Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road, Nagpur-441 108
NAAC A+ Accredited
Approved by AICTE, New Delhi, Govt. of Maharashtra
(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Department of Civil Engineering

DEPARTMENT OF CIVIL ENGINEERING

Structure & Curriculum

From

Academic Year 2022-23

Vision of Institute

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

Mission of Institute

- To strive for rearing standard and stature of the students by practicing high standards of professional ethics , transparency and accountability.
- To provide facilities and services to meet the challenges of Industry and Society.
- To facilitate socially responsive research, innovation and entrepreneurship.
- To ascertain holistic development of the students and staff members by inculcating knowledge and profession as work practices.

Vision of the Department

To forge learning Center of Excellence in the field of Civil Engineering

Mission of the Department

- To promote academic and ethical development while upholding high standards.
- To provide advance facilities with the skills needed to face Industry and societal challenges.
- To promote socially responsible research, innovation, and entrepreneurship in the field of Civil Engineering.
- To foster the holistic development of both students and faculty members by inculcating a blend of knowledge and professional work methods for overall progress.

Program Education Objectives (PEO)

Graduates will be able to

- PEO1 : Analyse and design civil engineering structures while keeping social awareness and ethical responsibilities in mind.
- PEO2 : Demonstrate leadership abilities in supporting sustainable practices in Civil Engineering
- PEO3 : Exhibit a commitment to lifelong learning, staying updated on developing technologies and industry trends, and adjusting to the evolving world of Civil Engineering.
- PEO4 : Executing Proficiency in creative problem-solving and innovation, demonstrating an entrepreneurial attitude within the context of Civil Engineering.

Program Outcomes (PO)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and

need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

SCHEME OF INSTRUCTION & SYLLABI

Programme: Civil Engineering

Scheme of Instructions: Second Year B. TECH in Civil Engineering

Semester – IV

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME				
									CT-1	CT-2	TA/CA	ESE	TOTAL
1	PCC	BCE2401	Hydrology and Water Resources	3	-	-	3	3	15	15	10	60	100
2	PCC	BCE2402	Surveying	3	-	-	3	3	15	15	10	60	100
3	PCC	BCE2403	Transportation Engineering	3	-	-	3	3	15	15	10	60	100
4	PCC	BCE2404	Structural Analysis	3	1	-	4	4	15	15	10	60	100
5	PCC	BCE2405	Environmental Engineering	3		-	3	3	15	15	10	60	100
6	PCC	BCE2406	Surveying Lab	-	-	2	2	1	-	-	25	25	50
7	PCC	BCE2407	Transportation Engineering Lab	-	-	2	2	1	-	-	25	25	50
8	PCC	BCE2408	Structural Analysis Lab	-	-	2	2	1	-	-	25	25	50
9	PCC	BCE2409	Environmental Engineering Lab	-	-	2	2	1	-	-	25	25	50
10	PROJ	BCE2410	Micro Project	-	-	2	2	1	-	-	25	25	50
11	HSMC	BSH2401	Human Values for Professional Society	3	-	-	3	3	15	15	10	60	100
12	MCC	BAU2404	Group Reading of Classics	2	-	-	2	Audit	-	-	-	-	-
			Total	**20**	**1**	**10**	**31**	**24**	**90**	**90**	**185**	**485**	**850**

L- Lecture T-Tutorial P-Practical

CT1- Class Test 1 TA/CA- Teacher Assessment/Continuous Assessment

CT2- Class Test 2 ESE- End Semester Examination (For Laboratory End Semester performance)

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective courses from other discipline)	Project / Seminar / Industrial Training	MCC (Mandatory Courses)
Credits	3	--	--	20	--	--	01	Yes
Cumulative Sum	6	27	18	28	--	--	01	--

PROGRESSIVE TOTAL CREDITS :56+24 =80

H.O.D. Department of Civil Engineering T.G.P.C.E.T. Nagpur

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Vice Principal Tulsiramji Gaikwad-Patil College Of Engineering & Technology, Nagpur

Principal Principal Tulsiramji Gaikwad Patil College Of Engineering and Technology, Nagpur

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Program: B.Tech. Civil Engineering

Semester-IV	BCE2401 : Hydrology & Water Resources

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15Marks
Tutorial		**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Engineering Applied Chemistry		**Total Marks**	**100 Marks**

Course Contents

Unit I	**Introduction:** Hydrology, definition, engineering hydrology, and its importance, development of hydrology and allied science, hydrological cycle, hydrological evolution and brief description of its components, the earth and its atmosphere, importance of temperature, humidity, and wind in hydrological study. **Precipitation**: Definition anticipation, artificial rains, types of precipitation, orthographic, conventional and cyclonic, factors affecting precipitation with reference to physiographic divisions of India **Measurement of precipitation:** Non-automatic and automatic rain gauges, selection of site, density and adequacy of rain gauge stations, optimal number of rain gauge, radar measurement of rainfall, mass curve, supplementary rainfall data missing records, intensity duration frequently and depth area duration analysis
Unit II	**Infiltration**: definition, mechanism, factors affecting infiltration, infiltration indices, measurement, application, problems. **Evaporation and transpiration**: definition, mechanism and factors affecting evaporation, evaporation estimations by pan, water budget, energy budget and imperial formula, control of evaporation. Evapo-transpiration and its measurement. Interception and its measurement.
Unit III	**Runoff**: Source and components of run-off, classification of streams, factors affecting the runoff processes, estimation methods, measurement of discharge of streams by area-slope and area velocity method. **Hydro-graphics:** Flood hydrology, definition, typical flood hydrograph and its components, base flow and base flow separation, unit hydrograph, S-curve and its use, instantaneous UHG.
Unit IV	**Statistical Methods**: statistics in hydrological analysis, probability and probability distributions, average measure of dispersion, co-relation. Analysis of time series, frequency analysis. **Floods**: causes and effects, factors affecting peak flows and estimation of peak flows, low flow, basin flood, flood routine and flood forecasting, economic planning for flood control (Emergency action plan)
Unit V	**Geo-hydrology**: Introduction, occurrence and distribution of ground water, water table and water table maps, aquifer, aquiclude, aquitard and aquifuge. Groundwater exploration, electrical sensitivity method, confined and unconfined aquifer, porosity, permeability, specific yield, specific retention, Darcy's law, introduction to hydraulic wells, open wells, safe yield test, Well Hydraulics- Image well theory, Water Well Design and Drilling. **Groundwater recharge**: Concept of recharge, selection of recharge sites, recharging

	methods, spreading method, induced recharge method, recharge well method, sub-surface dams, waste water recharge, recharge by urban storm runoff, recharge through rain water harvesting. Groundwater Management, Conjunctive Use, Artificial Recharge of Groundwater, Groundwater Quality Modelling. Rain Water Harvesting: Introduction to rain water harvesting, Assessment of site's water resources, water harvesting methods using earthwork, tanks.
Text Books	
T.1	Hydrology And Water Resources Engineering - S.K.Garg, Khanna Publishers, 2015 edition
T.2	Text book of Hydrology - P. Jaya Rami Reddy, Laxmi Publications, 3rd edition 2016
T.3	Hydrology & Water Resource Engineering – Gite & Deshpande, Nirali Prakashan, 2018 edition
T.4	Irrigation & Water Resources Engineering - G.L. Asawa, New Age International Publishers, 2005 edition
Reference Books	
R.1	Engineering Hydrology – Dr. K. Subramanya, Tata McGraw Hill, 4th edition 2017
R.2	Irrigation Engineering – R. N. Reddy, Gene-Tech Books, 2010 edition
R.3	Irrigation, Water Resources and Water Power Engineering – Dr. P.N.Modi, Standard Book House, 11th edition 2019
R.4	Hydrology – Madan Mohan Das, PHI Learning, 2009
R.5	Rain Water Harvesting for Drylands and Beyong- Brad Lancaster. Rain Resourse Press.
Useful Links	
1	https://nptel.ac.in/courses/105/104/105104103/
2	https://nptel.ac.in/courses/105/105/105105042/
3	https://nptel.ac.in/courses/105/103/105103026/

	Course Outcomes	CL	Class Sessions
BCE2401.1	**Apply** knowledge of hydrology as well as measurement of precipitation	3	9
BCE2401.2	**Apply** knowledge of basics of hydrology in calculating infiltration, evaporation, total runoff.	3	10
BCE2401.3	**Classify** the components and factors affecting the runoff, as well as analyze the hydro-graphics.	3	8
BCE2401.4	**Analyze** the flood occurrence & frequency by applying Statistical techniques	4	10
BCE2401.5	**Apply** the knowledge of geo-hydrology & groundwater recharge terms in planning, assessing & computation of ground water potential and its assessment techniques.	3	9

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Semester-IV | BCE2402 : Surveying

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15Marks
Tutorial	-	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Engineering Mechanics		**Total Marks**	**100 Marks**

Course Contents

Unit I	**Chain and Compass Traversing** Introduction: - Classification, division of survey, Principle of survey, Chain Surveying: - Basics, direct ranging and cross staff survey. Compass Surveying: Prismatic Compass, true and magnetic bearing, local attraction, Compass traversing, traverse adjustment of closing errors.
Unit II	**Leveling:** Leveling: Definitions, Study of Dumpy & Auto Level, temporary adjustments, principles of leveling, reduction of levels, Classification of leveling, Curvature & Refraction corrections, Reciprocal leveling.
Unit III	**Contouring and Trignometrical Leveling** Contouring: Definitions, Characteristics, uses, and methods of locating contours, interpolation of contours. Trignometrical Leveling: Indirect leveling, elevation of a point with base of an object accessible and inaccessible (with instrument station in/not in the same vertical plane as the elevated object)
Unit IV	**Theodolite Surveying:** Theodolite: Introduction, Type of Theodolite, Temporary adjustment, Principle Axes and relationship, Measurement of horizontal and vertical angles, Traverse Computation: Consecutive and independent co-ordinates, adjustment of closed traverse, Area calculation by co-ordinate.
Unit V	**Plane Table Surveying & Computation of Area & Volume** Plane Table Survey: Instruments and accessories, advantages and disadvantages, orientation, Methods of plane table surveing – radiation, intersection, traversing, resection, two-point and three-point problems in plane tabling. Computation of Area and Volume: Trapezoidal and Simpsons Rule, errors in plane table surveying. Introduction to Remote sensing and Geographical Information System (GIS) and its applications

Text Books

T.1	Surveying and Levelling - Kanetkar and Kulkarni (Vol.I) Pune Vidyarthi Griha Prakashan, 2006 edition
T.2	Surveying and Levelling - Dr. B.C. Punmia (Vol. I) Laxmi Publications, 17th edition 2016
T.3	Surveying (Vol 1) – S. K. Duggal, McGraw-Hill, 5th edition 2019

T.4	Surveying and Leveling – N. N. Basak, Tata McGraw–Hill Education, 2nd edition 2017
Reference Books	
R.1	Surveying Fundamentals & Practices – Jerry A. Nathanson, Pearson Publication, 7th edition 2017
R.2	Surveying with Construction Applications – Barry & Dianne, Pearson Education India, 8th edition 2013
R.3	Construction Surveying and Layout – Wesley Crawford, Creative Construction Publishing, 3rd edition 2002
R.4	Surveying-I – D.G. Phadke, V.M. Thorat, Nirali Prakashan, 4th reprint edition
R.5	Surveying Fundamentals & Practices – Jerry A. Nathanson, Pearson Publication, 7th edition 2017
Useful Links	
1	https://nptel.ac.in/courses/105/107/105107122/

	Course Outcomes	CL	Class Sessions
BCE2402.1	**Examine** the basic concepts of surveying and use of conventional surveying equipment	3	8
BCE2402.2	**Implement** the basic principles, operation, handling & uses of advanced surveying equipment	3	9
BCE2402.3	**Sketch** the location map, contour map using surveying equipment	3	10
BCE2402.4	**Interpret** linear and angular measurements and elevations using Theodolite surveying	3	8
BCE2402.5	**Interpret** survey data for preparing drawings, plans or maps & to calculate their areas & volumes	3	10

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Semester-IV | BCE2403 : Transportation Engineering

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15Marks
Tutorial	-	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Engineering Mechanics		**Total Marks**	**100 Marks**

Course Contents

Unit I	Highway Development & Planning: Principles of Highway planning, Road development in India, Classification of roads, network patterns, Planning, Surveys. **Highway Alignment:** Requirements, Engineering Surveys. **Highway Materials:** Properties of sub grade and pavement component materials, Tests on sub-grade soils, aggregates and bituminous materials. Application of Geo-synthetics.
Unit II	**Highway Geometric Design**: Cross Section elements, carriageways, camber, stopping & overtaking sight distances Horizontal alignment- Curves, design of super elevation, widening, transition curves, vertical curves.
Unit III	**Pavement Design:** Types of pavements & characteristic, Design parameters, Axle & Wheel load, tyre pressure, ESWL for dual Wheels, repetitions, Group Index & IRC method of flexible pavement design. Analysis of load & temperature stresses of rigid pavement, joints **Highway Construction & Maintenance:** Earthen/Gravel road, Bituminous pavement, Cement Concrete pavement. Pavement failures, Pavement evaluation
Unit IV	**Traffic Engineering:** Traffic characteristics (Road User, Driver and Vehicular characteristics) Traffic Studies (Volume studies, speed studies, parking studies and accident studies.) Traffic Safety (Causes and types of accidents, Use of intelligent transportation system) **Bridge Engineering:** Classification, identification and site selection. Flood discharge, waterways, scour depth, economic span. IRC classification of Loads, Forces, Stresses: IRC Specification & code of practices, Critical combinations. **Rating and Maintenance:** Methods & Techniques of rating of existing bridges Inspection, Repairs, maintenance, corrosion-causes and prevention, aesthetics.
Unit V	Rapid Mass Transport system: Need for Metros, Basic planning & finances, Civil Engineering aspects, Surveys & Investigations, Electronics & Communication Engineering aspects, Signaling systems, Mechanical & Tunnel Ventilation systems, Electrical Engineering aspects, OHE, Green buildings, Carbon credits & clear air mechanics.

Text Books

T.1	Highway Engineering – Khanna and Justo, Nem Chand Publication, 10th Revised edition 2018
T.2	Textbook of Highway & Traffic Engineering – Subhash C. Saxena, CBS Publishers & Distributors, 1st edition 2017
T.3	Bridge Engineering - S. C. Rangwala, Charotar Publishing House Pvt. Limited, 16th Revised edition 2017

T.4	Principles, practices and design of Highway Engineering - S. K. Sharma, S. Chand & Company, 2014 edition
T.5	Traffic Engineering & Transport Planning - L.R.Kadiyali, Khanna Publishers, 1999 edition
Reference Books	
R.1	Principles of Pavement Design - Yoder and Witzak, Wiley India Pvt. Ltd., 2nd edition 2011
R.2	World Metro Systems – Paul E. Garbutt, Capital Transport Publishing, 2nd edition 1997
R.3	Traffic & Highway Engineering – Nicholas Garber, Wadsworth Publishing, 5th edition 2013
R.4	Highway Engineering – L.R.Kadiyali, Khanna Publishers, 1st edition 2018
Useful Links	
1	https://nptel.ac.in/courses/105/101/105101087/
2	https://nptel.ac.in/courses/105/105/105105107/
3	https://nptel.ac.in/courses/105/101/105101008/

	Course Outcomes	CL	Class Sessions
BCE2403.1	**Classify** Highway Planning, Materials and Engineering surveys for highway alignment	3	9
BCE2403.2	**Design** the Geometric Elements of Highways and Urban roads, Flexible and Rigid pavements.	6	8
BCE2403.3	**Analyze** the load and temperature stresses of rigid pavement, joints and judge the Highway Construction and Maintenance	4	10
BCE2403.4	**Summarize** and undertake the concepts of Traffic studies & classification, identification, site selection for Bridge Engineering	3	10
BCE2403.5	**Apply** the knowledge regarding Rapid Mass Transportation System	3	8

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Semester-IV | BCE2404: Structural Analysis

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15Marks
Tutorial	1 Hrs/week	**CT-II**	15 Marks
Total Credits	**4**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Engineering Mechanics, Mechanics of Solids		**Total Marks**	**100 Marks**

Course Contents

Unit I	Introduction of Statically indeterminate Structures, Concept of Static indeterminacy, Analysis of fixed and continues beams by theorem of three moments, effects of sinking of support
Unit II	Slope defection method as applied to indeterminate beams & continues beams portal frames. Frame with inclined legs up to 3 degrees of freedom. Analysis of Continuous Beams & Simple Portal frames (sway and Non-Sway) Using Moment Distribution Method
Unit III	Rolling loads on simply supported beams with concentrated and uniformly distributed loads, maximum B.M. and S.F. Influence Line Diagrams for Reactions, Shear Forces and Bending Moments in simply supported beam, cantilevers and beams with overhangs, ILD for forces in members of Simple Trusses.
Unit IV	Basic concept, Degree of Freedom, Direct Stiffness Method. Formulation of elemental local stiffness matrix and global stiffness matrix for beam members (without axial deformation), for plane frame members. Member load matrix due to concentrated loads, uniformly distributed loads. Transformation matrix, Assembly of global/ structural load matrix up to three elements. Solution to problems with maximum degree of freedom three.
Unit V	Formulation of elemental/local stiffness matrix and global stiffness matrix for plane truss. Transformation matrix, Assembly of global/ Structural stiffness matrix up to (8 x 8). Assembly of global / structural load matrix. Solution to problems with maximum degree of freedom three.

Text Books

T.1	"Structural Analysis: A Matrix Approach" author by Pandit G.S and Gupta S.P., 2nd edition, Tata McGraw-Hill Publishing company LTD, New Delhi, 1997
T.2	"Structural Analysis-I" author by Bhavikatti S. S., 4th edition Vikas Publication
T.3	"Structural Analysis" author by Ghali ,A; Neville, A. M; Brown, T .G., 6th edition REPRINT, Taylor And Francis publication
T.4	"Structural Analysis", author by Vaidyanatnan, R and Perumal PVol – I & II, 3rd edition, Laxmi Publication, New Delhi, 2007.

Reference Books

R.1	"Analysis of structures: Theory and Design Vol. 2" author by Vazirani V.N, Ratwani M.M. and S.K. Duggal, 2nd edition Khanna Publishers New Delhi 2009.
R.2	"Structural Analysis (volume II)" author byBhavikatti,4th edition, S.S Vikas publishing House LTD Delhi 2011

R.3	"Mechanical Behavior of Materials" author by Courtney, T. H., 2nd Edition McGraw-Hill publication, 2005.
R.4	"Basic Structural Analysis" author by Reddy C. S. 2nd edition Tata Mc graw Hill publication
Useful Links	
1	https://nptel.ac.in/courses/105/101/105101085/
2	https://nptel.ac.in/courses/105/105/105105166/
3	https://nptel.ac.in/courses/105/105/105105180/

	Course Outcomes	CL	Class Sessions
CE2404.1	**Apply** knowledge to determine the forces in determinate structures and indeterminate structures	3	9
CE2404.2	**Analyze** the slope and deflection of beams and frames under structural loading conditions using MDM.	4	9
CE2404.3	**Apply** knowledge of Influence Line structural members for rolling loads	3	9
CE2404.4	**Apply** stiffness method to analyze beams and plane frames.	3	9
CE2404.5	**Apply** direct stiffness method to formulate, stiffness , transformation, load matrix to analyze plane truss.	3	9

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Semester-IV | BCE2405: Environmental Engineering

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/week	**CT-I**	15Marks
Tutorial	-	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10 Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre-Requisites: Engineering Applied Chemistry, Fluid Mechanics		**Total Marks**	**100 Marks**

Course Contents

Unit I	**Introduction:** Importance and necessity of water supply scheme. **Water Demand:** All types of water demand, empirical formulae, factors affecting per capita demand, variation in demand, design period, population forecasting methods and examples. **Sources of water:** Rain water, Ground water-springs, infiltration galleries, dug wells, tube wells, Surface water stream, lake, river, impounding reservoirs, ponds & sea. **Intake structures:** Location, types - river, lake, canal, reservoir etc.
Unit II	**Conveyance of water:** Types of pipes, joints, fittings, valves & appurtenances. Hydraulic design aspects: Friction, Manning's, Darcy-Weishbach & Hazen-Williams equation and problem. **Rising main and pumps:** Concept of rising main, Classification, working, merits and demerits, selection of pumps.
Unit III	**Water quality:** Physical, Chemical and bacteriological characteristics of water, Health effects of various water characteristics, Standards of drinking water. (WHO 2011, CPHEOO, IS 10500). Water borne diseases **Water treatment:** Objective of treatment, unit operations and processes, house hold & community based rural water treatment, decentralized water treatment, flow sheet of conventional water treatment plant. **Aeration:** Purpose, types of aerators, design of cascade aerator. **Coagulation and Flocculation:** Definition, Principles, types of coagulants and reactions, coagulant doses, types of mixing and flocculation devices.
Unit IV	**Sedimentation:** Principles, types of setting basins, inlet and outlet arrangements, simple design of sedimentation tank. **Clariflocculators:** Principles and operation. **Filtration:** Mechanism of filtration, types of filters-RSF, SSF, Pressure filters, elements of filters sand specification, operational problems in filtration, Design of SSF and RSF, Membrane filtration technique of water treatment.
Unit V	**Disinfection**: Purpose, Mechanism, criteria for good disinfectant, various disinfectants, their characteristics, disinfection by chlorination using different forms of chlorine. Types of chlorination. **Distribution systems**: Requirements of a good distribution system, methods of distribution

	systems and layouts, Leakage and leak detector, Study of fire hydrants. Storage reservoirs for treated water: Types, capacity of reservoir, mass curve. **Miscellaneous Methods of Water Treatment**: Colour, Odors & Taste removal, removal of iron & manganese - water softening processes, base exchange process, swimming pool water treatment.
Text Books	
T.1	Water supply & Sanitary Engineering - B.C. Punmia, Laxmi Publication, 2016 edition
T.2	Water supply and Sanitary Engineering - Birdie G.S., Dhanpat Rai Publication, 2010 edition
T.3	Environmental Engg. I - P. N. Modi, Standard Book House, 5th edition, 2018
T.4	Environmental Engg.(Water supply Engg.) - S.K.Garg, Khanna Publication, 33rd edition. 2010
T.5	Environmental Engg. – N.N.Basak, Tata Mcgraw Hill Publication, 22nd reprint edition
T.6	Environmental Engg. – G.N. Pandey, Tata Mcgraw Hill Publication, 5th reprint edition
Reference Books	
R.1	Water Supply and Sanitary Engineering – S.C.Rangwala, Charotar Publishing House, 2005 edition
R.2	Water supply and sewage -M.J.Mcghee, Mc.Graw Hill, 6th edition, 1991
R.3	Environmental Pollution Control Engg. - C.S.Rao, New Age International Publishers, 3rd edition, 2018
R.4	Elements of Environmental Engineering – Dr.K.N.Duggal, S.Chand Publication, 2007 edition
R.5	CPHEOO manual on Water Supply & Treatment 2009, New Delhi, Ministry of Urban Development, G.O.I.
Useful Links	
1	https://nptel.ac.in/courses/105/105/105105201/
2	https://nptel.ac.in/courses/105/106/105106119/

	Course Outcomes	CL	Class Sessions
BCE2405.1	**Illustrate** the importance and necessity of water supply scheme.	3	8
BCE2405.2	**Implement** the basic concepts of water conveyance systems & hydraulic design aspects.	3	9
BCE2405.3	**Determine** characteristics of water, BIS & WHO drinking water standards and necessity of water treatment.	3	10
BCE2405.4	**Examine** sedimentation & filtration water treatment units	4	8
BCE2405.5	**Analyze** disinfection & miscellaneous units of conventional water treatment plant.	4	10

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Semester	Course Code	Name of Course	L	T	P	Credits
IV	BCE2406	Surveying Lab	-	-	2	1

Pre-Requisites:

	Course Contents	CO
1	Measurement of distance by Chaining / Tape and ranging	CO1
2	Determination of area of given polygon by tape and cross staff survey.	CO1
3	Measurement of bearings of sides of traverse with prismatic compass and computation of correct included angles.	CO1
4	Determination of elevation of various points with dumpy level by collimation plane method and rise & fall Method.	CO2
5	Fixing bench mark with respect to temporary bench mark with Auto level by fly leveling and check leveling.	CO2
6	L - Section and cross section of road (One full size drawing sheet each for L-section and cross section)	CO3
7	Measurement of horizontal angles using Theodolite by method of repetition	CO4
8	Measurement of vertical angles with Theodolite.	CO4
9	Determination of horizontal distance between two inaccessible points with Theodolite.	CO4
10	Locating given building by plane table traversing (One full size drawing sheet	CO5
11	Locating given building by Theodolite traversing (One full size drawing sheet)	CO4
12	Determination of elevation of point by trigonometric leveling.	CO2
13	Determination of area of a irregular figure by using Planimeter	CO5
14	To draw Contour map of given area (One full size drawing sheet)	CO3
15	To give site Layout for given plan of building.	CO5

Text Books

T.1	Surveying and Levelling - Kanetkar and Kulkarni (Vol.I), Pune Vidyarthi Griha Prakashan
T.2	Surveying and Levelling - Dr. B.C. Punmia (Vol. I & II), Laxmi Publications

Reference Books

R.1	Surveying and Leveling - Basak N. N.1st Edition, Tata McGraw–Hill Publishing company Ltd. New Delhi

Useful Links

1	https://nptel.ac.in/courses/105/107/105107122/

	Course Outcomes	CL	Class Sessions
BCE2402.1	**Examine** the basic concepts of surveying and use of conventional surveying equipment	3	8
BCE2402.2	**Implement** the basic principles, operation, handling & uses of advanced surveying equipment	3	9
BCE2402.3	**Sketch** the location map, contour map using surveying equipment	3	10
BCE2402.4	**Interpret** linear and angular measurements and elevations using Theodolite surveying	3	8
BCE2402.5	**Interpret** survey data for preparing drawings, plans or maps & to calculate their areas & volumes	3	10

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Program: B. Tech. Civil Engineering

Semester	Course Code	Name of Course	L	T	P	Credits
IV	BCE2407	Transportation Engineering Lab	-	-	2	1

Pre-Requisites: Nil

	Course Contents	CO
1	To Perform California Bearing Ratio Test	**CO1**
2	To identify AASHTO Classification of Sub grade Soil	**CO1**
3	To determine the aggregate crushing value of the given specimen	**CO3**
4	To determine the abrasion value of coarse aggregate by using Los Angles machine	**CO2**
5	To determine the aggregate impact value of the given specimen	**CO2**
6	To determine the Specific gravity and water absorption of an aggregate sample	**CO2**
7	To determine the Penetration Value of the given bitumen	**CO4**
8	To determine the ductility value of the given bitumen	**CO4**
9	To determine the Softening point of the given bitumen	**CO5**
10	To determine the Flash point and Fire point of the given bitumen	**CO5**

Text Books

T.1	Highway Engineering: Khanna and Justo, Nem Chand Publication
T.2	Principles and practices of Highway Engineering - S. K. Sharma, Khanna Publication

Reference Books

R.1	Pavement Design: Yoder and Witzak, Wiley Publication
R.2	Traffic Engineering: L.R.Kadiyali, Khanna Publishers
R.3	Relevant IS Codes: IS-2720-PART-16-1979, AASHTO manual, IS:2386-Part 1 to 6-1963, IS:1203-1978, IS 1208-1978, IS 1201 to 1220 (1978).

Useful Links

1	https://nptel.ac.in/courses/105/101/105101087/
2	https://nptel.ac.in/courses/105/105/105105107/
3	https://nptel.ac.in/courses/105/101/105101008/

	Course Outcomes	CL	Lab Sessions
BCE2407.1	**Identify** the properties of highway materials and draw appropriate conclusion	3	4
BCE2407.2	**Determine** the properties of aggregate used for road construction	3	8
BCE2407.3	**Determine** flakiness index & elongation index of aggregate.	3	4
BCE2407.4	**Evaluate** the suitability of bitumen and check the properties of bitumen by Penetration & Ductility tests	5	4
BCE2407.5	**Relate** complete knowledge of softening point, Flash and Fire point of bitumen.	4	4

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Semester	Course Code	Name of Course	L	T	P	Credits
IV	BCE2408	Structural Analysis Lab	-	-	2	1

Pre-Requisites: Engineering Mechanics, Mechanics of Solids

	Course Contents	CO
1	To find the slope and deflection of continuous beam.	CO 1
2	To find the value of Flexural rigidity (EI) for a given beams .	CO 1
3	To determine the moment required to produce a given rotation at one end of a beam when the other end is i) Pinned ii) Fixed	CO 2
4	To calculate the Eulers Buckling load in order to determine the behavior of different types of struts.	CO 3
5	To determine the horizontal thrust and to draw the influence line diagram for horizontal thrust of two hinged parabolic arch.	CO3
6	To measure the strain in the cantilever beam with the help of acoustic resistance strain gauge.	CO3
7	To verify the Maxwell's reciprocal theorem for beam.	CO2
8	To determine horizontal thrust for indeterminate portal frame	CO2
9	Analysis of a continuous beam using computer software.	CO 4, CO5
10	Analysis of a plane frame using computer software.	CO 4, CO5
11	Analysis of a plane truss using computer software.	CO4, CO5

Text Books

T.1	"Structural Analysis: A Matrix Approach"author by Pandit G.S and Gupta S.P., 2nd edition, Tata McGraw-Hill Publishing company LTD, New Delhi, 1997
T.2	"Structural Analysis-I" author by Bhavikatti S. S., 4th edition Vikas Publication
T.3	"Structural Analysis" author by Ghali ,A; Neville, A. M; Brown, T .G., 6th edition REPRINT, Taylor And Francis publication
T.4	"Structural Analysis", author by Vaidyanatnan, R and Perumal PVol – I & II, 3rd edition, LaxmiPublication, New Delhi, 2007.

Reference Books

R.1	"Analysis of structures: Theory and Design Vol. 2" author byVazirani V.N, Ratwani M.M. and S.K. Duggal, 2nd edition Khanna Publishers New Delhi 2009.
R.2	"Structural Analysis (volume II)" author byBhavikatti,4th edition, S.S Vikas publishing House LTD Delhi 2011
R.3	"Mechanical Behavior of Materials" author by Courtney, T. H., 2nd Edition McGraw-Hill publication, 2005.

R.4	"Basic Structural Analysis" author by Reddy C. S. 2nd edition Tata Mcgraw Hill publication
Useful Links	
1	https://nptel.ac.in/courses/105/105/105105166/
2	https://nptel.ac.in/courses/105/105/105105180/

	Course Outcomes	CL	Lab Sessions
BCE2408.1	**Analyze** the slope and deflection of continuous beam and flexural rigidity by MDM.	4	4
BCE2408.2	**Determine** the moment required to produce a rotation at one end of beam and verification of Maxwell Reciprocal Theorem.	3	2
BCE2408.3	**Determine** the behavior of strut by Euler's buckling load and measure horizontal thrust of two-hinged parabolic arch.	3	4
BCE2408.4	**Analysis** of continuous beam using Staad Pro.	4	6
BCE2408.5	**Analysis** of plane frame and truss using Staad Pro.	4	6

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Semester	Course Code	Name of Course	L	T	P	Credits
IV	BCE2409	Environmental Engineering Lab	-	-	2	1

Pre-Requisites: Engineering Applied Chemistry, Environmental Engineering

	Course Contents	CO
1	Determination of Chlorides	**CO1**
2	Determination of Solid's (Suspended & dissolved)	**CO1**
3	Determination of Turbidity	**CO2**
4	Determination of Acidity	**CO2**
5	Determination of Dissolved Oxygen	**CO3**
6	Determination of Conductivity	**CO3**
7	Determination of Residual Chlorine	**CO4**
8	Determination of coagulant by Jar Test apparatus	**CO4**
9	Determination of COD in waste water	**CO5**
10	Determination of BOD in waste water	**CO5**

Text Books

T.1	Water supply & Sanitary Engineering - B.C. Punmia, Laxmi Publication
T.2	Water supply and Sanitory Engineering - Birdie G.S., Dhanpat Rai Publication
T.3	Environmental Engg. I - P. N. Modi, Std. Publication
T.4	Environmental Engg.(Water supply Engg.) - S.K.Garg, Khanna Publication

Reference Books

R.1	CPHEOO manual, New Delhi, Ministry of Urban Development, G.O.I.
R.2	Water supply and sewage -M.J.Mcghee, Mc. Graw Hill
R.3	Environmental Pollution Control Engg. -C.S.Rao, Mc. Graw Hill
R.4	Relevant IS Codes: IS 3025 Part 11 (1983), and 22 (1986), IS 3025 Part 32 (1988), IS 3025-15 (1984), IS 3025-10 (1984), IS 3025 Part 22 (1986), IS 3025-50 (2001)

Useful Links

1	https://nptel.ac.in/courses/105/105/105105201/
2	https://nptel.ac.in/courses/105/106/105106119/

	Course Outcomes	CL	Lab Sessions
BCE2409.1	**Identify** and recommend water quality analysis tests for determining pollution in water	3	4
BCE2409.2	**Identify** and recommend tests for analysis of physical constituents of water	3	4
BCE2409.3	**Investigate** properties of chemical constituents of water using identification tests	6	4
BCE2409.4	**Evaluate** & acquire the knowledge to test strength & quality of reagents & coagulants	5	4
BCE2409.5	**Examine** the concepts of water quality related to Environmental Engineering	4	4

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Program: B.Tech. IV Semester (All Branches)

Semester IV	BSH2401: Human Values for Professional Society

Teaching Scheme		**Examination Scheme**	
Theory	3 Hrs/week	**CT-I**	15 Marks
Tutorial	-	**CT-II**	15 Marks
Total Credits	**3**	**CA**	10Marks
Duration of ESE: 3Hrs		**ESE**	60 Marks
Pre- Requisite: Ethical Science & Business Ethics		**Total Marks**	**100 Marks**

Course Contents

Unit I	**Introduction to Value Education** Value Education, Definition, Concept and Need for Value Education, The Content and Process of Value Education, Basic Guidelines for Value Education, Self-exploration as a means of Value Education.
Unit II	**Harmony in the Human Being, Family, Society and Nature** Human Being is more than just the Body, Understanding Myself as Co-existence of the Self and the Body, Understanding the activities in the Self and the activities in the Body, Family as a basic unit of Human Interaction and Values in Relationships, The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory.
Unit III	**Social Ethics** The Basics for Ethical Human Conduct, Defects in Ethical Human Conduct, Holistic Alternative and Universal Order, Universal Human Order and Ethical Conduct.
Unit IV	**Basic Theories** Basic Ethical principles, Moral Developments, Deontology, Utilitarianism, Virtue theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.
Unit V	**Global Issues in Professional Ethics:** Introduction- Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights.

Text Books	
T.1	A.N Tripathy, New Age International Publishers, 2003.
T.2	Bajpai. B. L, New Royal Book Co, Lucknow, Reprinted, 2004.
T.3	Bertrand Russell Human Society in Ethics & Politics.
T.4	Professional Ethics: R. Subramanian, Oxford University Press, 2015.
Reference Books	
R.1	Corliss Lamont, Philosophy of Humanism.
R.2	Gaur. R.R, Sangal. R, Bagaria. G.P, A Foundation Course in Value Education, Excel Books, 2009.
R.3	Gaur. R.R, Sangal. R, Bagaria. G.P, Teachers Manual Excel Books, 2009.
R.4	I.C. Sharma. Ethical Philosophy of India Nagin & co Julundhar.
R.5	Mortimer. J. Adler, – Whatman has made of man.
R.6	Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, Cengage Learning, 2015.

	Course Outcomes	CL	Class Sessions
BSH2401.1	**Relate** Value Education and its role for Self-exploration.	3	9
BSH2401.2	**Illustrate** the Harmony in the Human Being and Society.	3	9
BSH2401.3	**Examine** the Ethical Human Conduct along with Universal Order.	3	9
BSH2401.4	**Use** of various theories of Basic Ethical principles.	3	9
BSH2401.5	**Predict** Global Issues in Professional Ethics and Sustainable Development.	3	10

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