



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

IV 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	BSC	CE4T001	Life Science	2	0	0	20	20	60	100	2
2	PCC	CE4T002	Hydrology & Water Resource Engineering	2	1	0	20	20	60	100	3
3	PCC	CE4T003	Concrete Technology & Design of RCC Building Elements	2	1	0	20	20	60	100	3
4	PCC	CE4T004	Solid Mechanics	2	1	0	20	20	60	100	3
5	PCC	CE4T005	Surveying and Geomatics	2	0	0	20	20	60	100	2
6	PCC	CE4T006	Materials, Testing & Evaluation	2	0	0	20	20	60	100	2
7	PCC	CE4L001	Concrete Technology & Design of RCC Building Elements Lab	0	0	2	60	0	40	100	2
8	PCC	CE4L002	Solid Mechanics Lab	0	0	2	60	0	40	100	1
9	PCC	CE4L003	Surveying and Geomatics Lab	0	0	4	60	0	40	100	2
10	PROJECT	CE4F004	Internship/Field Visit II	0	0	0	0	0	50	50	1
11	MC	CE4T007	Universal Human Values	3	0	0	10	15	25	50	AU
				15	3	8					21

IV SEMESTER

Semester	Course Code	Name of Course	L	T	P	Credits
IV	CE4T001	Life Science	2	0	0	2

Prof. Nilesh Pal

Prerequisites for the course	
1.	Basic knowledge of biology
2.	A fundamental understanding of chemistry, particularly organic chemistry and biochemistry, is important for understanding the chemical reactions and processes that occur in plants and ecosystems.
3.	Basic mathematical skills such as algebra and geometry are necessary for understanding concepts such as statistical analysis and population dynamics.

Prior Reading Material/useful link	
1.	Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
2.	https://byjus.com/chemistry/
3.	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5869253/

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Acquire the knowledge of Plant Physiology, Transpiration, PopulationDynamics, Environmental Management, biotechnology covering and Biostatistics covering.
2	CO2	Explain Community ecology, Ecosystem structure, Population ecology, Policiesand legal aspects in environmental management and Plant & Animal tissue culture.
3	CO3	Figure out the terms used in biostatics and the data analysis of biostatics.
4	CO4	Classify the Ecosystem structure, methods of Plant & Animal tissue culture andmeasures of Central Tendencies in biostatics.
5	CO5	Analyze the biostatics data parameters.
6	CO6	Summarize the life science in respect of Plant Physiology, PopulationDynamics, Environmental Management, Biotechnology and Biostatics.

Syllabus:

Course Content	
Unit I	Plant Physiology covering, Transpiration; Mineral nutrition. Ecology covering, Ecosystems- Components, types, flow of matter and energy in an ecosystem; Community ecology- Characteristics, frequency, life forms, and biological spectrum; Ecosystem structure- Biotic and a-biotic factors, food chain, food web, ecological pyramids. [05 hrs]
Unit II	Population Dynamics covering, Population ecology- Population characteristics, ecotypes; Population genetics- Concept of gene pool and genetic diversity in populations. [05 hrs]
Unit III	Environmental Management covering, Principles: Perspectives, concerns and management strategies; Policies and legal aspects- Environment Protection Acts and modification, International Treaties; Environmental Impact Assessment- Case studies. [05 hrs]
Unit IV	Biotechnology covering, Basic concepts, Methods and uses in agriculture, medicine and health. [05 hrs]
Unit V	Biostatistics covering, Introduction to Biostatistics:-Terms used, types of data; Measures of Central Tendencies- Mean, Median, Mode, Normal and Skewed distributions; Analysis of Data- Hypothesis testing and ANNOVA (single factor) [05 hrs]

Text Books:	
1	Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S.A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd.
2	Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
Reference Book:	
1	Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman andCompany
Useful Link:	
1	https://onlinecourses.swayam2.ac.in/nos23_sc22/preview

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization	Signature
1.	Mr. Nilesh Pal	Assistant professor	JDCEM, Nagpur	
2.	Mr. Gaurav Rangari	Assistant professor	JDCEM, Nagpur	

Semester	Course Code	Name of Course	L	T	P	Credits
IV	CE4T002	Hydrology & Water Resource Engineering	2	1	0	3

Prerequisites for the course	
1.	Basic knowledge of geology and geotechnical engineering, including soil and rock properties.
2.	Basic knowledge of meteorology and climatology, including weather patterns and atmospheric processes
3.	Environmental science, including the water cycle and the impacts of human activities on natural systems.

Prior Reading Material/useful link	
1.	https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/meteorology-and-climatology
2.	http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/earth_sciences/meteorology_&_climatology/03._climatology-an_outline/et/1062_et_et83.pdf
3.	https://www.sciencelearn.org.nz/resources/726-humans-and-the-water-cycle#:~:text=There%20is%20considerable%20evidence%20that,local%20and%20global%20water%20cycles.&text=A%20number%20of%20human%20activities,t he%20burning%20of%20fossil%20fuels.

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Acquire the knowledge to design irrigation projects and understand its importance with respect to necessity and its effect.
2	CO2	Describe the methods of irrigation and distinguish the stages of reservoir planning.
3	CO3	Compute the reservoir capacity considering the crop water requirement to construct the dam and distribution system
4	CO4	Categorize the type of dam and the design parameter according to the type of dam along with development of irrigation system by provision of diversion head works, canals and canal head works.
5	CO5	Evaluate the forces acting on dam and stability condition of dam.
6	CO6	Design the Dam, Spillway, Canal and Canal Head Work

Syllabus:

Course Content	
Unit I	Engineering Hydrology: Definition and its importance, Hydrological Cycle, Hydrologic equation, Precipitation: Forms, Types, Factors affecting, Measurement, Rain gauge Network, Estimation of Missing data, Consistency of data, Mean Areal Precipitation, Brief introduction of Intensity-duration Frequency relationship and Artificial rain. [06 hrs]
Unit II	Evaporation: Process, factors affecting, measurement and estimation, control of evaporation. Evapotranspiration: Factors affecting, measurement, and estimation Infiltration: Process, factors affecting, measurement, Infiltration indices. Run-off: Factors affecting, estimation of runoff, Rainfall- Runoff correlation. [06 hrs]
Unit III	Irrigation Engineering: Necessity and advantages of irrigation, suitability of soils for different crops, standards for irrigation water. Minor Irrigation Works: Necessity and general layout of Bandhara and percolation Tank. Lift Irrigation: Necessity and general layout, main components. Crop Water Requirements: Principal Indian crop seasons and water requirements for different crops, Duty and Delta, Consumptive use of water and its estimation, Irrigation efficiency. Irrigation methods: Comparative Study of different irrigation methods with special emphasis on sprinkler and drip irrigation. [08 hrs]
Unit IV	Reservoir Planning: Selection of site for Reservoirs; Engineering surveys, Geological and Hydrological Investigations; Different storage zones in reservoir; Determination of storage capacity by mass curve method;(Reservoir operation scheduling,) Reservoir sedimentation; Life estimation of reservoir by Brune's method. Dams: General Classification of dams as per use, hydraulic design and materials; Factors governing selection of dams. Instrumentation in dam. [06 hrs]
Unit V	Spillways: Types of spillway, General principle of design of ogee spillway; Spillway gates – vertical lift, radial, rolling and drum; Gate O.S. Energy dissipation methods. Canals : General : Types of canal; Alignments of canal; Cross section of Irrigation canals; Balancing depth; Schedule of area statistics; Losses in canals, Canal Structures: Canal Regulation Works: Purpose, components of Head Regulator, Cross regulators, canal escapes, Canal falls and canal outlets. [08 hrs]

Text Books:	
1	Irrigation Engineering and Hydraulic Structures- Santosh Kumar Garg
2	Irrigation Engineering and Hydraulic Structures- S.R. Sahastrabudhe
3	Irrigation Engineering and Water Power Engineering- B.C. Punmia
4	Irrigation Engineering and Hydraulic Structures- K.R.Arora
5	Irrigation Engineering- N.N. Basak
Reference Book:	
1	Irrigation Engineering and Hydraulic Structures-R.K.Sharma
2	Irrigation Engineering- G.L. Asawa
3	Water Resource Engineering Principles and Practice-C.S. Murty
Useful Link:	
1	https://onlinecourses.nptel.ac.in/noc23_ce44

Contribution for Syllabus Design:

Sr.No.	Name of Person	Designation	Organization
1.	Dr. Rahul Ralegaonkar	Professor	VNIT, Nagpur
2.	Dr. Prashant Pawade	Professor	GHRCOE, Nagpur
3.	Mr. Nilesh Pal	Assistant professor	JDCOEM, Nagpur
4.	Mr. Gaurav Rangari	Assistant professor	JDCOEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
IV	CE4T003	Concrete Technology & Design of RCC Building Elements	2	1	0	3

Prerequisites for the course	
1	Basics of Civil Engineering
2	a basic understanding of chemical reactions, compounds, and elements.
3	Basic mathematical skills such as algebra and geometry are necessary for understanding concepts such as mix design, strength calculations, and testing results.
4	A basic understanding of physics concepts such as mechanics, force, and energy is necessary for understanding the behavior of materials and structures.
5	A basic understanding of civil engineering principles, including structures, construction materials, and testing methods, is necessary for understanding the principles and practices of concrete making.

Prior Reading Material/useful link	
1	http://assets.press.princeton.edu/chapters/s9638.pdf
2	https://ftp.idu.ac.id/wp-content/uploads/ebook/tdg/ADVANCED%20MATERIAL%20DESIGN/pdf .

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Memorize the ingredients of concrete, its physical and chemical properties with the testing on concrete in fresh and hardened state, different philosophies and aspects of reinforced concrete as per the relevant IS Codes.
2	CO2	Describe the materials and admixtures to be used in concrete and the application of limit state method and working state method.
3	CO3	Demonstrate the tests on different ingredient of concrete and the results obtained from the testing to appraise it's properties in fresh and hardened state.
4	CO4	Apply the knowledge & skills in practical analysis and design of various RCC members like Beams, Columns, stair case, slab, footings etc.
5	CO5	Assemble the construction materials to produce homogenous mixture and Design a RCC element like beam, slab, column and footings by limit state and working stress method as per IS456-2000 and IS 456-1978.
6	CO6	Recommend appropriate and conventional method as well as code of analysis and design for particular RCC Structure.

Syllabus:

Course Content	
Unit I	Materials for concrete: Physical Properties of cement, sand and aggregate, Hydration of Cement, Bulking of Sand, Water: Specifications of Water to be used For Concrete. Properties of fresh concrete: Batching, Workability, W/C Ratio, Segregation and Bleeding, setting time, Curing of Concrete, Temperature Effects on Fresh Concrete, Admixtures in concrete. [08 Hrs]
Unit II	Properties of Hardened concrete: Strength, Durability & Impermeability, Characteristic Strength, Bond Strength, Modulus of Elasticity, creep and shrinkage of concrete. Concrete mix design: Nominal Mix Concrete, Mix Design. Non-destructive Test on Concrete. [08 Hrs]
Unit III	Introduction to LSM and WSM. Analysis & Design of Beams by LSM: Singly Reinforced, Doubly Reinforced and Flanged Beams. [08 Hrs]
Unit IV	Limit State Method: Short Column and Long Column. Concepts of the footings. Rectangular and Square Column Footings with Axial Load and also for Axial Load & Moment. [08 Hrs]
Unit V	Introduction to one way and two-way slabs. Design of Cantilever, Simply Supported and One-Way Continuous Slab. Design of Two-Way Slabs for Different Boundary Conditions. [08 Hrs]

Text Books:	
1	Shetty M. S., "Concrete Technology", S. Chand Publication.
2	Pillai & Menon: RCC Design.
3	Dr. Shah V.L. & Karve S.R.: Limit State Design
Reference Book:	
1	Gambhir M L, "Concrete Technology", Tata McGraw Hill.
2	Neville.A.M, Brooks .J. J, "Concrete Technology", Pearson Publication.
3	Jain A.K.: Plain & Reinforced Concrete, Vol. I & II
4	Sinha S.K. & Roy S.K.: Fundamentals of RCC.
Useful Link:	
1	https://onlinecourses.nptel.ac.in/noc23_ce50/preview
2	https://onlinecourses.nptel.ac.in/noc23_ce50/preview

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1.	Dr. Rahul Ralegaonkar	Professor	VNIT, Nagpur
2.	Dr. Anant Pande	Professor	YCCE, Nagpur
3.	Mrs. Atika Ingole	Assistant Professor	JDCEM, Nagpur
4.	Mr. Shital A. Navghare	Assistant Professor	JDCEM, Nagpur
5.	Mr. Parag Pal	Alumni	SAI Consulting Engineers PVT. Ltd, Bangalore

Semester	Course Code	Name of Course	L	T	P	Credits
IV	CE4T004	Solid Mechanics	2	1	0	3

Prerequisites for the course	
1	Equilibrium of Force system
2	Types of beams; simple and compound beams, type of supports and reaction
3	Plane frames
4	Kinematics- Basic concepts

Prior Reading Material/useful link	
1	https://www.youtube.com/watch?v=JVMCOcUW_zc
2	https://www.youtube.com/watch?v=tM5hsUiNpGA
3	https://www.youtube.com/watch?v=8r4Zek6EB28
4	https://www.youtube.com/watch?v=MJeRFzs4oRU

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Acquire the concepts of stresses, strain, columns and elastic failure theory.
2	CO2	Identify the critical section to resist deformation for safe design against external loading for suitable design.
3	CO3	Calculate the stresses in beams, shafts, columns and springs.
4	CO4	Analyze the thick and thin cylinders, columns using Euler's and Rankin's theory.
5	CO5	Draw bending moment, shear force and Bending stress diagram under different loading conditions.
6	CO6	Justify the various types of stresses, moments and forces developed in structural members for designing purpose.

Syllabus:

Course Content	
Unit I	Mechanical properties: Concept of direct, bearing and shear stresses and strains, stress strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, TOR steel and concrete, Generalized Hook's law, factor of safety. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.
Unit II	Shear force & bending moment diagrams: Beams, loading and support conditions, bending moment, shear force and axial load diagrams for all types of loadings for simply supported beams, cantilevers and beams with overhangs, relation between shear forces, bending moment and loading intensity.
Unit III	Stresses in beams (Bending, Shear): i) Bending: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section. ii) Shear: Distribution of shear stresses on beam cross sections, iii) Strain energy under uniaxial tension and compression, impact loads and instantaneous stresses.
Unit IV	Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft Principal stresses: Biaxial stress system, principal stresses, principal planes, principal strains. Thin and Thick cylinders and thin spherical shells subjected to internal pressures. Combined direct & bending stresses: Combined direct and bending stresses, applications to short columns with eccentric loads.
Unit V	Slope & deflection of beams: Slope & deflection in statically determinate beams subjected to point loads, uniformly distributed loads, moments by Macaulay's method, Moment Area method and Conjugate Beam method. Columns: Theory of long columns, Euler, Rankin formula Introduction to fatigue.

Text Books:	
1	Strength of Materials Vol. I by D.S. PrakasaRao University Press
2	Engineering Mechanics by R.K. Bansal, Laxmi Publications (p) Ltd., NewDelhi
Reference Book:	
1	Engineering Mechanics by S. Timoshenko, D.H. Young and J.V. Rao
2	Strength of Materials by S.S. Rattan, Tata McGraw Hill Education Pvt., Ltd.,
3	Strength of materials by R.K. Raj put, S. Chand & Co, New Delhi.,
4	Strength of materials by S. Ramamurtham, Dhanpat Rai & publication.
Useful Link:	
1	https://onlinecourses.nptel.ac.in/noc19_ce27/announcements?force=true

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. Rahul Ralegaonkar	Professor	VNIT, Nagpur
2	Dr. Anant Pande	Professor	YCCE, nagpur
3	Dr. P. D. Pachpore	Professor	RKNCE, Nagpur
4	Mrs. Atika Ingole	Assistant Professor	JDCEM, Nagpur
5	Mr. Kamlesh Meshram	Assistant Professor	JDCEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
IV	CE4T005	Surveying and Geomatics	2	0	0	2

Prerequisites for the course	
1	Basics of Physics and mathematics upto 12th standard
2	Mathematics, including trigonometry, geometry, calculus, and algebra.
3	A fundamental understanding of the principles of surveying, including measurement, precision, and accuracy

Prior Reading Material/useful link	
1	12 th Standard Physics and mathematics books
2	https://www.youtube.com/watch?v=PG4ByTyYp-U
3	https://www.youtube.com/watch?v=CNJuHqK1Ik

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Acquire the knowledge of basic surveying equipment used in basic and advanced surveying techniques.
2	CO2	Identify the various concepts involved in surveying to observe horizontal, vertical and angular measurements on the field using the latest surveying technology.
3	CO3	Evaluate Reduced Levels, Horizontal Distances, Vertical Distances, Offset for curve plotting and Parameters of Photogrammetry.
4	CO4	Analyze the data obtained from Compass Surveying, Leveling, Theodolite Survey, Tacheometry Survey, Plane Table Survey and Photogrammetry Survey.
5	CO5	Judge suitable method for a various surveying map and data required for further purpose in civil engineering projects.
6	CO6	Develop various types of Survey maps and suggest suitable method according to the requirement of client and field conditions.

Syllabus:

Course Content	
Unit I	<p>Introduction to Surveying: Definition, Uses, Principles of Surveying, Classifications, conventional signs,, Equipment of survey, Scale, Representative Fraction.</p> <p>Compass Surveying: Prismatic compass, surveyor's compass, bearing systems and conversions, local attraction, magnetic declination, traversing. [08 hrs]</p>
Unit II	<p>Leveling and Contouring: Leveling: - Introduction, Instrument used in leveling, Temporary and permanent adjustments, Type of leveling, Bench Marks & their Type, RL & Methods of calculating RL. Contouring: - Introduction, Methods - Characteristics and uses of contours – Plotting. Planimeter:-Types, Theory, concept of zero circle, Study of Digital Planimeter, Computation of Areas and Volumes [08 hrs]</p>
Unit III	<p>Theodolite and Tachometric Survey Theodolite survey: Classifications, Components, Uses, Terms used in Theodolite, Temporary and permanent adjustments, Measurement of horizontal, vertical angle and Deflection Angle, Consecutive Co-ordinates and Independent Co-ordinates with Numerical, Gales's table. Tachometric Survey: Definitions, Distinguish Theodolite and Tachometer, Constants in Tachometry, Principle of Tachometry, Tachometric Methods, Numerical. [08 hrs]</p>
Unit IV	<p>Curves and Plane Table Survey Curves: Necessity of curve, Classification of curve, Notation of simple circular curve, Designation of curve setting simple circular curve by offsets from long chord and Rankin's deflection angle method, Simple numerical problems. Plane Table Survey: Plane table instruments and accessories, merits and demerits, methods: radiation, intersection, resection, traversing. [08 hrs]</p>
Unit V	<p>Advanced Surveying Instruments: Basic introduction of Speedometer, EDM, Laser Tape, Total Station, Remote sensing & GIS, Drone Survey. Photogrammetry Surveying: Introduction, Basic concepts, Numerical. [08hrs]</p>

Text Books:

1	Kanetkar, Kulkarni, "Surveying and Levelling", Volume I & II, Pune Vidyarthi Prakashan.
2	Punmia B C; Jain Ashok; Jain Arun "Surveying", Volume I & II, Laxmi Publication.

Reference Book:

1	Basak N N, "Surveying and Levelling", Volume I And II, Tata McGraw-Hill.
2	Duggal S. K. "Surveying", Volume I And II, Tata McGraw-Hill.

Useful Link:

1	onlinecourses.nptel.ac.in/noc23_ce05/
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Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1.	Dr. Rahul Ralegaonkar	Professor	VNIT, Nagpur
2.	Dr. Anant Pande	Professor	YCCE, nagpur
3.	Dr. Kshitija Kadam	Professor	GCOE, Nagpur
4	Ms. Shital Navghare	Assistant Professor	JDCEM, Nagpur

Semester	Course Code	Name of Course	L	T	P	Credits
IV	CE4T006	Materials, Testing & Evaluation	2	0	0	2

Prerequisites for the course	
1	Basics of Civil Engineering
2	Understanding of basic mechanics, including statics and dynamics, stress and strain, and material properties.
3	Familiarity with engineering drawing and design principles.
4	Knowledge of manufacturing processes, including casting, forging, welding, and machining.

Prior Reading Material/useful link	
1	Basic of Civil (A Hand Book for Civil Engineering Students) By R. Khan
2	https://www.bu.edu/moss/mechanics-of-materials-stress/
3	https://www.youtube.com/watch?v=q4eBIaSAz5k

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Acquire the knowledge of engineering materials and testing on it.
2	CO2	Understand the different characteristics of a material.
3	CO3	Measure the tension or compression behavior of material.
4	CO4	Analyze the stresses developed in the material after loading during testing.
5	CO5	Describe the fracture mechanics.
6	CO6	Identify modes of failure.

Syllabus:

Course Content	
Unit I	Introduction to Engineering Materials: Cements, M-Sand, Concrete (plain, reinforced and steel fibre / glass fibre-reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete) Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes. [08 hrs]
Unit II	Standard Testing & Evaluation Procedures, Laboratory testing SOP, ISO, Preparation of QMS, Details about NABL, QCI and NABET and their guidelines. Elastic deformation; Plastic deformation; Impact test and transition temperatures; Creep. [08 hrs]
Unit III	Acoustical material and geotextiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses. Mechanical behavior and mechanical characteristics; Elasticity – principle and characteristics; Plastic deformation of metals. [08 hrs]
Unit IV	Tensile test – standards for different material (brittle, quasi-brittle, elastic and so on); True stress – strain interpretation of tensile test; hardness tests; Bending and torsion test; strength of ceramic; Internal friction, creep – fundamentals and characteristics; Brittle fracture of steel – temperature transition approach; [08 hrs]
Unit V	Fracture Mechanics Concept; Fracture Toughness Testing – Different Materials; Concept of Fatigue of Materials; Structural Integrity Assessment [08 hrs]

Text Books:

1	Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.), R. Butterworth Heinemann 2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Materials and Pavement Testing', Nem Chand & Bros, Fifth Edition
2	Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering applications.

Reference Book:

1	Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella
2	E.N. Dowling (1993), Mechanical Behaviour of Materials, Prentice Hall International Edition
3	American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000)
4	Bureau of Indian standards, NABET Guidelines, ISO-9001, ISO 14001, IEC, OHSAS

Contribution for Syllabus Design:

Sr. No.	Name of Person	Designation	Organization
1	Dr. Rahul Ralegaonkar	Professor	VNIT, Nagpur
2	Dr. Anant Pande	Professor	YCCE, Nagpur
3	Prof. Atul Gautam	Assistant Professor	JDCEM, Nagpur
4	Prof. Kamlesh Meshram	Assistant Professor	JDCEM, Nagpur

Laboratory:

Semester	Course Code	Name of Course	L	T	P	Credits
IV	CE4L001	Concrete Technology & Design of RCC Building Elements Lab	0	0	2	1

Sr. No.	Learning Outcome number	Learning Outcome Statement
1	LO1	Demonstrate tests on ingredients of concrete and concrete mix
2	LO2	Analyze the data obtained from testing.
3	LO3	Evaluate the properties of ingredients of concrete and concrete mix and checkit's suitability in construction
4	LO4	Judge the material behaviour in fresh and hardened state.

Syllabus:

Sr. No.	Name of Experiments
1	Determination of specific gravity of the given cement sample.
2	Determine fineness of the given cement sample.
3	Determine soundness of the given cement sample.
4	Determine standard consistency, initial and final setting time of concrete.
5	Determine bulking of fine aggregates.
6	Determine the workability of concrete by slump cone test and compaction factor test.
7	Determine effect on workability after addition of admixture-Accelerator, Retarder, SuperPlasticizer.
8	Find Compressive, flexural and tensile strength of concrete as per Indian standards.
9	Exercise and verification of Concrete Mix Design as per IS 10262: 2019 Method.
10	Determine the quality of concrete by Non-destructive Testing methods using ReboundHammer and ultrasonic Pulse velocity apparatus (Demo only).
11	Design of beam and column.
12	Design of RCC staircase.
13	Prepare excel sheet for the design of one way and two-way slab.

Semester	Course Code	Name of Course	L	T	P	Credits
IV	CE4L002	Solid Mechanics Lab	0	0	2	1

Sr. No.	Learning Outcome number	Learning Outcome Statement
1	LO1	Perform tension, compression, impact, hardness, torsion test on different specimens and observe the nature of failure.
2	LO2	Compare and observe the result obtained with standard IS values and comment on nature of failure and determine the compressive stress.
3	LO3	Formulate the compressive and shear stresses in specimen and compare the resistance qualities of different materials under different testing and loading conditions.
4	LO4	Interpret the graph of torque and angle of twist and determine shear strength and modulus of rigidity of the specimen.

Syllabus:

Sr. No.	Name of Experiments
1	To perform tension test on mild steel and compare the results obtained with standard IS values and comment
2	To perform tension tests on TOR steel also perform bend tests. Compare the results obtained with standard IS values and comment. Refer I.S. 1608.
3	To perform a compression test on metals. Observe the nature of failure and determine the compressive stress. Refer I.S.1708 for test procedure.
4	To perform a compression test on Wood (parallel and perpendicular to grains). Observe the nature of failure and determine the compressive stress. Refer I.S.1708 for test procedure. Comment on results.
5	To perform shear tests on metals. Study single & double shear action. Interpret failure pattern and calculate shear strength in single & double shear. Refer I.S 5242-9779.
6	To perform an impact test on metals. Determine the shock absorbing capacity of the material using Izod impact test apparatus. Compare the impact resisting qualities of different metals. Refer IS: 1598 and IS: 1757 – 1973.
7	To perform a hardness test on different metals and compare hardness number for different metals. Refer IS 1500.
8	To perform torsion test on metals. Interpret the graph of torque and angle of twist and determine shear strength and modulus of rigidity of the specimen. Refer I.S. 1717.
9	To find deflection of beams, bending stresses and their relation for simply supported beam. Also find Young's modulus.
10	Determine modulus of rupture of wooden beam. Observe the parameters that affect modulus of rupture.
11	Observe types of columns, their deflection behaviors. Understand buckling of columns and factors affecting strength of columns. Find buckling load of given set of columns with different end conditions.
12	Observe deflection and working of different types of springs. Determine modulus of rigidity of spring material and stiffness of spring.

Part B: At least four problems from four different topics to be solved using either programming or spreadsheet or solvers or any software.

Semester	Course Code	Name of Course	L	T	P	Credits
IV	CE4L003	Surveying and Geomatics Lab	0	0	4	2

Sr. No.	Learning Outcome number	Learning Outcome Statement
1	LO1	Apply the principles of surveying on various surveying methods as per the field conditions.
2	LO2	Analyze the data collected during the survey to plot the map on the paper.
3	LO3	Evaluate the horizontal distances, Reduced Levels, Area of irregular figures and independent coordinates of traverse.
4	LO4	Judge the topography of the field from the map.

Syllabus:

Sr. No.	Name of Experiments
1	Measurement of bearings of sides of traverse with prismatic compass and computation of correct included angles.
2	Determination of elevation of various points with leveling instrument by collimation method and rise & fall Method.
3	Measurement of horizontal angles and vertical angles with Theodolite.
4	Methods of Plane Table Survey. A) Radiation. B) Intersection. C) Traversing. D) Resection.
5	Determination of area of an irregular figure by using Digital Planimeter.
6	Setting out a simple circular curve by offsets from long chord produced.
7	Setting out a simple circular curve by offsets from Rankine's method.
8	Determine horizontal distances using tachometer between the stations when line of sight is inclined.
Survey Project	
1	To prepare block contour.
2	To prepare contour for the natural water body.
3	To prepare road project.
4	Preparing the sheet of Theodolite Traversing.

Semester	Course Code	Name of Course	L	T	P	Credits
IV	CE4T007	Universal Human Values	3	0	0	AU

Prerequisites for the course	
1.	Human Values
2.	Professional Ethics
3.	Work Ethics
4.	Service learning
5.	Senses of engineering ethics
6.	Engineering as Social Experimentation
7.	Open-mindedness and willingness to challenge

Prior Reading Material/useful link	
1.	https://www.udemy.com/course/human-values-and-professional-ethics/
2.	https://online.gndu.ac.in/pdf/HANDBOOHUMANPROFESSIONALETHICS.pdf
3.	https://medium.com/@TerriMKozlowski/how-to-challenge-yourself-to-be-open-minded-for-growth-7dbdaf4b28c6

Sr. No.	Course Outcome number	Course Outcome Statement
1	CO1	Students are expected to become more aware of their surroundings, Society, social problems and their sustainable solutions, while keeping human relationships and human nature in mind.
2	CO2	They would have better critical ability.
3	CO3	They would also become sensitive to their commitment towards what they believe in (humane values. Humane relationships and humane society).
4	CO4	They would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.
5	CO5	Evaluate the reasons for Conflicts;
6	CO6	Create sustainable efforts towards a better World.

Syllabus:

Course Content	
Unit I	Purpose and motivation for the course, recapitulation from Universal Human Values-I. Self-Exploration–what is it? - Its content and process; „Natural Acceptance“ and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.
Unit II	Understanding human being as a co-existence of the sentient “I” and the material “Body”. Understanding the needs of Self (“I”) and “Body” - happiness and physical facility. Understanding the Body as an instrument of “I” (I being the doer, seer and enjoyer). Understanding the characteristics and activities of “I” and harmony in “I” Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one’s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease
Unit III	Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students’ lives
Unit IV	Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.
Unit V	Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: <ul style="list-style-type: none"> a. Ability to utilize the professional competence for augmenting universal human order. b. Ability to identify the scope and characteristics of people- friendly and eco- friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: <ul style="list-style-type: none"> a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations ems. Strategy for transition from the present state to Universal Human

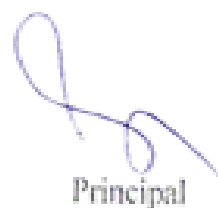
Text Books:	
1	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
Reference Book:	
1	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3	The Story of Stuff (Book).
4	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5	Small is Beautiful - E. F Schumacher.
6	Slow is Beautiful - Cecile Andrews
7	Economy of Permanence - J C Kumarappa
8	Bharat Mein Angreji Raj – Pandit Sunderlal
9	Rediscovering India - by Dharampal
10	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11	India Wins Freedom - Maulana Abdul Kalam Azad
12	Vivekananda - Romain Rolland (English)
13	Gandhi - Romain Rolland (English)

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