



JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
KATOL ROAD, NAGPUR
 Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere
 Website: www.jdcoem.ac.in E-mail: info@jdcoem.ac.in
 An Autonomous Institute, with NAAC "A" Grade Affiliated to DBATU,
 RTMNU, MSBTE, Mumbai Department of Civil Engineering
 “Building Better Development”



Program: B. Tech in Civil Engineering

Course Structure & Evaluation Scheme

VI Semester												
Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit	
				L	T	P	CA	MSE	ESE/Ext. Pra.	Total		
1	PCC	CE6T001	Design of Steel Structures	2	1	0	20	20	60	100	3	
2	PCC	CE6T002	Environmental Engineering	3	0	0	20	20	60	100	3	
3	PEC	CE5TE01	Professional Elective I	3	0	0	20	20	60	100	3	
4	PEC	CE6TE02	Professional Elective-II	3	0	0	20	20	60	100	3	
5	OEC	CEOEC2	Open Elective-II	4	0	0	20	20	60	100	4	
6	PCC	CE6L001	Design of Steel Structures Lab	0	0	2	60	0	40	100	1	
7	PCC	CE6L002	Environmental Engineering Lab	0	0	2	60	0	40	100	1	
8	PROJECT	CE6P003	Mini Project & Seminar	0	0	2	30	0	20	50	1	
9		CE6P004	Campus Recruitment Training (CRT)	0	0	2	50	0	0	50	1	
		CE6P005	Skill Development	0	0	2	15	0	35	50	1	
10	MC	CE6T004	Research Methodology	2	0	0	10	15	25	50	AU	
				17	1	10					21	

VI SEMESTER

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6T001	Design of Steel Structures	2	1	0	3

Prerequisites for the course	
1	Stress-Strain Curve of Mild Steel
2	Moment of Inertia
3	Euler's Buckling Theory

Prior Reading Material/useful links	
1.	http://www.engineeringcorecourses.com/solidmechanics2/C5-buckling/C5.1-eulers-buckling-formula/theory/
2.	https://www.eigenplus.com/the-stress-strain-curve-of-the-mild-steel/
3.	https://www.toppr.com/guides/physics/system-of-particles-and-rotational-dynamics/moment-of-inertia/

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Understand the fundamentals of steel structures, fasteners and connections, concept of balanced section, under reinforced and overreinforced section.
2	CO2	Explain Plastic theory, Plastic hinge concept, Plastic collapse load, Types of tension members, behavior of tension members.
3	CO3	Apply knowledge of Welding, Types and Properties of Welds, Types of joints, Weld symbols, Weld specifications, Effective areas of welds, Design of welds.
4	CO4	Analyze the tension and compression members, Elastic buckling of slender compression members, Sections used for compression members.
5	CO5	Solve numerical on simple slab base and gusseted bases Beam types, simple and built-up beams in bending (without vertical stiffeners).
6	CO6	Build steel structure elements with Limit State Method of design, by using Codes, Specifications and section classification.

Syllabus:

Course Content	
Unit I	Introduction to Design of Steel Structures, Steel as a structural Material, grades of structural steel, various rolled steel sections and their properties. Limit State Method of Design, Design considerations, Failure Criteria for Steel. Introduction to I.S. 800, 808, 816, 875 etc. [04 hrs]
Unit II	Introduction to Connection, Behavior of bolted and welded connections (Types, Designations, Properties, Permissible Stresses), Design of bolted and welded Connections, Eccentric Connections, Efficiency of joints. Tension Members: Design Strengths, Design of Tension Members, Design of Gusset Plate. Lug Angles. Design of roof truss, Load assessment for DL, LL and WL. [08 hrs]
Unit III	Compression Member: Modes of Failure of Column, Design of Compression Member. Design of single rolled steel section column subjected to axial load and uniaxial moment. Design of axially loaded built up columns: Laced and Battened. [10 hrs]
Unit IV	Introduction to Flexural Member, Design of Laterally restrained and unrestrained beams (symmetrical as well as unsymmetrical section). Calculation of Plastic Section modulus. Design of Girder. [08 hrs]
Unit V	Design of Column Bases: slab base and gusseted base subjected to axial and eccentrically loaded. [06 hrs]

Text Books:	
1	Design of Steel Structures (By Limit State Method as per IS: 800-2007) , by Bhavikatti, Publisher: IKBooks.
2	Design of steel structures by N. Subramanian (Using IS: 800-2007) Publisher: Oxford University Press,India.
3	Limit State Design of Steel Structures by S. K. Duggal Publisher: Tata McGraw Hill.
4	Limit State Design of Steel Structures: Based on IS: 800-2007 by Dr. Ramchandra, Virendra Gehlot Scientific Publishers.
5	Design of steel structures by K. S. Sairam Publisher: Pearson Education
Reference Book:	
1	Design of steel structures by Willam T Segui, CENGAGE Learning

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. K. N. Kadam	Associate Professor	GCOE, Nagpur
2	Prof. Atika Ingole	Assistant Professor	JDCEM, Nagpur
3	Prof. Shital Navghare	Assistant Professor	JDCEM, Nagpur

**Secretary
BoS**

**Chairman
BoS**

**Dean
Academics**

**Chairman
Acad. Council**

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6T002	Environmental Engineering	3	0	0	3

Prerequisites for the course	
1	Basics of Civil Engineering
2	Basic sciences such as chemistry, physics, and biology
3	Knowledge of engineering principles related to fluid mechanics and hydraulics
4	Familiarity with environmental laws and regulations related to water supply and wastewater treatment

Prior Reading Material/useful link	
1.	https://www.youtube.com/watch?v=E00FN9yKkoY
2.	https://guide.berkeley.edu/graduate/degree-programs/civil-environmental-engineering/
3.	https://www.youtube.com/watch?v=CTUOchYZG2k

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Define the importance and necessity of water supply and waste water treatment scheme.
2	CO2	Understand the various unit operations and unit processes in water & waste water treatment and flow sheet of conventional municipal water & waste water treatment plant.
3	CO3	Compare various units of conventional water & waste water treatment plant..
4	CO4	Apply advance treatment process to treat water and waste water.
5	CO5	Estimate an ecofriendly system for reuse and recycling of waste water.
6	CO6	Design and develop safe, effective and efficient water supply and waste water disposal system.

Syllabus:

Course Content	
Unit I	<p>Introduction: Importance and need of planned water supply scheme, various components of water supply scheme.</p> <p>Water Demand: Types of demand, factors affecting per capita demand, variation in demand, losses, design period and population forecasting methods. Sources of Water: Various sources of surface water and groundwater for water supply scheme including various intake structures.</p> <p>Water quality: Physical, Chemical and bacteriological characteristics of water.</p>
Unit II	<p>Treatment of Water</p> <p>Types of Treatments: Aeration: Necessity, methods, removal of taste and odour, design of aeration fountain.</p> <p>Sedimentation: Suspended Solids, settling velocity, types of sedimentation tanks, surface loading, detention time, inlet and outlet arrangements, Design of Sedimentation tank.</p> <p>Filtration: Theory of filtration, filter materials, types of filters, components, working and cleaning of filters.</p> <p>Disinfection: Theory of disinfection, factors affecting, efficiency of disinfection, types of disinfectants.</p>
Unit III	<p>System of Water Supply Continuous and intermittent system, type of distribution systems, layouts, methods of supply: gravity, pumping and combination, hydraulic analysis of distribution system.</p>
Unit IV	<p>General Aspects of waste water treatment & Disposal Necessity of treatment, classification of waste water, grey water and black water, system of sanitation, patterns of sewage collection systems. Estimation of storm water and sanitary waste water.</p> <p>Disposal of waste water: Disposal standards, disposal by dilution, disposal by land treatment along with their advantages and disadvantages.</p> <p>Conveyance of sewage: Types, shapes, hydraulic design of sewer.</p>
Unit V	<p>Wastewater treatment Process</p> <p>Wastewater treatment flow sheet and its site selection, preliminary and primary treatment - Screens, Grit chambers, Primary Settling Tank, Design of Conventional waste water treatment plant.</p>

Text Books:	
1	Water supply & Sanitary Engineering Vol. I : B. C. Punmia (Laxmi Publication)
2	Water supply & Sanitary Engineering : G. S. Birdie (Dhanpat Rai Publication)
3	B.C. Punmia, "Waste Water Engineering" - Laxmi Publication
4	G.S. Birdie, "Water Supply & Sanitary Engineering" - Dhanpat Rai Publ. Company (P) Ltd.
Reference Book:	
1	S. K. Garg "Environmental Engineering Vol-II (Khanna Publication)
2	CPHEEO manual on sewerage and sewage treatment. Metcalf and Eddy "waste water treatment

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization	Signature
1	Dr. Rahul Ralegaonkar	Professor	VNIT, Nagpur	
2	Prof. Atika Ingole	Asst. Professor	JDCOEM, Nagpur	
3	Prof. Nilesh Pal	Asst. Professor	JDCOEM, Nagpur	

Professional Elective I

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6TE01A	Urban Transportation Systems Planning	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of urbanization and urban areas, including urban design and classification of urban roads.
2	Understanding of transportation systems and modes, such as road transport, rail transport, and public transport.
3	Knowledge of the impact of transportation on the environment and sustainable transportation concepts.
4	Familiarity with data collection and analysis methods, including surveys and environmental impact analysis.

Prior Reading Material/useful link	
1.	https://www.unfpa.org/resources/classification-and-delineation-urban-areas-census
2.	https://www.preventionweb.net/understanding-disaster-risk/risk-drivers/poorly-planned-urban-development
3.	https://www.nrel.gov/transportation/sustainable-mobility-initiative.html

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Remember the issues & challenges in the Urban Transportation Sector.
2	CO2	Explain the characteristic of urban transportation, structure of urban transportation and classification of urban roads.
3	CO3	Develop skills required for Transport planning & formulation.
4	CO4	Analyze the processes for Transport project execution and control.
5	CO5	Choose the contracting process as applied in Urban Transport projects.
6	CO6	Elaborate the use of intelligent Transport System and need to accommodate non-motorized transports

Syllabus:

Course Content	
Unit I	Urbanization and Transportation: Importance of urban area, Structure of urban area, urban design, use of roadspace, classification of urban roads.
Unit II	Urban Transportation Characteristics: Factors influencing transportation needs, transportation demand, type of trips, mode of travel, urban transportation scene in India. Road congestion, impact of transport on environment.
Unit III	Urban Transportation Planning Process: Urban transportation planning objectives, urban transportation system, urban transportation planning process, data collection, surveys for data collection, environmental impact analysis.
Unit IV	Travel Demand Forecasting: Trip generation and attraction analysis, trip distribution models, model split analysis, route assignment analysis. Public Transportation: Bus transport characteristics, bus route planning, performance indicator, types of rail transit, rail transit system development in Indian cities, Integrated Transport System, Modes of Integrated transport systems
Unit V	Innovations in Urban Transportation: Need for innovative approaches, track guided bus, BRT, GIS, ITS, functional areas of ITS. Non-motorized Urban Transportation : Importance of pedestrian facilities, sidewalks, PUP & POB, bicycle facility planning, types of bicycle facilities, bicycle network planning, bicycle parking, cycle - rickshaws.

Text Books:	
1	Traffic Engineering and Transport Planning: L R Kadiyali, Khanna Publishers.
2	Urban Transportation: D. J. Victor & S. Ponnuswamy, Tata McGraw – Hill
Reference Book:	
1	Transport Planning and Traffic Engineering: C A O' Flaherty, BUTTER WORTH- HEINEMANN
2	Urban Development and Sustainable Transport P. Anbalagan, Bookwell Publications
3	Urban Transportation Planning 2nd Edition by Michael Meyer, Eric Miller, McGraw - Hill

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. K. N. Kadam	Associate Professor	GCOE, Nagpur
2	Prof. Shital Navghare	Assistant Professor	JDCOEM, Nagpur
3	Prof. Gauarv Rangari	Assistant Professor	JDCOEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6TE01B	Building Construction Practices	3	0	0	3

Prerequisites for the course	
1	Basics of Civil Engineering
2	Understanding of civil engineering, including knowledge of construction materials and their properties, as well as the principles of building construction and design.
3	Understanding of mathematics and physics, including mechanics and structural analysis
4	Knowledge of the relevant Indian Standard Codes (IS codes) related to building construction

Prior Reading Material/useful link	
1.	https://www.twi-global.com/technical-knowledge/faqs/structural-engineering
2.	https://structuralengineeringbasics.com/what-types-of-construction-building-materials/
3.	https://www.youtube.com/watch?v=R2dNp5tLni0

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Acquire the knowledge about building construction, stone work, brick work, timbering, floors and brick.
2	CO2	Understand the basic components of building and fundamental parameters in stonework, brickwork and timbering.
3	CO3	Utilize the knowledge on the site during building construction.
4	CO4	Distinguish the properties different materials used in building construction.
5	CO5	Choose the material and method of work for the appropriate construction of building.
6	CO6	Construct the building using the knowledge gained.

Syllabus:

Course Content	
Unit I	Building: Building components and its classification to NBC-2005. Foundations: Necessity and types of foundations. Details shallow foundations, Introduction to deep foundation. Loads on foundations, Causes of failures of foundations and remedial measures, Foundation on black cotton soil, Foundation trenches, excavation timbering of foundation trenches, Load bearing and framed structures, Simple numerical on design of footing for load bearing structures. [08 hrs]
Unit II	Stone Work: Stones, cutting and dressing, selection of stones types of stone masonry, principles of construction, and joints in masonry. Lifting heavy stones, common building stones in India, artificial building stones, uses and application of stones, stone cladding Pointing: Necessity and types of pointing Arches and Lintels: Terminology in construction of arches and types, types chajjas and canopies. Pre cast lintels& Arches. Plastering: Necessity, types and its procedure of construction. [08 hrs]
Unit III	Brickwork: Qualities of good bricks, classification of bricks tests on bricks as per IS codes. Terms used in brickwork, commonly used types of bonds in brickwork (one brick thick only) such as header, stretcher, English and Flemish bonds, principles of construction, reinforced brickwork, brick knogging, Parapets, copings, sills and corbels, brief introduction to cavity walls, loadbearing and partition walls. Masonry construction using cement concrete blocks, perforated bricks, paving, hollow blocks, fire clay bricks, AAC block. Precast construction: introduction, advantages and comparison with conventional construction methods. [08 hrs]
Unit IV	Timbering: Centering and formwork shoring, underpinning, and scaffolding. Timber: Classification, structural, characteristics, defects and prevention. Painting: White washing, color washing and distempering new materials& Techniques. Damp Proofing: Causes and effect of dampness. Various methods of damp proofing, Damp proofing of plinth Heat and sound insulation [08 hrs]
Unit V	Floors: General principles, types and method of construction upper floors finishes quality and testing floor tiles, synthetic & Ceramic Tiles. New techniques and materials used for flooring. Manufacturing of vitrified tiles Roofs: Flat and pitches roofs, roof coverings types and their constructional features, Thermal Insulation, Innovative roofing material used Ex. FRP Stairs: Types of stairs, functional design of stairs. Introduction of Lift and Escalators Doors and Windows: Purpose materials of construction and types. [08 hrs]

Text Books:	
1	Building Construction: B. C. Punmia, Laxmi publication Pvt. Ltd. New Delhi and distributor, 1984 & later 2008.
2	Building construction by Sushil Kumar, 16th Edition, Standard Publishers Distributors, 2006.
3	Building Construction Material by S.K. Duggal, 4th edition, New Age International, Reprint Nov.2014.
Reference Book:	
1	Building Construction and Materials by Singh Gurcharan, Standard Publisher and Distributor, Standard Publishers Distributors, 2003.

2	Alternative building Materials and Technologies: K. S. Jagdish& B. V. Venkatarama Reddy, New ageinternational Publishers, 2007.
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1	Dr. P. D. Pachpor	Professor	RCOE, Nagpur
2	Prof. Atika Ingole	Asst. Professor	JDCEM, Nagpur
3	Prof. Nilesh Pal	Asst. Professor	JDCEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6TE01C	Rural Water Supply and Onsite Sanitation Systems	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of water supply and sanitation systems, their components, and their functions.
2	Understanding of rural communities, their lifestyles, and their specific needs for water supply and sanitation.
3	Knowledge of the importance of environmental protection, pollution control, and sustainable development.
4	Basic knowledge of chemical properties of water and pollutants, chemical reactions, and chemical treatment processes.

Prior Reading Material/useful link	
1.	https://www.coursera.org/lecture/engineering-humanitarian/introduction-to-water-supply-systems-wQrM2
2.	https://www.smsfoundation.org/wastewater-management-in-rural-india/
3.	https://www.youtube.com/watch?v=57RkhH4KkAU

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Know the problems pertaining to rural water supply and sanitation.
2	CO2	Understand the engineering knowledge and principals of appropriate technology to develop cost effective technique for rural water supply and sanitation.
3	CO3	Develop water supply and sanitation system for rural community.
4	CO4	Discover low cost waste management systems for rural areas.
5	CO5	Evaluate high quality solid waste composting system to convert solid waste into good quality manure.
6	CO6	Plan and design an effluent and solid waste disposal mechanism.

Syllabus:

Course Content	
Unit I	Concept of environmental & scope of sanitation in rural areas. Magnitude of problem of water supply and sanitation –population to be covered and difficulties National policy. Various approaches for planning of water supply systems in rural areas. Selection and development of preferred sources of water, springs, well sand in filtration galleries, collection of raw water from surface source. [06 hrs]
Unit II	Specific problem in rural water supply and treatment e.g.iron, manganese, fluorides etc. Low cost treatment, appropriate technology for water supply and sanitation. Improvised method and compact system of treatment of surface and ground water such as MB settlers, slow sand filter, chlorine diffusion cartridge etc. Water supply through spot sources, hand pumps, open dug–well. [06 hrs]
Unit III	Planning of distribution system in rural areas. Water supply during fairs, festivals and emergencies. Treatment and disposal of waste water/sewage. Various method of collection and disposal of night soil. [06 hrs]
Unit IV	On site sanitation system and community latrines. Simple waste water treatment system for rural areas and small communities such as stabilization ponds, septic tanks, soakage pits etc. [06 hrs]
Unit V	Disposal of solids waste: composting, land filling. Biogas plants. [06 hrs]

Text Books:	
1	Low cost onsite sanitation option, Hoffman &Heijno Occasional Nov.1981
2	Rijswijk (the Haque). Wagner, E. G. and Lanoik, J. N. water supply for rural area sand smallcommunities, Geneva: W.H.O.1959.
Reference Book:	
1	Manual of water supply and treatment, 3rd edition, CPHEEO, GOI, New delhi.

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1	Dr. P. Y. Pawade	Professor	GHRCOE, Nagpur
2	Prof. Shital Navghare	Assistant Professor	JDCEM, Nagpur
3	Prof. Gauarv Rangari	Assistant Professor	JDCEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6TE01D	Introduction to Earthquake Engineering	3	0	0	3

Prerequisites for the course	
1.	Basic knowledge of physics and mechanics, including Newton's laws of motion, force, and energy.
2.	Understanding of structural analysis and design principles, particularly for reinforced concrete structures.
3.	Knowledge of geology and plate tectonics.
4.	Basic understanding of seismology and seismographs.

Prior Reading Material/useful link	
1.	Basic of Civil (A Hand Book For Civil Engineering Students)By R. Khan
2.	https://www.youtube.com/watch?v=g550H4e5FCY
3.	https://www.iare.ac.in/sites/default/files/RCSDD_PPT%20editing%20format.pdf

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Define basics of introduction to earthquakes, behavior of plates, effects and importance of Earthquake Engineering
2	CO2	Demonstrate history of earthquakes in India and abroad, case studies of effects of earthquakes, causes and sources of earthquake damage.
3	CO3	Solve numerical of magnitude of earthquake, epicenter, epicenter distances, by using IS codes.
4	CO4	Analyze the behavior of load bearing structures, masonry structures behave under earthquake in seismic zoning of India (IS 1893:2002 Part I), irregularities in buildings.
5	CO5	Conclude the application of design method for earthquake resistance structures.
6	CO6	Adapt the preventive measures to avoid critical damages due to natural disasters.

Syllabus:

Course Content	
Unit I	Introduction to earthquakes : Geology of earth, configuration of tectonic plates in a globe, behavior of plates, their motion and effects, causes of earthquake and their characteristics, Earthquake parameters, magnitudes, intensity. Seismic waves, recording of earthquakes, analysis and interpretation of earthquake data, determination of magnitude, location of epicenter, focal depth. Seismic zoning maps of India. Response spectra. Strong motion characteristics [08 hrs]
Unit II	Earthquake effects on the structures, classification of loads, Seismic damages during past earthquakes, effect of irregularities and building architecture on the performance of RC structures [08 hrs]
Unit III	Seismic methods of analysis, seismic design methods, Design of multi – story RC structure foundation as per latest IS 1893 by Equivalent static lateral load method and Response spectrum Method. Introduction to Time history method. Concept of Capacity based design of soft story RC building, concept of shear walls. Ductile detailing as per latest IS :13920 [08 hrs]
Unit IV	Seismic retrofitting, Source of weakness in RC framed building, Various retrofitting techniques, Conventional and non- conventional methods, Comparative study of various methods and case studies. [08 hrs]
Unit V	Base isolation for earthquake resistant design of structures: Base isolation concept, isolation systems and their modeling; linear theory of base isolation; stability of elastomeric bearings; codal provisions for seismic isolation, practical applications. [08 hrs]

Text Books:	
1	Agrawal & Shrikhande, „Design of Earthquake Resistant Structures“, 3rd Edition, 2006, Prentice – Hall of India Pvt. Ltd.
2	Jai Krishna, Chandrasekaran Brijesh Chandra, „ Elements of Earthquake Engineering“, 2nd Edition, Standard Publishers Distributors, New Delhi 3. Roberto Villaverde, „Fundamental Concepts of Earthquake Engineering“, 2009, CRC Press
	Asadour H. Hadjian, „Basic Elements of Earthquake Engineering“, 2015, Wiley
Reference Book:	
1	Clough R.W. and Penzien J., 'Dynamics of Structures', McGraw-Hill, 2 nd edition, 1992.
	Newmark N.M. and Rosenblueth E., 'Fundamentals of Earthquake Engg.,' Prentice Hall, 1971.
	David Key, 'Earthquake Design Practice for Buildings', Thomas Telford, London, 1988.
	Ellis L. Krinitzsky, J.M. Gould and Peter H. Edinger, 'Fundamentals of Earthquake Resistant Construction', John Wiley, 1993.
	Blume J.A., Newmark N.M., Corning L.H., 'Design of Multi-storied Buildings for Earthquake groundmotions', Portland Cement Association, Chicago, 1961.

	Pankaj Agarwal and Manish Shrikhande, 'Earthquake Resistant Design of Structures', PHI, 2008.
	Proc. of World Conferences on Earthquake Engg., 1956-2008.8. I.S. Codes No. 1893, 4326, 13920 etc.

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Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6TE01E	Foundation Engineering	3	0	0	3

Prerequisites for the course	
1.	Basic knowledge of soil mechanics and geotechnical engineering principles.
2.	Understanding of the behavior of soil under different loads and stress conditions.
3.	Familiarity with the properties of different types of soils and their classification systems.
4.	Knowledge of the principles and methods of site investigation and soil exploration.

Prior Reading Material/useful link	
1.	https://onlinecourses.nptel.ac.in/noc21_ce41/preview
2.	https://www.youtube.com/watch?v=V1m3cB-Aqy8
3.	https://www.youtube.com/watch?v=P0j_pt4BLS0

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Predict soil behavior under the application of loads.
2	CO2	Describe and illustrate the soil properties by various field and lab analysis.
3	CO3	Calculate bearing capacity and depth of foundation for different field conditions.
4	CO4	Analysis of shallow and deep foundation and it's settlement.
5	CO5	Judge the concept of foundation for the different field conditions.
6	CO6	Develop the knowledge of foundation engineering for effective designing.

Syllabus:

Course Content	
Unit I	General requirements to be satisfied for satisfactory performance of foundations, Soil exploration: Necessity, Planning, Exploration Methods, Soil Sampling Disturbed and undisturbed, Rock Drilling and Sampling, Core Barrels, Core Boxes, Core Recovery, Field Tests for Bearing Capacity evaluation, Test Procedure & Limitations [08 hrs]
Unit II	Bearing capacity of soils: Terzaghi's theory, its validity and limitations, bearing capacity factors, types of shear failure in foundation soil, effect of water table on bearing capacity, correction factors for shape and depth of footings. Bearing capacity estimation from N-value, factors affecting bearing capacity, presumptive bearing capacity [08 hrs]
Unit III	Settlement of shallow foundation: causes of settlement, elastic and consolidation settlement, differential settlement, control of excessive settlement. Proportioning of footings for equal settlement. Plate load test: Procedure, interpretation for bearing capacity and settlement prediction. [08 hrs]
Unit IV	Guidelines for Weak and Compressible Soils, Expansive soil, Parameters of Expansive Soils, Collapsible Soils and Corrosive Soils, Causes of Moisture changes in Soils, Effects of Swelling on Buildings, Preventative, Measures for Expansive Soils, Modification of Expansive Soils, Design of Foundation on Swelling Soils, Ground Improvement Methods: for general considerations, for Cohesive Soils, for Cohesion less Soils [08 hrs]
Unit V	Pile Foundation: Classification of piles, constructional features of cast-in-situ and precast concrete piles. Pile driving methods, effect of the driving on ground. Load transfer mechanism of axially loaded piles. Pile capacity by static formula and dynamic formulae, pile load test and interpretation of data, group action in piles, spacing of piles in groups, group efficiency, overlapping of stresses. Settlement of pile group by simple approach, negative skin friction and its effect on pile capacity, general feature of underreamed piles. [08 hrs]
Text Books:	
1	Kasamalkar, B.J., "Foundation Engineering", Pittsburgh vintage Grand Prix.
2	Murthy V.N.S., "Soil Mechanics and Foundation Engineering", CRC Press 2002.
3	Arora K.R., "Soil Mechanics and Foundation Engineering", Standard publication 2009
4	Punmia B. C., "Soil Mechanics and Foundation Engineering", Laxmi publication.
5	Nayak N.V., "Foundation Design Manual", Dhanpat Rai and Sons.
Reference Book:	
1	Brahma S.P., "Foundation Engineering", Tata McGraw-Hill 5th Edition.
	Bowles J.E., "Foundation analysis & Design" McGraw-Hill Higher Education 5th edition

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1	Dr. P. Y. Pawade	Professor	GHRCOE, Nagpur
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3	Prof. Gauarv Rangari	Assistant Professor	JDCOEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6TE01F	Irrigation Engineering	3	0	0	3

Prerequisites for the course	
1.	Knowledge of basic principles of fluid mechanics, mechanics of materials, and engineering mathematics
2.	Knowledge of soil mechanics and foundation engineering
3.	Basic knowledge of surveying and engineering drawing

Prior Reading Material/useful link	
1.	https://studentlesson.com/fluid-mechanics/
2.	https://byjus.com/physics/fluid-dynamics/
3.	https://www.youtube.com/watch?v=BzAeUZAmcXM

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Acquire the knowledge about irrigation engineering.
2	CO2	Describe the different structures involved in irrigation projects
3	CO3	Compute the necessary data required to design the irrigation project.
4	CO4	Differentiate the hydraulic structures according to their functions and requirement.
5	CO5	Evaluate stability condition of Dam.
6	CO6	Design the hydraulic structures.

Syllabus:

Course Content	
Unit I	Water Requirement of Crops: Suitability of soils for Irrigation, Standards of Irrigation water; PET-R method of crop water requirements; Depth & frequency of Irrigation; Relation between duty and delta; Factors affecting duty; Crop rotation; Methods of assessment of Irrigation water, Reservoir Capacity.
Unit II	Gravity Dam: Definition; forces acting on gravity dam; stability requirements; Theoretical & practical profile of gravity dam; Low & Highdam; Galleries. Earthen Dams: Types and component parts of earthen dams, seepage and drainage arrangements; Failure of earthen dams; Plotting of phreatic line for homogeneous earthen dams with horizontal filters; Stability checks.
Unit III	Diversion Head Works : Component parts of diversion headworks; Causes of failure of weirs on permeable foundation; Bligh's Creep theory; Dr. Khosla's theory for design of weirs on permeable foundations. Canals: Canals In Alluvial Soils: Kennedy's silt theory, Lacey's silt theory, Lacey's Regime equation. Lined Canals: Design procedure, types of lining, relative merits and demerits of canal lining, Economics of canal lining
Unit IV	Canal Regulation Works: Theoretical aspects of location, objects, classification, components and schematic section of Head Regulator, Cross regulators, canal escapes, Canal falls and canal outlets. Cross Drainage Works: Theoretical aspects of location, objects, classification, components and schematic section of aqueducts, siphon aqueducts, super passage, canal siphon, inlets and level crossing
Unit V	Water Logging and Land Drainage: Causes, effects, preventive measures of water logging, Types of drains, Layout of tile drains system, flow of groundwater to drains. Soil Erosion: Causes, effects and control

Text Books:	
1	Varshney R. S., Gupta & Gupta, 1987, "Theory and Design of Irrigation Structures", Vol. I & II.
2	Punamia B. C. Pandey B. B. and Lal, 1992, "Irrigation and Water Power Engineering", Standard Publishers, New Delhi.
3	Garg S. K., 1976, "Irrigation Engineering & Hydraulic Structures", Khanna Publishers, N. Delhi.
4	Priyani, 1982, "Irrigation and Water Power", Charotar Publishing House, Anand.
5	Bharat Singh, 1979, "Irrigation", Nemchand Brothers, Roorkee
Reference Book:	
1	Subramanya K., 1984, "Engineering Hydrology", Tata Mc-Graw Hill Company Limited, N. Delhi.

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. Rahul Ralegaonkar	Professor	VNIT, Nagpur
2	Prof. Atika Ingole	Assistant Professor	JDCOEM, Nagpur
3	Prof. Gauarv Rangari	Assistant Professor	JDCOEM, Nagpur

Professional Elective-II

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6TE02A	Geometric Design of Highway	3	0	0	3

Prerequisites for the course	
1.	Basic knowledge of civil engineering principles and concepts.
2.	Understanding of road construction and design process.
3.	Familiarity with geometric principles and design factors related to roadways, including topography, traffic capacity, design vehicle, and environmental factors.

Prior Reading Material/useful link	
1.	https://www.youtube.com/watch?v=mx2SNc6kBgw
2.	https://www.youtube.com/watch?v=9WdVvDfWvhE
3.	https://slideplayer.com/slide/6973484/

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Define the elements of vertical alignment, including being able to design and set out vertical curves.
2	CO2	Demonstrate the geometric design controls and criteria.
3	CO3	Choose the elements of horizontal alignment, including being able to design and set out circularcurve elements and circular and transition curves.
4	CO4	Distinguish the geometrical designs of local roads and streets, collector roads and streets, rural andurban arterials, and freeways.
5	CO5	Evaluate the elements of cross-section elements of pavement
6	CO6	Design the geometric parameters of Highway.

Syllabus:

Course Content	
Unit I	Introduction: Geometric Control factors like Topography, design speed, design vehicle, Traffic Capacity, volume, environment, and other factors as per IRC and AASHTO standards and specifications, PCU concept, factors controlling PCU for different design purpose [06 hrs]
Unit II	Cross Sectional Elements: Pavement surface characteristics, friction, skid resistance, pavement unevenness, light reflecting characteristics, camber, objectives, types of camber, methods of providing cambers in the field, problems, carriage way, kerb, median, shoulder, foot path, parking lanes, service roads, cycle tracks, Driveways, Right of way, Factors influencing right of way, Design of Road humps as per latest IRC provisions. [10 hrs]
Unit III	Horizontal Alignment: Definition, Checking the stability of vehicle, while moving on horizontal curve, Super elevation, Ruling minimum and maximum radius, Assumption, problems, method of providing super, elevation for different curves, Extra widening of pavement on curves, objectives, Mechanical widening, psychological widening, Transition curve, objectives, Ideal requirements, Types of transition curve, Method of evaluating length of transition curve, Setting the transition curve in the field, set back distance on horizontal curve and problems on above. [10 hrs]
Unit IV	Sight Distance: Importance, types, Side distance at uncontrolled intersection, derivation, factors affecting side distance, IRC, AASHTO standards, problems on above. Vertical Alignment: Gradient, Types of gradient, Design criteria of summit and valley curve, Design of vertical curves based on SSD, OSD, Night visibility considerations, Design standards for hilly roads, problems on the above. [06 hrs]
Unit V	Intersection Design: Principle, At grade and Grade separated junctions, Types, channelization, Features of channelizing Island, median opening, Gap in median at junction. Rotary Intersection: Elements, Advantages, Disadvantages, Design guide lines, problem on the above, Grade separated intersection, Three legged intersection, Diamond inter change, Half clover leaf, cloverleaf, Advantages, Disadvantages only. Highway Drainage: Importance, sub surface drainage, surface drainage, Design of roadside drains, Hydrological, Hydraulic considerations and design of filter media, problems on above. [10 hrs]

Text Books:	
1	L.R. Kadyali & N.B Lal, Principles and practices of Highway Engineering 2006
2	Sharma S.K, Principles and Practices of Highway Engineering 2012
Reference Book:	
1	O'Flaherty, A. Coleman, "Highways: the Location, Design, Construction and Maintenance of Road Pavements", 4th Ed. , Elsevier 2006

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. Rahul Ralegaonkar	Professor	VNIT, Nagpur
2	Prof. Shital Navaghre	Assistant Professor	JDCOEM, Nagpur
3	Prof. Gauarv Rangari	Assistant Professor	JDCOEM, Nagpur
4	Prof. Tina Khandale	Assistant Professor	JDCOEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6TE02B	Project Planning and Cost Analysis	3	0	0	3

Prerequisites for the course	
1	Basics of project management
2	Principles of accounting and finance
3	Organizational behavior and leadership
4	Emerging technologies and automation in construction

Prior Reading Material/useful link	
1.	https://www.youtube.com/watch?v=wJ8HZ7hqUs8
2.	https://www.youtube.com/watch?v=Hs-U3jAvqo4&list=PLYqSpQzTE6M-DIbYhV1psqEz8xlpbhTgs
3.	https://www.youtube.com/watch?v=-sLHfYnxh8s&list=PLbMVogVj5nJQYXoO3foSZ6CrU7aCCwTsb
4.	https://www.youtube.com/watch?v=2B7DhQvL8kw&list=PLwdnzlV3ogoVGSUhjx4VzW-dGz7DqQFoj

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Acquire the fundamental knowledge in project planning.
2	CO2	Understand the process involved for project planning, modern construction techniques used for planning.
3	CO3	Develop the planning including all the resources with safety measures.
4	CO4	Assume the required resources during planning for cost analysis of project.
5	CO5	Choose the method for project planning and resource allocation.
6	CO6	Apply the knowledge in the modern techniques used for planning.

Syllabus:

Course Content	
Unit I	Definition of Projects; Stages of project planning: pretender planning, pre- construction planning, detailed construction planning, role of client and contractor. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts.
Unit II	Project organization, documentation and reporting systems. Control & monitoring. Temporary Structures in Construction; Construction Methods for various types of Structures. Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction. Importance of Contracts Management; Planning and organizing construction site and resources, Documentation at site; Manpower: planning, organizing, staffing, motivation.
Unit III	Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction
Unit IV	Basics of Modern project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.
Unit V	Cost Analysis: Introduction to the application of scientific principles to costs and estimates of costs in construction engineering; concepts and statistical measurements of the factors involved in direct costs, general overhead costs, cost markups and profits; and the fundamentals of cost recording for construction cost accounts and cost controls.

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

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. Rahul Ralegaonkar	Professor	VNIT, Nagpur
2	Prof. Kamlesh Meshram	Assistant Professor	JDCOEM, Nagpur
3	Prof. Gauarv Rangari	Assistant Professor	JDCOEM, Nagpur
4	Prof. Tina Khandale	Assistant Professor	JDCOEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6TE02C	Water and Air Quality Modeling	3	0	0	3

Prerequisites for the course	
1	Knowledge of Environmental Science and Ecology.
2	Knowledge of Hydrology, Geology, and Meteorology.
3	Understanding of Water and Air Pollution sources, types, and effects.
4	Knowledge of Water and Air Quality standards and regulations.

Prior Reading Material/useful link	
1.	https://study.com/academy/lesson/what-is-environmental-science-definition-and-scope-of-the-field.html
2.	https://www.youtube.com/watch?v=G7CnE5NBxZs
3.	https://www.vedantu.com/biology/pollution-of-air-and-water

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Acquire scientific and technological understanding on the physico-chemical operations and processes used in the treatment of water and wastewater.
2	CO2	Understand the water/wastewater characterization and the treatment units'' monitoring required for their design, operation and control, and acquiring the related monitoring and analysis skills.
3	CO3	Plan control the routinely used physico-chemical water and wastewater treatment units
4	CO4	Analyze cost effective, high efficiency water and air quality model.
5	CO5	Explain learning of the techniques employed in the monitoring of particulates and gaseous pollutants in ambient air and stack gas.
6	CO6	Formulate the modelling of air quality through the use of different software''s.

Syllabus:

Course Content	
Unit I	Water Quality and Parameters: Physical; chemical and biological water quality parameters; General parameters; Biological water quality and fecal coliform count; Solids; Biodegradable and non-biodegradable organic matter; Nutrients; Heavy metals; and pesticides and recalcitrant/toxic organic compounds.
Unit II	Water Quality Monitoring: Surface water and groundwater quality; Water quality standards and effluent standards; Water quality criteria and guidelines; Classification of water bodies; water quality monitoring programs; Water sampling and analysis and usespecific water quality index. techniques; Water quality index
Unit III	Water Quality Modelling: Introduction to water quality modelling; Modelling of Lakes and reservoirs; Rivers and streams; and Groundwater modelling; Modelling for common water quality parameters: DO; temperature; suspended solids; algae; nutrients; coliforms and toxics; Calibration; validation and use of water quality models (DO-BOD models; solute transport models; nutrients and eutrophication models; and toxic substances and sediments models).
Unit IV	Air Quality: Introduction: Overview of current air quality trends and challenges; Basic concepts; applications and importance of air quality Monitoring; Iso-kinetic sampling; Precision and accuracy of monitoring; Air Quality Guidelines and Standards.
Unit V	Air Quality Modelling: Basic Components of an Air Quality Simulation Model; Parameters of Air Pollution Meteorology; Steady-state; Non-Steady-state and Grid Meteorological Modelling; Dispersion and Receptor modelling techniques; Gaussian plume model; Pasquilli's stability classification; Modelling softwares; Validation of Models; Applications of Modelling; Air Pollution Forecast Models.

Text Books:	
1	Borrego C and Ana IM, Air Pollution Modelling and its Application; Springer(2008).
2	Tiwary A and Colls J, Air Pollution: Measurement; Modelling and Mitigation; Spon Press (2002).
Reference Book:	
1	Khare M, Air Pollution –Monitoring; Modelling; Health and Control; InTech Publishers (2012).

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. Rahul Ralegaonkar	Professor	VNIT, Nagpur
2	Prof. Gauarv Rangari	Assistant Professor	JDCEM, Nagpur
3	Prof. Tina Khandale	Assistant Professor	JDCEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6TE02D	Design of Precast and Pre-stressed Elements	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of reinforced concrete design and analysis.
2	Understanding of structural analysis and mechanics of materials.
3	Knowledge of concrete materials and properties.
4	Familiarity with Indian Standard Codes for concrete design and construction.

Prior Reading Material/useful link	
1.	https://www.youtube.com/watch?v=lyg_a8NVEzY
2.	https://www.youtube.com/watch?v=YjCW2at77-w
3.	https://civilengineeronline.com/design/rcc.htm

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Demonstrate the concepts & methods for pre-stressing systems for different materials principles according to codal provisions.
2	CO2	Find stresses, losses in prestress, strength of prestressed structures.
3	CO3	Utilize stress distribution in anchorages, end block by limit state design.
4	CO4	Interpret Principles of Precast and Pre-Engineered buildings.
5	CO5	Compare Economy of prefabrication coordination and planning
6	CO6	Estimate strength of prestress structures Pre-Engineered buildings

Syllabus:

Course Content	
Unit I	Introduction to prestressed concrete, types of prestressing, Advantages and limitations of Prestressing, systems and devices, materials, Introduction to losses in Prestress, IS 1343 –2012 codal provisions. Prestressed concrete construction: Principle, methods, materials, Tools and equipment for the construction of prestressed structures.
Unit II	Analysis of member for prestress and bending stresses at various stages; Pressure Line; Stress, strength and Load Balancing concepts; Losses in prestress; short term and long term deflections; flexural ,shear and torsional strength, Estimation of crack width. Fatigue and impact strength, resistance to fire and corrosion
Unit III	Transfer of prestress in pretensioned and posttensioned members, stress distribution at end anchorages, anchorages and end block design; Limit state design criteria, design of pre and post tensioned girders; design of post tensioned one way and two way slabs.
Unit IV	General Principles of Pre-Fabrication (Precast & Pre-Engineered Building), Comparison with monolithic construction, Types of Prefabrication, site and plant prefabrication
Unit V	Economy of prefabrication, Modular coordination, Standardization , Planning for Components of prefabricated structures, Dis-uniting of structures

Text Books:

1	Shah M.G., Kale.C.M. RCC Theory and Design. Macmillan India Ltd. 1987.
2	N. Krishnaraju; Prestressed Concrete, Tata McGraw Hill, (Third Edition) 198.
3	M.S.Shetty, Concrete Technology, S.Chandand Company New Delhi, 2005.
4	Orchard D.F., Concrete Technology -Vol I., Applied Science Publishers (Fourth Edition) 1979.

Reference Book:

1	Neville A.M and J.J.Brook; Properties of Concrete, Addison Wesley 1999.
2	Lin T.Y, Burns N.H.; Design of prestressed concrete structures. John Wiley and sons. (Third Edition).1982.
3	S. Ramamurtham Reinforced Concrete Design Dhanpat Rai Publications 2009

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. P. Y. Pawade	Professor	GHRCOE, Nagpur
2	Prof. Atul Gautam	Assistant Professor	JDCEM, Nagpur
3	Prof. Gauarv Rangari	Assistant Professor	JDCEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6TE02E	Geotechnical Design	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of soil mechanics and geotechnical engineering principles.
2	Understanding of soil classification systems and index properties of soils.
3	Knowledge of laboratory and field testing methods for soil properties and behavior.
4	Understanding of different types of foundations and their behavior under loads.
5	Familiarity with soil-structure interaction and its importance in foundation design.

Prior Reading Material/useful link	
1.	https://onlinecourses.nptel.ac.in/noc21_ce41/preview
2.	https://www.youtube.com/watch?v=7kizaNBowrw
3.	https://www.elementaryengineeringlibrary.com/civil-engineering/soil-mechanics/soil-classification-system

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Understand concept of stable foundation.
2	CO2	Describe various geotechnical methods for foundation selection.
3	CO3	Calculate the bearing values from the field test for foundation design for different field conditions.
4	CO4	Analyze the settlement of foundation under the application of load.
5	CO5	Evaluate the design parameters for foundation design for the different field conditions.
6	CO6	Develop the knowledge of ground improvement and foundation designing.

Syllabus:

Course Content	
Unit I	Shallow and deep foundations, Requirements of stable foundation design, foundation location and depth of foundation. Minimum depth of foundation, Criteria for Selection of type of foundation
Unit II	Shallow foundation design from trial pit and bore hole data, relevance of plate load test with foundation design, Bearing capacity evolution from various methods effect of compressibility on foundation design
Unit III	Settlement of Pile foundation, load transfer mechanism ,critical depth of pile foundation, negative skin friction.
Unit IV	Pile bearing capacity from cone penetration test, Design of pile foundation on cohesive and cohesion less soil, Pile efficiency.
Unit V	Geo-textiles, reinforce earth, Compaction for deeper layers, Preloading ,stone columns ,grouting, injecting methods, electrical and thermal stabilization.

Text Books:	
1	Kasamalkar, B.J., “Foundation Engineering” , Pittsburgh vintage Grand Prix.
2	Murthy V.N.S., “Soil Mechanics and Foundation Engineering”, CRC Press 2002.
3	Arora K.R., “Soil Mechanics and Foundation Engineering” , Standard publication 2009.
4	Punmia B. C., “Soil Mechanics and Foundation Engineering”, Laxmi publication.
Reference Book:	
1	Nayak N.V., “Foundation Design Manual”, DhanpatRai and Sons.
2	Brahma S.P., “Foundation Engineering”, Tata McGraw-Hill 5th Edition.
3	Bowles J.E., “Foundation analysis & Design” McGraw-Hill Higher Education 5th edition.

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. P. Y. Pawade	Professor	GHRCOE, Nagpur
2	Prof. Atul Gautam	Assistant Professor	JDCEM, Nagpur
3	Prof. Nilesh Pal	Assistant Professor	JDCEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6TE02F	Railway Engineering	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of civil engineering and construction principles.
2	Understanding of mechanics of materials and structural analysis.
3	Knowledge of surveying and alignment principles.
4	Understanding of geotechnical engineering and soil mechanics.
5	Basic knowledge of transportation engineering and traffic flow principles.

Prior Reading Material/useful link	
1.	https://www.youtube.com/watch?v=LCyZFTEyNoo
2.	https://eng.libretexts.org/Bookshelves/Civil_Engineering/Fundamentals_of_Transportation/05%3A_Traffic/5.02%3A_Traffic_Flow
3.	https://www.youtube.com/watch?v=G7qU7HOw9QA

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Define the various component of railway track.
2	CO2	Explain the terminology used in planning of rails and tunnels.
3	CO3	Analyze the cause the reactions between the track and locomotives.
4	CO4	Classify the types of the various technical terms used in railway stations.
5	CO5	Decide the construction and maintenance steps of railway.
6	CO6	Build the various geometric features of railway track.

Syllabus:

Course Content	
Unit I	Railway and its Development: Long Term Operative Plans for Indian Railways. Classification of Railway Lines, General Features of Indian Railways. Railway Track: Alignment, Requirement, Gauges, Track Section, Coning of Wheels, Stresses in railway Track, High Speed Track.
Unit II	Rails: Types and Functions, Selection of Rails, Test on rails wear and defects, Corrugations and Creep of Rails. Rail joints, short and long welded panels. Sleepers: Functions and Requirements of Sleepers, Density and Spacing of Sleepers, Types of Sleepers, Merits and Demerits. Ballast: Functions, Types, Sizes and Requirements of Good Ballast. Rail Fixtures and Fastening.
Unit III	Geometric Design of Railway Track: Gradients, Speed, Super Elevation, Cant Deficiency, Negative Super Elevation, Curves, Length of Transition Curves, Grade Compensations. Points & Crossings: Left and Right Hand Turn Out, Design Calculations for Turnout & Crossover, Railway Track Functions. Station and Yards: Types, Functions Facilities & Equipment.
Unit IV	Rail Joints and Welding of Rails: Requirements of an Ideal Rail Joint, Types of Rail Joints. Locomotives and Other Rolling Stock: Types of Traction, Classification of Locomotives, Traction and Tractive Resistance, Hauling Capacity and Tractive Effort of Locomotives. Railway Signaling and Interlocking: Objectives, Classification, Signalling Systems, Interlocking, Modern Signalling Installations, Control and Movement of Trains.
Unit V	Railway track construction & Maintenance: Railway Track Construction, Inspection and Modern Techniques of Maintenance, Push through Technique, Suburban Railway in Metro cities. Railway Tunneling: Necessity, Alignment, Gradient, Size and Shapes, Methods of Tunnelling, Shaft of Tunnels, Maintenance and Safety.

Text Books:

1	Saxena; Railway Engineering.
2	Oza H.P., Oza G.H. Dock and harbour Engineering, Charotar.
3	William W. Hay, Railroad Engineering, 2nd Edition, John Willey and Sons.
4	Srivastav R., Docks harbour and tunnels engineering, Charoter.

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. P. Y. Pawade	Professor	GHRCOE, Nagpur
2	Prof. Shital Navghare	Assistant Professor	JDCOEM, Nagpur
3	Prof. Nilesh Pal	Assistant Professor	JDCOEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6O002A	Building Construction Materials	4	0	0	4

Prerequisites for the course	
1	Knowledge of the properties and characteristics of different types of building materials.
2	Knowledge of construction processes and techniques.
3	Understanding of the properties and applications of concrete.
4	Understanding of the manufacturing processes and properties of different types of steel.
5	Knowledge of the properties and characteristics of different types of building materials.

Prior Reading Material/useful link	
1.	https://structuralengineeringbasics.com/what-types-of-construction-building-materials/
2.	https://www.masterclass.com/articles/building-materials-guide
3.	https://www.youtube.com/watch?v=PU4_J5n6Y28

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Identify the various construction materials.
2	CO2	Classify various properties of the basic construction materials such as brick, stone timber, metals
3	CO3	Choose the various civil engineering materials by performing different lab tests on materials.
4	CO4	Categorize the concretes used in construction industry for specific applications.
5	CO5	Estimate various properties of concrete and construction techniques for earthwork, tunneling and formwork.
6	CO6	Adopt advanced construction materials for thermal and sound insulation, smart materials and plastic and timber products.

Syllabus:

Course Content	
Unit I	Cement: Manufacture, basic properties of cement compounds, grades, packing storage, quality control and curing. Aggregates: Classification, characteristics, soundness of aggregates, fineness modulus. Lime & Mortar: Classifications & Properties.
Unit II	Concrete: Introduction, properties of concrete, water cement ratio, workability, compressive strength, grades, Production of Concrete: Batching, mixing, transportation, placing, compaction and curing of concrete, quality control of concrete, concrete mix design. Introduction to HPC, SCC and FRC Admixtures and Superplasticizers: Functions, classification, accelerating admixture, water reducing admixture, retarding admixture, air-containing admixture.
Unit III	Bricks: Composition of good brick earth, harmful ingredients, manufacture of bricks, characteristics of good bricks, shapes, classification of bricks as per IS 1077-1985 and testing. Stones: Classification of rocks, test for stones, characteristics of a good building stone, deterioration of stones, common building stones of India Timber: Classification and identification of timber, defects in timber, characteristics of good timber, seasoning of timber.
Unit IV	Steels: Manufacture of steel, market forms of steel e.g. mild steel and HYSD steel bars, rolled steel sections. Thermo Mechanically Treated (TMT) Bars. Miscellaneous Materials: Asphalt, Bitumen, insulating materials, materials for doors and windows, paints. Laboratory Work: Tests on: Cement, fine aggregates, coarse aggregates, fresh and hardened concretes, tests on bricks, Tests on Steel.
Unit V	Advanced Construction Materials: Plastics, Timber products and Preservation, materials for thermal insulation, materials for sound insulation. Smart Materials and their applications. Special Concretes: Light Weight Concrete, Vacuum Concrete, Waste Material Based Concrete, Fiber reinforced concrete, Polymer Concrete Composites, Ferrocement, Concreting at High and Low Temperatures, Self- Compacting Concrete (SCC), Ready Mixed Concrete (RMC) and its characteristics and advantages, Shotcrete and concreting in tunnels.

Text Books:	
1	Saxena; Railway Engineering.
2	Oza H.P., Oza G.H. Dock and harbour Engineering, Charotar.
3	William W. Hay, Railroad Engineering, 2nd Edition, John Willey and Sons.
4	Srivastav R., Docks harbour and tunnels engineering, Charotar.

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. Rahul Ralegaonkar	Professor	VNIT, Nagpur
2	Prof. Tejaswini Jungahre	Assistant Professor	JDCOEM, Nagpur
3	Prof. Tina Khandale	Assistant Professor	JDCOEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6O002B	Remote Sensing and GIS	4	0	0	4

Prerequisites for the course	
1	Basic knowledge of electromagnetic radiation and its properties, including the concept of wavelength and frequency.
2	Understanding of the principles and applications of optical and digital imaging systems.
3	Familiarity with the fundamentals of remote sensing and the various types of remote sensing platforms.
4	Knowledge of the characteristics and properties of various types of remote sensing data, including analog and digital data.
5	Understanding of image interpretation techniques and the ability to interpret and analyze remote sensing imagery.

Prior Reading Material/useful link	
1.	https://byjus.com/jee/electromagnetic-spectrum-and-electromagnetic-waves/
2.	https://www.ncbi.nlm.nih.gov/pmc/articles/NIHMS363450/
3.	https://www.researchgate.net/publication/51041882_Optical_and_Digital_Microscopic_Imaging_Techniques_and_Applications_in_Pathology

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Label the technical terms based on remote sensing and GIS.
2	CO2	Explain the fundamental of principles of aerial photography and remote sensing.
3	CO3	Apply knowledge of remote sensing and GIS in various fields of civil engineering
4	CO4	Compare spatial and non-spatial data, projection system, topology, geo referencing while using remote sensing data.
5	CO5	Evaluate the logical information and choose digital image processing for supervised/un-supervised classification of given data
6	CO6	Develop skills and knowledge regarding basic principles of Remote Sensing and GIS.

Syllabus:

Course Content	
Unit I	Definition and scope of remote sensing: electromagnetic energy and its wavelengths. Remote sensing systems, sensors and scanners, resolution of sensors, multi-spectral, thermal and radar scanners, radiometers spectral response curve and spectral signatures. [06 hrs]
Unit II	Elements of sensing system: Terrestrial, airborne and space borne platforms, Sun-synchronous and geo-stationary satellites, advantages and disadvantages. Various earth Resources satellites, Indian remote sensing program. Remote sensing data products and their types: analogues and digital data formats, Thermal and radar imageries. [08 hrs]
Unit III	Interpretation techniques: Elements of interpretation and methods, interpretation key, interpretation instruments. Relief displacement, image parallax and vertical exaggeration, Determination and calculation of elevation from RS data. Digital image processing: image rectification and restoration, image enhancement-contrast manipulations, spatial feature manipulation, multi- image manipulation, image classification supervised and unsupervised classification, accuracy assessments and data merging. [10 hrs]
Unit IV	Geographical Information System: Raster and vector data, concepts and basic characteristics of vectorization, topology generation, attribute data attachment, editing and analysis. Global Positioning System: Introduction to Global Positioning System (GPS) - Fundamental concepts, GPS system elements and signals, Classification of GPS receivers. [10 hrs]
Unit V	Applications: Integrated approach of RS and GIS application: Application in Geological Investigations, water resources management, environmental studies, EIA based studies, Land use planning, soil studies and transportation planning. Application in civil engineering projects dams and bridges, site investigations, landslide studies. [08 hrs]

Text Books:

1	BasudebBhatta: Remote Sensing And Gis Oxford University Press
2	Dr. B. C. Panda, Remote Sensing Principles And Applications Viva Books Pvt. Ltd.
3	Remote sensing Geology: Ravi P Gupta, Springer publication
4	Remote sensing and GIS: Anji Reddy ISBN publication.

Reference Books:

1	Jensen ,Remote Sensing Of The Environment: An Earth Resource Perspective, Jensen ,2ndEdition,Pearson, India
2	Emilio Chuvieco ,Fundamentals of Satellite Remote sensing: An Environmental Approach, , 2ndEdition,CRC Press/Taylor & Francis, Boca Raton, Florida, USA. 2016

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. Rahul Ralegaonkar	Professor	VNIT, Nagpur
2	Prof. Tina Khandale	Assistant Professor	JDCEM, Nagpur
3	Prof. Gaurav Rangari	Assistant Professor	JDCEM, Nagpur

(Laboratory)

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6L001	Design of Steel Structures Lab	0	0	2	1

Sr. No.	Learning Outcome number	Learning Outcome Statement
1	LO1	Analyze the behavior and general design of Structural steel components along with codal provisions
2	LO2	Explain the philosophies of steel structures.
3	LO3	Design the structural detailing of elements.

Syllabus:

Sr. No.	Name of Experiments
1	Design of Tension Member.
2	Design of Compression Member.
3	Design of Welded Connection.
4	Design of Bolted Connection.
5	Design of Built up Beam (symmetrical or unsymmetrical section).
6	Design single rolled steel column subjected to axial load and uniaxial moment.
7	Design of axially loaded built up column (Laced or Battened).
8	Design of Column base subjected to axial load and uniaxial moment.
9	Design of Plate Girder.

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6L002	Environmental Engineering Lab	0	0	2	1

Sr. No.	Learning Outcome number	Learning Outcome Statement
1	LO1	Examine the common environmental experiments relating to water and wastewater quality, and know which tests are appropriate for given environmental problems.
2	LO2	Statistically analyze and interpret laboratorial results.
3	LO3	Adopt the laboratorial results to problem identification, quantification, and basic environmental design and technical solutions.

Syllabus:

Sr. No.	Name of Experiments
1	Determination of pH.
2	Determination of Conductivity.
3	Determination Chlorides.
4	Determination of Total Solids.
5	Determination of Turbidity.
6	Determination Suspended Solids.
7	Determination Hardness.
8	Determination of Residual Chlorine (Titrating Method/Coloroscope Method).
9	Jar Test.
10	Study practical of MPN and Plate Count Tests.
11	Study practical of BOD test.

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6L003	Campus Recruitment Training	0	0	2	1

About CRT Training Campus Recruitment training (CRT) at is designed to aid candidates in their preparation for Recruitment through Campuses or outside campuses (i.e On campus or off campus). Students in their final step of graduation looking for placement in reputed organizations can make use of this training to get trained to deliver their best in the selection processes of organizations.

Course Objectives:

1. To enhance the problem solving skills, to improve the basic mathematical skills and to help students who are preparing for any type of campus recruitment drive.
2. To groom the students to the corporate level
3. To ensure that all eligible students are employed by the end of the final year of study.

Course Outcomes:

At the end of the course students will be able to

1. Solve the problems easily by using Short-cut method with time management which will be helpful to them to clear the competitive exams for better job opportunity.
2. Analyze the Problems logically and approach the problems in a different manner.
3. Students will be able to apply mathematical analysis of data to make connections, draw conclusions and solve problems.
4. Students will learn a series of techniques through practical activities to develop presenting skills and enhance confidence to expand the potential of the individual.
5. Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity.
6. Students demonstrate an ability to target the resume to the presenting purpose
7. Demonstrate professional behavior(s) including preparedness, professional attire, and respectful presentation during interviews.

Syllabus:

Unit	Content	Duration
PART I: QUANTITATIVE ABILITY		
I	Speed Maths Calculation, Number Systems, Ratio & Proportion, Percentage	03
II	Profit – Loss & Discount, Simple Interest & Compound Interest, Simple Equation and Age's	03
III	Averages Mixture & Allegation, Time and work, Time Speed & Distance, Permutation – Combination & Probability.	03
PART II: - REASONING ABILITY		
I	Coding Decoding, Blood Relation, Direction sense, Number Series, Analogy	03
II	Sitting Arrangement, Puzzles.	03
III	Syllogism, Statement course of action, Statement arguments, Statement Assumptions, Miscellaneous Type of Reasoning	03
PART III: - EMPLOYABILITY SKILLS		
I	Presentation Skills: What is a presentation? Essential characteristics of Good presentation. Preparation of presentation: Identify the purpose, Analyze the audience, Design and organize the information, Medium of presentation and Visual aids. Delivering Presentation: rehearsal, body Language, Handling questions, Tips to fightstage fear.	02
II	Job Interview Skills Types of interviews, Focus of interview, dress code, importance of body language. Probable interview questions, Telephonic and video interview, Strategies for success at interview.	02
III	Resume Building Meaning, Difference among Bio-data, Curriculum vitae and Resume.CV writing tips, The content of Resume, Structure of Resume.	02

Text Books:	
1	Prashant Sharma, SOFT SKILLS PERSONALITY DEVELOPMENT FOR LIFE SUCCESS. BPB Publication.
2	P. D. Chaturvedi & Mukesh Chaturvedi, Business Communication: Concepts, Cases, and Applications 2nd Edition. Pearson Education.
3	Barun Mitra, Personality Development and Soft Skills. Oxford University Press.
4	Dr.K.Alex, <i>Soft Skills Know yourself and Know the World</i> . S.Chand Publishing, 2014
5	R.S Agrawal, Quantitative Aptitude.
6	Arun Sharma, How to Prepare for Quantitative Aptitude.
7	R. S Agrawal, Verbal and Non Verbal Reasoning.
8	R.V.Praveen, Quantitative Aptitude and Reasoning, 2nd Revised Edition 2013, Prentice-Hall of India Pvt.Ltd.

9	G. K. Ranganath, C. S. Sampangiram and Y. Rajaram, A text Book of business Mathematics, 2008,Himalaya Publishing House
10	Emilio Chuvieco, Fundamentals of Satellite Remote sensing: An Environmental Approach, , 2ndEdition, CRC Press/Taylor & Francis, Boca Raton, Florida, USA. 2016
11	Dale A. Quattrochi, Elizabeth Wentz, Nina Siu-Ngan Lam, and Charles W. Emerson, Integrating Scalein Remote Sensing and GIS: Boca Raton: CRC Press, 2017
12	James B. Campbell, Randolph H. Wynne, Introduction to Remote Sensing, , Guilford Press,2011.

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. Rahul Ralegaonkar	Professor	VNIT, Nagpur
2	Prof. Hemant Baitule	Assistant Professor	JDCOEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
VI	CE6P004	Mini Project & Seminar	0	0	2	1

Term work shall consist of detailed report for chosen topic and final working proposed in next semester. Report shall summarize the literature survey; spell out the scope of work, proposed methodology and expected results. It is desirable to have a topic sponsored by Industry or research organization or community.



**BoS, Chairman,
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