results and report writing.

Each project group is required to maintain log book for documenting various activities of

Major Project submit group project report at the end of Semester-VII in the form of Hard bound.

Domain knowledge (any beyond) needed from the following areas for the effective Implementation of the project:

Experimental design / Theoretical Analysis/ software analysis / Fabrication of model, structural design, Hydraulic design, construction management, Environmental studies, sustainable development, Smart city planning, Advanced Transportation system, Structural audit, comparative study, case study, filed/ market survey, Smart material, Economical study etc.

Guidelines:

The main purpose of this activity is to improve the students' technical skills, communication skills by Integrating writing, presentation and teamwork opportunities. each group will be reviewed twice in a semester and marks will be allotted based on the various

Points mentioned in the evaluation scheme. - In the first review of this semester, each group is expected to complete 70 % of project. (May Consist theoretical design of project, block diagram and components required for design, Experimental work, using software, comparative study/analysis/ filed work etc.

-In the second review of this semester, each group is expected to complete 100 % of project.

(May consist theoretical design of project, block diagram and components required for design, Experimental work, using software, comparative study/analysis/ filed work etc. The students may use this opportunity to learn different computational techniques towards

Development of a product. Interaction with alumni mentor will also be appreciated for the improvement of project.

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will Submit project completion report in prescribed format for assessment to the departmental Committee (including project guide).
- Assessment of the Major project at the end of the semester will be done by the departmental Committee (including project guide).

- The candidate must bring the project part- 1 report and the final report completed in all respect while appearing for End Semester Examination.
- Oral examination should be conducted by Internal and External examiners. Students have to give presentation and demonstration based on their project.

Prescribed project report guidelines:

Every group should prepare hard bound report (preferable Latex/ word file format) of about minimum 40pages on the work carried out by a batch of students in respect of the project work done during

Semester-VII. Project Report should include appropriate content for:

- Title
- Abstract
- Introduction
- Problem identification and project objectives
- Literature Survey
- Related Theory
- Project design and Implementation details
- Case study/Analysis/Design Methodology
- Project Outcomes
- Result and Conclusion Future scope
- References

Assessment criteria for the departmental committee (including project guide) for

Continuous Assessment:

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Each group will be reviewed twice in a semester by faculty guide and faculty coordinator based on the following criteria:

Project progress

- Documentation/Technical paper writing, Key findings Validation of results
- Product development

Each review consists of 25 marks. Average of the marks scored in both the two reviews will be Considered for final grading. The final certification and acceptance of TW ensures the satisfactory Performance on the above aspects.

Table -1 Log Book Format

S. No.	Week (Start date : End date)	Work done	Sign of Guide	Sign of Coordinator
1				
2				

Table -2 Continuous Assessment Sheet

S. No.	Exam Seat	Name of Student	Student Attendance	Log book Maintain	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table -3 Evaluation Sheet

S. No.	Exam Seat	Name of Student	Project Selection	Design simulation/ Logic	Hardware programing/ Experimental work	Result verification	Presentation	Total
			5	5	5	5	5	25

Program: Civil Engineering	B Tech	Semester: VII
Coursera Course : Construction Finance (RCP23VCSC701)		

Course Objectives

1. Understand the fundamental principles of construction finance, economics, and the time value of money applicable to construction projects.
2. Apply financial analysis techniques, including cash flow analysis, NPV, IRR, and feasibility studies for evaluating construction investments.
3. Analyze financing options for construction, real estate development, infrastructure projects, and Public–Private Partnership (PPP) models.
4. Evaluate financial risks, project funding strategies, and lean financial management practices to support sustainable construction project delivery.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the basic principles of construction finance, financial planning, interest calculations, and economics of construction projects.	L2	Understand
CO2	Prepare and analyze project cash flows using Present Value (PV), Future Value (FV), Net Present Value (NPV), and Internal Rate of Return (IRR) techniques.	L4	Analyze
CO3	Evaluate financial feasibility, project funding alternatives, real estate financing, and infrastructure financing using engineering economic principles	L3	Apply
O4	Assess financial risks, Public–Private Partnership (PPP) models, and lean construction finance practices for effective project decision-making.	L4	Analyze

Course Content

UNIT I: Fundamentals of Construction Finance (6 Hours)

Introduction to construction finance, role of finance in construction projects, fundamentals of engineering economics, time value of money, simple and compound interest, nominal and effective interest rates, present worth, future worth, annuities, and financial decision-making in construction projects.

UNIT II: Financial Analysis and Project Evaluation (6 Hours)

Cash flow diagrams, cash flow forecasting, project cost estimation, capital budgeting, discounted cash flow techniques, Net Present Value (NPV), Internal Rate of Return (IRR), benefit-cost ratio, payback period, feasibility studies, and financial evaluation of construction projects using engineering economic principles.

UNIT III: Real Estate and Construction Project Finance (6 Hours)

Sources of construction finance, debt and equity financing, construction loans, commercial real estate financing, development costs, project lifecycle financing, financial planning for development projects, project stakeholders, financial modeling, and investment appraisal of construction projects.

UNIT IV: Infrastructure Finance and Public–Private Partnership (PPP) (6 Hours)

Principles of project finance, infrastructure financing, Public–Private Partnership (PPP) models, Build–Operate–Transfer (BOT), Design–Build–Finance–Operate (DBFO), concession agreements, stakeholder responsibilities, project risk allocation, contractual arrangements, and financing of transportation and infrastructure projects.

UNIT V: Risk Management and Lean Construction Finance (6 Hours)

Financial risk identification and analysis, risk mitigation strategies, sensitivity analysis, decision tree analysis, lean construction finance, waste reduction, value engineering, financial performance monitoring, sustainable investment strategies, and case studies on construction finance and project risk management.

Reference: courser web link: Construction Finance

Program: Civil Engineering Professional Elective -IV	B Tech	Semester: VIII
Course : Structural Audit (RCP23VCPE811)		

Course Objectives

1. Gain the knowledge of Bye laws, procedure of Structural audit and study the typical problems in structures.
2. Aware of causes and types of deterioration in structures.
3. Develop skills for use of various Non-destructive tests required during auditing of structures.
4. Acquire knowledge of legal procedure to conduct structural audits.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Students will able to learn the different Bye laws, procedure of Structural audit and study the typical problems in structures.	3	Learn
CO2	Students will able to aware of causes and types of deterioration in structures	4	Understand
CO3	Students will able to understand the use of various Non-destructive tests required during auditing of structures	4	Understand
CO4	Students will able to prepare detailed Structural audit report.	2	Analyse

Course Content

Unit- I Introduction to structural audit

06 Hrs.

- a) **Introduction to Structural Audit:** Objectives, Bye-laws, Importance, various Stages involved,
- b) **Visual inspection:** scope, coverage, limitations, Factors to be keenly observed. Aspects of audit of Masonry buildings, RC frame buildings, Steel Structures

Unit-II Causes and types of deterioration in Structures

12 Hrs.

- a) **Causes of deterioration of concrete structures:** Permeability of concrete, capillary porosity, air voids, Micro cracks and macro cracks, corrosion of reinforcing bars, sulphate attack, alkali silica reaction,.
- b. **Effects of environmental condition-** moisture, temperature, chemicals, wear, erosion and loading on serviceability and durability.
- c. **Design and construction errors-** Causes of seepage and leakage in concrete structures. Formation of cracks including those due to corrosion.

Unit-II Condition Survey, Evaluation and Assessment

12 Hrs.

- a. **Diagnostic methods and analysis.** Destructive, Semi destructive and Non- Destructive methods
- b. **Concrete Strength Assessment:**
NDT Test: Rebound hammer, Ultrasonic Pulse velocity, Penetration resistance, Pull out, Core test
Chemical test: Carbonation test, Chloride test, Corrosion potential assessment, Fire damage assessment: Differential thermal analysis, X ray diffraction, Structural Integrity and soundness assessment: Radiography, Impact echo test, dynamic testing of structure, Interpretation and evaluation of test results.

Unit-III Strength Evaluation of Existing Structures

06 Hrs.

Reserve strength, identification of critical sections, structural system and its validation, evaluation of damage in RC structures

Unit-IV Structural audit approach

6 Hrs.

Guidelines of Statutory Bodies, Legal aspects, Responsibility of calling Structural Audit, Scope of Investigation

Unit-V Structural Audit Report

6 Hrs

Study of sample Structural audit report for up-gradation of existing building, Audit for continuation of usage of old Buildings, Audit for Buildings damaged due to Earthquakes, Fire,

Reference Books:

1. Properties of Concrete by A M Neville, Longman
2. R. N. Raikar, Learning from Failures, R & D Centre, (SDCPL)
3. R. N. Raikar, Diagnosis and treatment of structures in Distress, R & D Centre, (SDCPL)
4. Demolition of Structures, Report by Mr. Girish Kulkarni, Mumbai
5. Structural Audit, Report by Mr. Umesh Dhargalkar, Mumba

Program: Civil Engineering Professional Elective -IV	B Tech	Semester: VIII
Course : Solid waste management (RCP23VCPE812)		

Course Objectives

1. To learn the various analysis of hazardous waste constituents.
2. To understand health and environmental issues related to solid waste management
3. To apply steps in solid waste management.
4. To become aware of Environment and health impacts solid waste mismanagement.
5. Evaluate the techniques and methods used in recovery of materials and energy from solid wastes.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Students will able to Understanding of problems of municipal waste, biomedical waste, hazardous waste, e-waste, industrial waste	3	Understand
CO2	Students will able to analyze and design engineering, financial and technical options for waste management	4	Analyse
CO3	Students will able to understand sampling and characterization of solid waste	3	Understand
CO4	Students will be able assessment of disposal techniques	4	Analyse

Course Content

Unit- I Introduction to Solid Waste Sources

06 Hrs.

Waste sources, Evolution, generation, nature and characteristics, Quantities and Qualities, generation rates, Potential of disease - nuisance and other problems.

Unit-II Functional elements of solid waste management

08 Hrs.

Solid waste management, on-site storage, collection and separation. Containers and its location, collection systems, vehicle routing- route balance- transfer station. Disposal methods – sanitary land filling, planning, site selection, design. Processing techniques; materials-recovery systems; recovery of biological conversion products; recovery of thermal conversion products; recovery of energy from conversion products; materials and energy recovery systems.

Unit-III Solid waste Transport means, methods, separation and processing

06 Hrs.

Collection and Storage, Transports means and methods, unit operation for component separation, recycling of dry waste components

Unit-IV Municipal Solid Wastes

8 Hrs.

Characteristics of MSW, Elements of solid waste management, engineered systems for solid waste management, Disposal of MSW, Hazardous waste, Biomedical and e-waste disposal.

Unit-V Special waste and integrated solid waste management

8 Hrs

Construction and demolition waste, Hazardous Waste Management, management of bio medical, inert waste, ISWM, MSW Rules.

Reference Books:

1. Integrated Solid Waste Management, Engineering Principles and Management Issues, Techno obanoglous G, Theisen H and Vigil SA, McGraw Hill Education, 2014,
2. Indian Edition, Environmental Engineering, Peavy, H.S., Rowe, D.R., and Techno obanoglous G., McGraw Hill Education, 2017 First Indian Edition.
3. Handbook of Solid Waste Management, Tchobanoglous G and Kreith F, McGraw-Hill Education, 2002, 2nd Edition

Text Books:

1. Waste Management Practices: Municipal, Hazardous and Industrial, John Pichtel, CRC Press, 2014, 2nd Edition
2. Solid Waste Engineering, Vesilind PA, Worrell W and Reinhart D, Brooks/Cole Thomson Learning Inc., 2010, 2nd Edition

Program: Civil Engineering Professional Elective -IV	B Tech	Semester: VIII
Course : Coastal Engineering (RCP23VCPE813)		

Course Objectives

1. Understand coastal engineering aspects of harbours methods to improve navigation.
2. Understand the wave properties and analysis of wave.
3. Gain knowledge in modelling in coastal engineering

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To study the coastal engineering aspects of harbours methods	3	Learn
CO2	To understand the wave properties and analysis of wave.	4	Analyze and design
CO3	Student will able to design coastal structure.	3	Understand
CO4	Understanding the Environmental aspects of Dredging & Disposal		Apply

Course Content

Unit- I Introduction

06 Hrs.

Basic understanding of wave and tides including wave generation, propagation, form and assessment in the surf zone. Statistical and spectral analysis of recorded wave data and prediction in coastal zone, Sediment motion along the coast.

Unit- II Tides & Coastal Processes, Global tidal cycle, tidal analysis.

06 Hrs.

Types of tides, effect of tides, significance in coastal engineering, Coastal process-erosion/accretion due to waves, estimation of littoral drift, Effect of construction of coastal structures on stability of shoreline / beaches, shoreline configuration.

Unit- III Coastal Structures.

06 Hrs.

Introduction to Coastal structures:, Design criteria and functional aspects of coastal structures: sea wall, revetment, bulk-head, quay- wall, jetties, breakwater types: rubble-mound, composite, floating and pneumatic types, design of RBW, Introduction to offshore structures: oil platform, design criteria for sub marine pipelines, cables, response of oil platform members, floating structure to wave load –vibration and spacing of piles, forces on piles.

Unit- IV Ports & Harbours.

06 Hrs.

Planning and management of port and Harbours, Modern trends and techniques in port engineering.- Roll on-Roll off/ Lift on –Lift off etc. Special purpose ports: Concepts of twin /mother port, SBM, outer to outer port etc. Significance of port cost analysis economic.

Unit- V Dredging & Disposal

06 Hrs.

Dredging technology: types of dredgers, radioactive tracers studies for feasibility of dumping ground for dredged materials- environmental aspects of dredging etc. Pollution in Coastal zone, disposal of waste/dredged.

Text Books:

1. Basic Coastal Engineering-R. M. Sorensen, 2006.
2. Coastal Hydrodynamics-J. S. Mani, I IT Madras

Reference Books:

1. Shore Protection Manual-U. S. Waterways Experiment Station Corps of Engineer, Coastal Protection Manual 2002. Narasimhan and S. Kathirolu,
2. Harbour and Coastal Engineering”, Vol I&II, Ocean and Coastal Engineering Publication, NIOT, Chennai

Program: Civil Engineering Professional Elective -IV	B Tech	Semester: VIII
Course : Data Analytics in Civil Engineering (RCP23VCPE814)		

Course Objectives

1. To provide necessary knowledge regarding analysis of data used in Civil Engineering.
2. To understand the various modules like structural Engineering, transportation Engineering, geomatics etc.
3. To Gain the knowledge of Data Analytics in Civil engineering

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Use the various mathematical techniques to analyse data used in Civil Engineering.	3	Learn
CO2	Apply data analytic tools in analysis of data used in Environmental Engineering.	4	Analyse
CO3	Execute data analysis in Structural & Transportation Engineering.	3	Understand
CO4	Use data analysis tools in Water Resource Engineering.	2	Apply

Course Content

Unit- I Introduction and Mathematical Foundation

06 Hrs.

An overview , Vector spaces and subspaces, Basis and dimensions of vectors spaces, Linear Transformation, Eigenvalues and Eigenvectors, Matrix factorization, Introduction to Regression analysis, Linear and Multi linear Regression Technique, Polynomial Regression Technique, Logistic Regression Technique.

Unit- II Environmental Data Analysis and Modelling

06 Hrs.

Introduction to Environmental Engineering, Areas of Environmental Engineering, Data Analysis, Applications of Soft Computing Tools, Multiple Criteria Decision Making Model.

Unit- III Structural Engineering

06 Hrs.

Trends, Applications and Advances of Structural Engineering, Need of Data Science in Structural Engineering, Current Trends & Applications of Data Science in Structural Engineering,

Unit- IV Data Science Application in Intelligent Transportation Systems

06 Hrs.

Introduction to Transportation Engineering, Data in Transportation Industry, Data Analytics in Transportation Industry, Boom Bike Share Demand Case study

Unit- V Data Driven Modelling in Water Resource Engineering

06 Hrs.

Introduction to Water Resource Engineering, Data Analytics in Water Resource Engineering, Computational Intelligence Techniques in Water Resources Management, Predictive Models, Applications of Data Analytics in water resource engineering

Text Books:

- 1 A Primer on Machine Learning Applications in Civil Engineering, by Paresh Chandra Deka
- 2 Data Sciences for Civil Engineering, CRC press, (under process)

Reference Books:

1. Big Data & Hadoop, V.K. Jain, Khanna Publishing House
2. Big Data Black Book, DT Editorial Services, Wiley India
3. Data Science & Analytics, V.K. Jain, Khanna Publishing House
4. Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, ISBN: 978-93- 86173454
- 5 Sivanandam & Deepa, Principles of Soft Computing, Wiley India
- 6 S. Rajasekaram & G.A. Vijyalakshmi Pai, Neural Networks, Fuzzy Logic, PHI
- 7 A Textbook of Matrices, Narayan & Mittal, (ISBN: 9788121925969), S.Chand

Program: Civil Engineering Professional Elective -IV	B Tech	Semester: VIII
Course : Metro Construction Technology (RCP23VCPE815)		

Course Objectives:

1. To develop civil engineering graduates having clear understanding of Metro construction technology.
2. To apply the knowledge of structural design in Metro construction.
3. Understand the concept of underground construction methods.
4. Able to Design precast concrete and understand fundamentals of metro rail

Course Outcomes (COs): After completion of this course students will be able to:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the importance of Advance method of construction technology	2	Understanding
CO2	To apply the knowledge of structural design in Metro construction	3	Applying
CO3	Understand the concept of underground construction methods.	2	Understanding
CO4	Able to Design precast concrete and understand fundamentals of metro rail	5	Evaluating

Course Content

Unit I Metro Projects Fundamentals (08 Hrs.)

Concept of rapid transit systems, requirements of rapid transit systems. Types of rapid transit systems, concept of metro rail transit system, terminology of metro construction, advantages and disadvantages of metro, metro construction projects in India

Unit II Underground Construction (08 Hrs.)

Need for underground construction, fundamentals of underground constructions, planning for underground construction, site preparations, characteristics of soil and basics of geotechnical engineering, methods of underground construction, top-down construction method, bottom-up construction method, safety during underground construction, workers health and safety provisions, regulations of underground construction

Unit-III Tunnel Construction (08 Hrs.)

Fundamentals theories of tunnel construction, types of tunnels, different cross-sections of underground tunnels, methods of tunnel boring, tunnel boring machine (TBM), parts of TBM, working procedure of TBM, procedure of tunnel construction using TBM, stations construction during tunnels, removal and dumping of excavated materials

Unit-IV Precast Concrete Technology (08 Hrs.)

Fundamentals of pre-cast concrete technology, Requirements of precast concrete elements in metro construction, Theories of formwork for precast concrete, curing of precast concrete, Admixtures and ingredients of precast concrete, Transportation off precast segments, Precast segments of tunnel, Precast bridge segments, Fundamentals of precast concrete bridge construction

Unit-V Metro rail (06 Hrs.)

Fundamentals of railway construction, terminology of railway and its components, Railway systems, Railway track construction, Components of railway track, Rail signalling, Introduction to electric supply for metro rail.

Text Books:

1. M Ramachandran, Metro Rail Projects in India: a Study in Project Planning, Oxford University Press, New Delhi, 2011.
2. R K Goel, B Singh and J Zhao, Underground Infrastructures: Planning, Design and Construction, Butterworth-Heinemann, Oxford, 2012.
3. S Chandra, Railway Engineering, Oxford University Press, New Delhi, 2008.
4. K S Elliott, Precast Concrete Structures, CRC Press, Boca Raton, 2016.
5. K N Jha, Construction Project Management: Theory and Practice, Pearson Education, New Delhi, 2015

Program: Civil Engineering Professional Elective -IV	B Tech	Semester: VIII
Course : NPTEL Course ()		

NPTEL/SWAYAM COURSE

Note: - Name of NPTEL /Swayam course will be declare by concerned BOS at the beginning of semester

Program: Civil Engineering	B Tech	Semester: VIII
Coursera Course: Generative AI for Sustainability (RCP2VCSC801)		

Pre-requisite:

1. Understanding of sustainability issues.
2. Basic knowledge of Artificial Intelligence.
3. Understanding of sustainability and circular economy principles.

Course Objectives:

- Understand the fundamental concepts of Artificial Intelligence, sustainability, and multi-agent systems, and their role in addressing global sustainability challenges.
- Apply AI techniques such as supervised, unsupervised, and reinforcement learning to analyse and solve sustainability-related problems.
- Analyse the use of AI in climate change mitigation through predictive modelling, energy demand forecasting, carbon footprint analysis, and emission monitoring.
- Explore AI applications in sustainable energy systems, including smart grids, renewable energy management, predictive maintenance, and energy storage optimization.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the fundamentals of Artificial Intelligence, sustainability, multi-agent systems, and their applications in solving environmental and societal challenges	L2	Understand
CO2	Apply supervised, unsupervised, and reinforcement learning techniques to develop AI-based solutions for sustainability-related problems.	L3	Apply
CO3	Analyse AI techniques for climate change mitigation, including climate forecasting, carbon footprint assessment, emission monitoring, and intelligent energy management.	L4	Analyze
CO4	Evaluate AI-based approaches for sustainable energy systems, including smart grids, renewable energy forecasting, predictive maintenance, and energy optimization.	L5	Evaluate
CO5	Design or recommend AI-enabled solutions for waste management and circular economy applications to improve recycling, resource recovery, and waste-to-energy processes.	L6	Create

Course Content

Unit I	Introduction to AI and Sustainability	(04 Hrs.)
	Overview of Artificial Intelligence	
	• 1.2 Introduction to Sustainability • 1.3 Sustainability Challenges • 1.4 Introduction to Multi-Agent Systems • 1.5 Case Study: AI Models for Climate Change Prediction	
Unit II	AI Techniques for Sustainability Solutions	(04 Hrs.)
	• 2.1 Understanding Sustainability Challenges and Global Responses • 2.2 Applying Supervised Learning for Environmental Forecasting and Classification • 2.3 Case Study: Predicting Air Quality in Beijing: A Machine Learning Approach • 2.4 Unsupervised Learning for Environmental Insights and Resource Optimization • 2.5 Dimensionality Reduction in Sustainability: Case Study on Precision • 2.6 Basics of Reinforcement Learning	
Unit III	AI for Climate Change Mitigation	(04 Hrs.)
	• 3.1 Predictive Models for Weather and Climate Pattern • 3.2 Machine Learning for Climate Change Forecasting • 3.3 AI-Based Risk Assessment and Mitigation • 3.4 Grid Optimization and Energy Storage with AI • 3.5 Demand Forecasting for Energy Consumption	
Unit IV	AI in Sustainable Energy Systems	(04 Hrs.)
	4.1 Predictive Maintenance in Energy Systems	
	4.2 AI for Smart Grids and Dynamic Energy Distribution	
	4.3 AI Applications for Wind and Solar Power Management	
	4.4 Real-Time Monitoring of Renewable Sources + Optimizing Energy Production with AI	
Unit V	AI in Sustainable Energy Systems	(04 Hrs.)
	5.1 Machine Learning in Waste Classification	
	5.2 Smart Recycling Systems Powered by AI	
	5.3 AI Applications in Waste-to-Energy Conversion	
	5.4 Predicting Energy Production from Waste	

Program: Civil Engineering	B Tech	Semester: VIII
Course: Internship (OJT) cum Project (RCP23IPELX10)		

Pre-requisite:

1. Fundamental knowledge of engineering concepts and programming
2. Basic understanding of professional ethics and communication skills
3. Exposure to laboratory courses and mini-projects
4. Teamwork and problem-solving skills

Objectives:

1. To provide practical exposure to industrial and professional environments.
2. To bridge the gap between academic learning and industry practices.
3. To develop technical, communication, teamwork, and managerial skills.
4. To enable application of engineering knowledge for solving real-world problems.
5. To familiarize students with modern tools, technologies, and professional ethics.
6. To prepare students for industry-oriented careers through project implementation and professional experience.

Outcomes: On completion of the course, the learner will be able to:

1. Apply engineering knowledge and technical skills in industrial environments.
2. Analyze and solve practical engineering problems using appropriate tools and techniques.
3. Demonstrate professional ethics, teamwork, communication, and organizational skills.
4. Utilize modern engineering tools and technologies for assigned tasks and projects.
5. Prepare technical reports, presentations, and project documentation effectively.
6. Adapt to professional work culture and demonstrate readiness for professional careers.

Overview of the OJT Process:

The On-Job Training (OJT) program begins with an introduction to workplace ethics, safety practices, organizational culture, and professional conduct to prepare students for industrial environments. Students are then exposed to industrial processes, workflow practices, tools, and modern technologies relevant to their domain of study.

During the technical training phase, students work on assigned industrial tasks and projects under the guidance of faculty mentors and industry supervisors. The program emphasizes the application of engineering concepts, teamwork, communication skills, and problem-solving abilities in real-world professional settings.

The later stages of the OJT focus on project implementation, report writing, technical documentation, and presentation preparation. Students are required to maintain logbooks and progress records throughout the training period. At the end of the semester, students present their project work through demonstrations and viva-voce examinations, followed by comprehensive evaluation and feedback.

Internship (OJT) cum Project Schedule, Duration and Credits

The Internship / On-Job Training (OJT) cum Project is an integral part of the Final Year B.Tech. program and carries a total of 18 academic credits toward completion of the degree requirements. Each

credit corresponds to 40 hours of work, resulting in approximately 550–600 hours of industrial training and project work over one semester.

The full-time OJT program is conducted during the designated semester as per the academic schedule. The duration of the OJT is one complete semester in the final year. Faculty mentors are assigned for mentoring, monitoring, and evaluating students throughout the OJT period. Approximately 50% of the students undergo OJT during Semester VII while the remaining students continue academic activities in the institute. In Semester VIII, the arrangement is interchanged to ensure equal academic and industrial exposure for all students.

To avoid academic scheduling conflicts and ensure fair evaluation, oral, practical, and End Semester Examinations for both Semester VII and Semester VIII will be conducted at the end of Semester VIII. Students are issued a combined mark sheet covering both semesters.

Types of External OJT Opportunities

Sr. No.	Type of OJT	Examples / Description
1	Industry OJT	Industrial internships with or without stipend
2	Government / PSU OJT	BARC, SAMEER, Railways, ISRO, etc.
3	Research OJT	IITs, NITs, IISc, IIMs, and other research institutes
4	Institute-Based OJT	OJT at institutes approved by DJSCE and departments
5	Other Approved OJT	Any approved industrial/research work relevant to the domain

OJT / Internship Sources

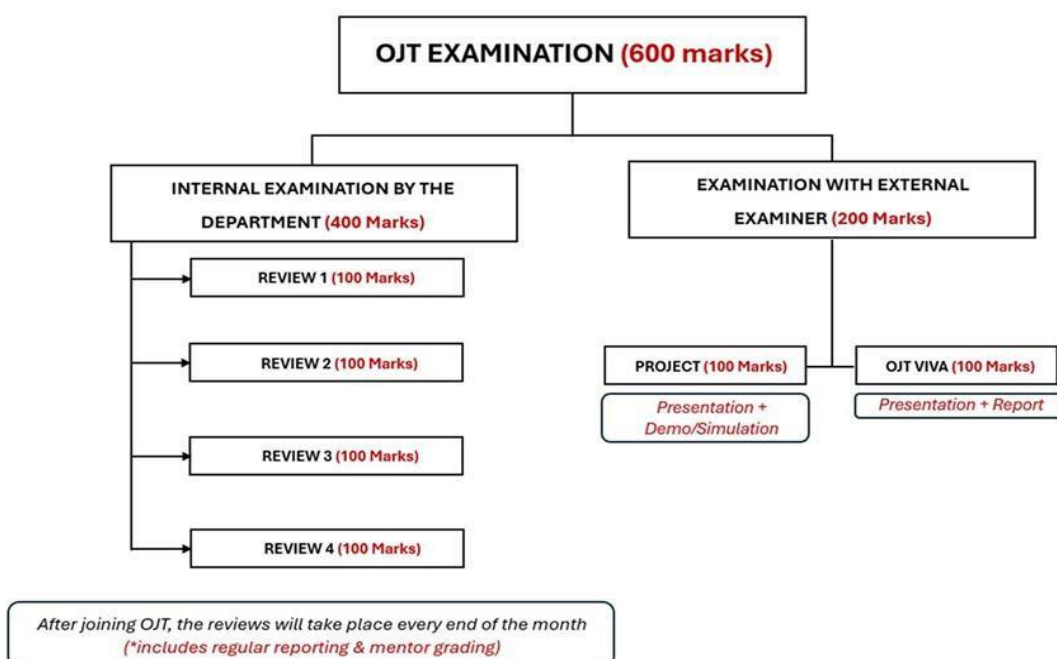
To facilitate OJT and internship opportunities, AICTE has signed Memorandums of Understanding (MoUs) with various industries, government organizations, and training institutions. These collaborations provide students with industrial exposure, skill development opportunities, research internships, and professional training through multiple recognized platforms and organizations. Students may also approach organizations such as the Board of Apprenticeship Training (BOAT) and Board of Practical Training (BOPT) for additional training opportunities.

Major OJT / Internship Sources

Sr. No.	Organization / Platform	Nature of Opportunity
1	Internshala	Internship and industry training opportunities
2	NETiit (Taiwan)	International internship opportunities
3	HireMee	Skill-based internships and employability support
4	IGNCA	Research and cultural project opportunities
5	CCEI, Republic of Korea	International innovation and creative economy internships
6	IWM, Bangalore	Waste management and sustainability projects
7	Engineering Council of India (ECI)	Engineering and professional development activities
8	Fourth Ambit	Industry training and technical internships
9	LinkedIn	Professional networking and internship opportunities
11	SCHOLARSMERIT	Internship and skill enhancement programs
12	Studenting Era	Student internship and academic support activities
13	MSME	Industry exposure and entrepreneurship opportunities
14	BOAT	Apprenticeship and industrial training programs
15	BOPT	Practical and apprenticeship-based training opportunities

Evaluation Metrics:

Sr. No.	Evaluation Component	Marks
1	Internal Review 1	100
2	Internal Review 2	100
3	Internal Review 3	100
4	Final Internal Review	100
5	End Semester Evaluation (OJT Viva/Presentation)	100
6	Project Report & Demonstration	100
	Total	600



Evaluation Parameters

The student shall be evaluated based on the following parameters:

- Understanding of assigned work
- Progress and task completion
- Technical skill development
- Learning ability and initiative
- Professional behaviour and discipline
- Communication and presentation skills
- Problem solving and contribution
- Quality of work and innovation
- Logbook maintenance and report documentation
- Application of engineering knowledge

Necessary Documents

Students are required to submit and maintain the following documents during the OJT period:

1. No Objection Certificate (NOC)
2. Undertaking for opting OJT
3. OJT Joining Form
4. Parent/Guardian Undertaking Form
5. Contact Details and OJT Objectives Form
6. Student Logbook / Daily Activity Record
7. Internal Review Evaluation Sheets
8. External Supervisor Evaluation Form
9. Internal Supervisor Feedback Form
10. Student Feedback Form
11. SDG Mapping Form
12. Final OJT Report
13. Project Report and Presentation
14. OJT Completion Certificate

Scheme of Examination

Component	Marks
Continuous Internal Assessment	400
End Semester OJT Evaluation	100
Project Report & Presentation	100
Total	600 Marks

Credits

- Total Credits: 18
- 1 Credit = 40 Hours of Work
- Minimum Duration: 550–600 Hours of OJT and Project Work over one semester

