RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
SCHEME OF EXAMINATION & EVALUATION
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)
SEMESTER: FIFTH

Sr. No	Subject Code	Subject	Workload in Hours			Credit				Marks					Minimum passing marks	
			L	T/ A	P	L	T	P	Total	Theory		Practical		Total	Theory	Practical
										Int	Uni	Int	Uni			
1	BTCVE501T	Hydraulic Engineering	3	0	0	3	0	0	3	30	70	--	--	100	45	--
2	BTCVE501P	Hydraulic Engineering (Practical)	0	0	2	0	0	1	1	--	--	25	25	50	--	25
3	BTCVE502T	Reinforced Cement Concrete (RCC) designs	3	1	0	3	1	0	4	30	70	--	--	100	45	--
4	BTCVE503T	Civil Engineering Materials, Testing & Evaluation	3	0	0	3	0	0	3	30	70	--	--	100	45	--
5	BTCVE503P	Civil Engineering Materials, Testing & Evaluation (Practical)	0	0	2	0	0	1	1	--	--	25	25	50	--	25
6	BTCVE504T	Professional Practice, Law & Ethics	3	0	0	3	0	0	3	30	70	--	--	100	45	--
7	BTCVE505T	Elective-I	3	0	0	3	0	0	3	30	70	--	--	100	45	--
8	BTCVE506T	Elective-II	3	0	0	3	0	0	3	30	70	--	--	100	45	--
9	BTCVE507P	Industrial Training (Already done in summer vacation after 4th sem) & Professional Skill Training (Software Applications in Civil Engineering)	0	0	2	0	0	1	1	--	--	50	50	100	--	50
10	BTCVE508AU	Organizational Behavior	2	0	0	0	0	0	0	--	--	50	Audit	50	--	--
TOTAL			20	1	6	18	1	3	22	180	420	150	100	850		

- L- Lecture , P-Practical, T- Tutorial , A- Activity (Half Credit per Hour)

(Dr. A.N. Dabhade) BOS Member

(Dr. Avinash N Shrikhande,) BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem:V	**Total Hours Distribution per week**		
Total Credit: 03	**Lecture (L): 3 Hrs**	**Tutorial/Activity (T/A): 0 Hrs.**	**Practical (P): 0 Hrs.**
Subject Code	**BTCVE501T**	**Name of Subject: Hydraulics Engineering**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15marks for sessional Examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	To know the boundary layer theory and concept of drag and lift
2	To understand the various losses occurring in pipe flow, various phenomenon occurring in this case
3	To compute uniform flow through open channel and understand the concept of specific energy
4	To analyse the gradual varied flow and hydraulic jump concept
5	To understand the design principle of various hydraulic machines likes turbines and pumps

Course Outcome	
After completion of syllabus student able to	
1	Understand the concepts related to boundary layer theory and determination of drag and lift forces
2	Apply the knowledge of theories and equations of pipe flow in analyzing and designing the pipe network systems and to discuss effects of water hammer pressures.
3	Use the concepts of uniform and critical flow through open channels, design of efficient channel sections and application of specific energy concept.
4	Understand gradually varied flow analysis and its computation, and its application in open channel flow.
5	Understand and apply basics principles related to turbines & Pumps in water Resources planning

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO
BECVE501T CO1	3	3	3			2						
BECVE501T CO2	3	3	3		2	2						
BECVE501T CO3	3	3	3		2	2						
BECVE501T CO4	3	3	3	3	2	2						
BECVE501T CO5	3	3	3	3	2	2	1	1				

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1			
Real Fluid Flow:	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Viscous Flow: Reynold's experiment, viscous flow through a circular pipe, velocity and shear stress distribution, Hazen poisuillee equation	**02**		**1**
Boundary layer concept: Nominal thickness, displacement thickness, momentumthickness of the boundary layer: Boundary layer along a thin plate and its characteristics; Laminar boundary layer; turbulent boundary layer; laminar sub-layer: separation of boundary layer on plane and curved surfaces.	**03**		**1**
Real, Incompressible Fluid Flow Around Immersed Bodies: General definition of drag and lift; flowpast plates, cylinders and spheres; drag on sphere; drag on sphere, cylinder and flat plate	**03**		**1**
	08		
Unit No.2			
Flow through Pipes:	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Hydraulically smooth and rough pipes: Frictional resistance to flow of fluid in smooth and rough pipes; Moody's chart; Darcy-Weisbach & Hazen-William's equation for frictional head loss; Hydraulic gradient	**07**		**2**

and energy gradient: Pipes in series and parallel; Branched pipes; Siphon; transmission of power through pipes; Hardy-Cross methods of pipe networks; Water-hammer, pressure head due to sudden closure of valve.			
	07		
Unit No.3			
Uniform Flow Through Open Channels	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
(A) General: Types of channel and their geometrical properties; Types of flow in open channel.	**03**		**3**
(B) Uniform Flow: Chezy's and Manning's equations; Hydraulically most efficient rectangular, triangular and trapezoidal sections; Computations of normal depth of flow, conveyance of channel, section factor for uniform flow, normal slope and normal discharge.	**03**		**3**
(C) Critical Flow: Specific energy and its diagram; alternate depths; Computations of critical depth, section factor for critical flow, critical slope; normal, critical slope, Specific force and its diagram; Conditions of critical flow.	**02**		**3**
	08		
Unit No.4			
Non Uniform Flow through Open Channel	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
(A) Gradually Varied Flow: Dynamic equation for GVF; Classification and characteristics of surface profiles; direct Step method of computing profile length.	**02**		**4**
(B) Rapidly Varied Flow: Definition of hydraulic jump; Equation of hydraulic jump in horizontal, rectangular channel; Length & height of jump; Energy loss in jump classifications of jump	**03**		**4**

Concept of Impact of Jet			
Force exerted on stationary and moving plate and curved surface, concept of velocity triangles	**02**		**4**
	07		
Unit No.5			
Fluid Machinery	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
(A) Turbines: Definition: Gross and net heads; different efficiencies; Classification of turbines; component parts and working principles; selection of turbines on the basis of head and specific speed.	**02**		**5**
(B) Reciprocating Pumps: Components parts, working principle, Work done of single & double acting pumps; Negative slip, Air vessels-Working principle and necessity, indicator diagram	**02**		**5**
(C) Centrifugal Pump: Component parts; working principle; Static and manometric heads; different efficiencies; Priming & priming devices, Specific speed; Theoretical aspects of multistage pumps; Trouble & remedies; operating characteristics curves.	**03**		**5**
	07		

References							
Applicable for Unit No.	**Name of Book**	**Name of Author**	**Name of Publisher**	**Edition**	**Category**		
					Text Book	**Research paper**	**Reference book**
1 and 5	Fluid Mechanics and Hydraulic Machines	P.N.Modi and S.M. Seth	Standard Book House Delhi	**21st 2017**	**Yes**		
All	Fluid Mechanics	A.K.Jain	Khanna Publishers Nai Sarak New Delhi.	**9th 2006**	**Yes**		

2 to 5	Fluid Mechanics	R.K.Rajput	S.Chand & Company Pvt(L), New Delhi	**6th 2015**	**Yes**		
	Hydraulics, Fluid Mechanics and Hydraulic Machine	S.Ramamrutham	Dhanpat Rai Publishing Co., New Delhi	**6th 1998**	**Yes**		
	Flow in open channels	K. Subramanya	Tata McGraw Hills Publishing Company Ltd, New Delhi	**2nd 1997**			**Yes**

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shrikhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FACULTY OF SCIENCE & TECHNOLOGY

B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem:V	**Two Hours Distribution per week**		
Total Credit: 1	**Practical (P): 02 Hrs.**		
Subject Code	**BTCVE501(P)**	**Name of Subject: Hydraulics Engineering(P)**	
Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
25 Marks	**25 Marks**	**25 Marks**	

List of Experiments- (Minimum 8 experiments should be performed)

1. Determination of Frictional factor of a pipe line
2. Determination of minor losses through a pipe system
3. Determination of critical slope of an open channel
4. Study on Main characteristics of a centrifugal pump
5. Study on operating characteristics of a reciprocating pump
6. Study on operating characteristics of a centrifugal pump
7. Study on main characteristics of reciprocating pump
8. Analysis of Hydraulic jump in open channel
9. Determination of coefficient of impact of jet
10. Study of characteristics of a Pelton wheel
11. Study of characteristics of a Francis Turbine
12. Study of Reynolds's experiment
13. Determination Chesy's and Manning constants
14. Analysis of a Water Distribution network by Hardy cross method

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shrikhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week 3-1-0**		
Total Credit:04	**Lecture (L):03 Hrs**	**Tutorial/Activity (T/A): 01 Hrs.**	**Practical (P): 00 Hrs.**
Subject Code	**BTCVE502T**	**Name of Subject: Reinforced Cement Concrete Designs**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15 Marks for sessional examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**4 Hr**

Course Objective	
1	To understand phenomenon's of design concepts and learning various codes related to RCC design.
2	To understand the structural behavior of steel and concrete.
3	To apply conventional methods for design structural components of building.

Course Outcome	
After completion of syllabus student able to	
1	Understand the fundamental concepts of working stress method as per IS 456- 2000 and Pre-stressed concrete method.
2	Apply the fundamental concepts of limit state method on limit state of serviceability
3	Analyze the fundamental concepts of limit state of collapse in flexure, Shear & Bond as per IS 456-2000.
4	Evaluate the fundamental concepts of limit state of collapse in compression and design of footing as per IS 456-2000.
5	Design of Simply supported Two-way slab

MAPPING OF CO WITH PO

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Subject Code &CO NO.												
CO1	3	3	3	-	-	-	-	-	-	-	-	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3
CO4	3	3	3	-	-	-	-	-	-	-	-	3
CO5	3	3	3	-	-	-	-	-	-	-	-	3
Avg CO	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Introduction to the Working Stress Method of RCC design. Basic concept in design for flexure, assumptions, design constants. Analysis of the rectangular section. (Balanced, under–reinforced and over– reinforced sections). **Introduction to Prestress Concrete:** Properties of high grade materials, concepts of prestress concrete, method of pre-stressing, losses in pre- stressing. Various systems for pre-stressing with particular reference to Freyssinet, Magnel Blatton and Giffod Udall system	**07**		1
	07		
Unit No.2			
Introduction to Limit State Design: Concept of limit state design and philosophy. Characteristic values, partial safety factors, stress strain relationship stress block parameters, failure criteria, types and properties of reinforcement, limit state of Serviceability and limit state of collapse. Limit states of durability **Limit State of serviceability**: **Causes and control of cracking**: Crack in plastic concrete at early	**10**		**2**

age, cracks due to temperature and shrinkage, restrain induced cracks, cracks due to loading. Needs for crack width control. Moment– curvature relationship, deflection control of beams and one way slabs. Limit state of collapse in flexure: Analysis and design of singly reinforced rectangular section. Limit state of Collapse in Flexure: Analysis & design of the Tee & L- beam section. Limit state of Collapse in Shear & Bond: Design of beam for shear , shear span, post cracking resistance, shear mechanism approach , shear failure modes and collapse loads, interaction of shear , flexure and axial force ,Check for bond.			
	10		
Unit No.3			
Limit state of collapse in compression: Analysis & design of short axially loaded column. Columns subjected to uni-axial bending, use of interaction curves.	**08**		**3**
	08		
Unit No.4			
Design of one –way, simply supported, single span and cantilever slabs and continuous slab / beam with IS coefficients,	**07**		**4**
	07		
Unit No.5			
Design of rectangular pad / slopped footing for axial load. Design of Simply supported Two-way slab	**04**		**5**
	04		

Text Books	1.	P.C.Varghese, Limit State design of Reinforced Concrete, 2nd Edition, PHI Learning Pvt Ltd, 2006
	2.	M.L.Gambhir, Design of Reinforced Concrete, 4th Edition, PHI Learning Pvt Ltd, 2011
	3.	M.L.Gambhir, Fundamental of Reinforced Concrete Design, 5th Edition, PHI Learning Pvt Ltd, 2011
EBooks	1.	Design of Reinforced Masonry Structures, Second Edition, Narendra Taly, Ph.D., P.E., F.ASCE
	2.	Building Design and Construction Handbook, Sixth Edition,Frederick S. Merritt

Reference Books	1.	Dr. V.L.Shah & Dr. S.R.Karve, Limit State Theory and Design of Reinforced Concrete (As Per IS : 456 - 2000), 7th Edition, Structures Publications, 2013
	2.	"Illustrated Reinforced Concrete Design" by Dr. V.L.Shah and Dr. S.R. Karve, 'Structures Publications' , Pune 411009
online TL Material	1.	Design of Reinforced Concrete Structures, Civil Engineering, Prof. N. Dhang, IIT Kharagpur

List of Code/Handbook			
Applicable for Unit No.	**Title of Code**	**Type of code**	**Year of Publication**
ALL	**IS 456 PLAIN AND REINFORCED CONCRETE - CODE OF PRACTICE (Fourth Revision)**		2000

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shirkhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week**		
Total Credit: 03	**Lecture (L): 3Hrs**	**Tutorial/Activity (T/A): NA**	**Practical (P): 2 Hrs.**
Subject Code	**BTCVE 503T**	**Name of Subject: Civil Engineering Materials, Testing and Evaluation**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks (15marks for sessional Examination) (15 Marks for Activity based)	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	The properties and importance of various constituent materials of concrete used in construction
2	The mechanical behaviour of engineering materials under compressive and tensile loads
3	The fundamentals of fracture mechanics and identify initiation and propagation of crack around stress-strain fields.
4	The standard testing procedures and assess engineering properties of construction materials.
5	The main goal of this course is to provide students with all information concerning principle, way of measurement, as well as practical application of mechanical characteristics.

Course Outcome	
After completion of syllabus student able to	
1.	Evaluate the role of materials in Civil Engineering
2.	Know the mechanical behaviour and properties of steel and concrete by standard testing procedures for identifying their performance
3.	Explain special materials, composite materials and use of new techniques in constructions for satisfying the future needs of industry.
4.	Exposure to a variety of established material testing procedures/techniques and the relevant codes of practice
5.	Evaluate and write a technical laboratory report.

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Subject Code &CO NO.												
1	2	3			2		2					3
2	2			2	2	1	2		1			2
3	2			2	2	2	3					3
4	2	3		2	2							3
5	2			3						1	2	3

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1 Introduction To Civil Engineering Materials			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Introduction and uses of cement, sand, aggregates	**01**		**1**
concrete, mortar and grouts, masonry mortars, rendering, cementations grouts	**02**		**1**
RCC, clay bricks, calcium silicate bricks, concrete blocks., rubbles, steel, mechanical properties of steel, different applications	**02**		**1**
Floor and roofing tiles, slates, timber, strength of timber, engineered wood products metals, glass for glazing, glass fibres, glass wool	**02**		**1**
Water proofing agents: any five water proofing agents, difference between wetting agents and water proof agent	**01**		**1**
	08		
Unit No.2 Basic Properties of Materials			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Importance of materials in civil engineering construction, types of materials such as ceramics, concrete, composites, optical /electronics materials, glass, metals, nano-materials, polymers and plastics, wood and other materials, comparison of strengths of various materials.	**04**		**2**
Some basic properties of materials such as temperature, energy, specific heat, thermal conductivity, coefficient of thermal expansion,	**03**		**2**

comparison for environmental impact, health and safety.			
	07		

Unit No.3 Special Materials

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Composite Materials: RCC, FRC, AAC (Autoclaved aerated concrete) blocks, WPC (Wood-plastic composites) Material, Cera sheets, 3D wall WPC panels, polymer based materials, steel/concrete composite bridge decks, fibre reinforced plastics structural insulated panels.	**03**		**3**
New Techniques in Constructions-Introduction, 3D printing, photo catalytic admixture, self-healing concrete, Biomaterials, zero cement concrete ,hemp lime, wood-glass epoxy composites, bamboo.	**04**		**3**
	07		

Unit No.4 Testing Procedures of Materials

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Material Testing, Machines and Equipment Requirements---Necessity of material testing, various testing methods, destructive tests, classification of destructive tests---static, impact and cyclic testing,non-destructive testing- its classification ,visual inspection, penetration test, ultrasonic test.	**03**		**4**
Testing Procedures for bricks, reinforcing steel, fine aggregates, coarse aggregates. Documenting the experimental program, including the test procedures, collected data, method of interpretation and final results.	**04**		**4**
	07		

Unit No.5 Testing and Evaluation Procedures of Materials

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Quality control- Use of test data/ testing reports in the material selection for various civil engineering projects /construction, Sampling, Acceptance criterion,	**04**		**5**
Code of practice and guidelines in this regards for Cements; Aggregates; Concrete (plain and reinforced); Soils; Bitumen and asphaltic materials; Timbers; Glass and Plastics; Structural Steel.	**03**		**5**
	07		

References							
Applicable for Unit No.	Name of Book	Name of Author	Name of Publisher	Edition	Category		
					Text Book	Research paper	Reference book
1,2	'Building Construction Handbook	Chudley, R., Greeno (2006),	R. Butterworth-Heinemann	(6th ed.)	√		
4	Mechanical Testing of Engineering Materials,	Kyriakos Komvopoulos (2011),	Cognella				√
1,2,4	' Highway Materials and Pavement Testing'	Khanna, S.K., Justo, C.E.G and Veeraragavan	Nem Chand & Bros,	Fifth Edition	√		
1,2,3	Mechanical Behaviour of Materials	E.N. Dowling (1993)	Prentice Hall, International Edition				√
1-5	Building Materials,Testing, and Sustainability	N. Subramania	Publisher: Oxford University Press, New Delhi				√
1-5	Related papers published in international journals					√	

List of Code/Handbook			
Applicable for Unit No.	Title of Code	Type of code	Year of Publication
	IS: 456 – code of practice for plain and reinforced concrete.		2000/2016
	IS: 2386 – methods of tests for aggregate for concrete.		1963
	10262; SP 23 – codes for designing concrete mixes.		2009/2019
	IS: 13311 – ultrasonic testing of concrete structures.		1992

	IS:1199 - Fresh Concrete – Tests		2018
	IS:3495 - Burnt Clay Bricks Tests		1992/2016
	IS:1786 –High strength deformed steel bars and wires for concrete reinforcement— specification		2008
	IS:2062 - Hot rolled medium and high tensile structural steel — specification		2011
	IS:1608 - Metallic Materials — Tensile Testing (Part 1-3)		2005/2018
	IS:1599 - Methods for bend test		2012
	American Society for Testing and Materials (ASTM),	Annual Book of ASTM Standards	(post 2000)
	BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering application		

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shirkhande,)
BOS (Civil Engg) Chairman

CIVIL ENGINEERING MATERIALS, TESTING AND EVALUATION

BTCVE503P **Evaluation Scheme: (25-Internal/25-External)**

(P-2 Hrs/Week); Total Credits- 01

Minimum Eight Practical's from the given below list should be performed

Sr. No.	Details of Topic
1	**Tests on cement (Any Two)** Field test on cement, Fineness, Normal consistency, Initial and Final Setting times, Specific gravity, Soundness, Compressive strength,
2	**Tests on fine aggregate (Any Two)** Grain size distribution, Uniformity coefficient and fineness modulus, Specific gravity, Density, Void ratio, Bulking & Absorption
3	**Tests on coarse aggregate (Any Two)** Grain size distribution, Uniformity coefficient and fineness modulus, Specific gravity, Density, Void ratio, Absorption
4	**Concrete mix Design**
5	**Test on concrete by using IS code method (Any Two)** (a) Workability test, Slump test, Compaction factor test, Flow table test, Vee-Bee Consist meter, (b) Compressive strength, Split tensile strength, Flexure test on beams, Modulus of elasticity
6	Tests on bricks Crushing strength, water absorption and efflorescence
7	Tensile and Compressive strength of materials & concrete composites
8	Tests on polymers and polymer-based materials
9	Testing on Ceramic Floor, Wall Tiles, Paver-blocks, Mosaic tiles, IS code recommendations.
10	Study of non-destructive testing of concrete (NDT)
11	Field density of bituminous roads

A.N. Dabhade)
BOS Member

(Dr. Avinash N Shirkhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week**		
Total Credit: 03	**Lecture (L): 3 Hrs**	**Tutorial/Activity (T/A): 0 Hrs.**	**Practical (P): 0 Hrs.**
Subject Code	**BTCVE504T**	**Name of Subject: Professional Practice, Law & Ethics**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15 Marks for sessional examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	The objective of this course is to inculcate the sense of social responsibility among learners and to make them realize the significance of ethics in professional environment so as to make them a global citizen

Course Outcome	
After completion of syllabus student able to	
1	Understand basic purpose of profession, professional ethics and various moral and social issues.
2	Analyse various moral issues and theories of moral development
3	Realize their roles of applying ethical principles at various professional levels
4	Identify their responsibilities for safety and risk benefit analysis.
5	understand their constructive roles in dealing various global issues

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BECVE504T1						2	2	3				1
BECVE504T2						2	2	3				1
BECVE504T3						2	2	3				1
BECVE504T4						2	2	3				1
BECVE504T5						2	2	3				1

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Human Values, Morals, values and Ethics, Integrity, Work ethics, Service learning, Civic virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage	**08**		**1**
Unit No.2			
Engineering Ethics, Senses of 'Engineering Ethics', Variety of moral issues, Moral dilemmas, Moral Autonomy, Kohlberg's theory, Gilligan's theory	**07**		**2**
Unit No.3			
Engineering as Social Experimentation, Engineering as Experimentation, Engineers as responsible Experimenters, Codes of Ethics, A Balanced Outlook on Law(Industrial Disputes Act, 1947; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017)	**07**		**3**
Unit No.4			
Safety, Responsibilities and rights, Safety and Risk, Assessment of Safety and Risk, Risk Benefit Analysis and Reducing Risk, Collective Bargaining, Professional Rights, Employee Rights	**07**		**4**

Unit No.5			
Global issues, Multinational Corporations, Computer Ethics, Weapons Development, Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors, Corporate Social Responsibility	**07**		**5**

References

Applicable for Unit No.	**Name of Book**	**Name of Author**	**Name of Publisher**	**Edition**	**Category**		
					Text Book	**Research paper**	**Reference book**
I,II,III, IV,V	Professional Ethics	R. Subramaniam	Oxford Publications, New Delhi.				Yes
	Human Values And Professional Ethics by,	Jayshree Suresh and B. S. Raghavan	S. Chand Publications				Yes
	Ethics in Engineering by–	Mike W. Martin and Roland Schinzinger	Tata McGraw-Hill – 2003.				Yes
	Human Values & Professional Ethics by,	S. B. Gogate	Vikas Publishing House Pvt. Ltd., Noida.				Yes
	Professional Ethics and Human Values	A. Alavudeen, R.Kalil Rahman, and M. Jayakumaran	University Science Press.				Yes
	Engineering Ethics & Human Values	M.Govindarajan, S.Natarajan, and V.S.SenthilKumar	PHI Learning Pvt. Ltd – 2009.				Yes

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shirkhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week**		
Total Credit: 01	**Lecture (L): 00 Hrs**	**Tutorial/Activity (T/A): 0 Hrs.**	**Practical (P): 02 Hrs.**
Subject Code	**BTCVE507P**	**Name of Subject: Industrial Training & Professional Skill Training**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
50 Marks	**50 Marks**	**50 Marks**	**--**

Course Objective	
1	The objective of the course is to give awareness of practical application of various theoretical concepts.
2	The objective of the course is to enhanced the skills by using software in the field of Civil Engineering

Course Outcome	
After completion of syllabus student able to	
1	Understand organizational skills & professional practices
2	Interpret the communication skills of organizational members with each other
3	Analyze the structural problems by using STADD.PRO
4	Design the structural members by using STADD.PRO

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BECVE507P1					3				2	2		1
BECVE507P2					3				2	2		1
BECVE507P3					3				2	2		1
BECVE507P4					3				2	2		1

1 Low 2 Medium 3 High

SYLLABUS

Part A: Industrial Training

(25 Marks Internal and 25 Marks External)

After successful completion of industrial training of 2 to 3 weeks, students have to give Industry training report including certificate of completion of industrial training.

Part B: Professional Skill Training on STADD.PRO/Any Other

(25 Marks Internal and 25 Marks External)

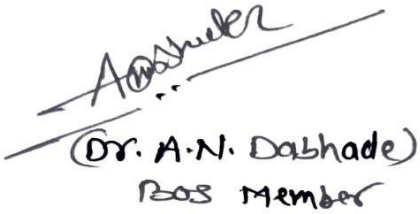
STAAD PRO is structural analysis and designing software which is used by civil engineers to analyse and design the structure. It helps to reduce the calculations of Shear Force, Bending Moment and deflection of structure.

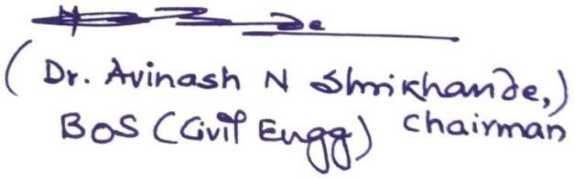
1. Practical Based on: Overview of Structural Analysis and Design, Introduction of STAAD. Pro V8i, STAAD Editor, Creating a New Project in STAAD.Pro, Units, Model Generation, Creating Nodes & Members, Select Menu, Insert Node, Add Beam, Modeling Methods, Long and Short Method Practice, Modeling Practice, Working On Examples.
2. Practical Based on: Support Specification, Member Property Specification, And Material Specification. Loading, Analyzing. Understanding Units, Working on examples, Understanding Material Properties, Understanding Various Types of Loads, and Implementing Loads.
3. Practical Based on : Performing Analysis, Pre Analysis Print, Post Analysis Print, Area Load, Floor Load.
4. Practical Based on: Wind Load Generation, Load Combination & Auto Load Combinations, Repeat Load Cases, Concrete Design.

5. Practical Based on : Concrete Column Design, Concrete Beam Design, Slab Design.

Student have to submit maximum four experiments on above contents (Selection of contents made by concern faculty) in 8 weeks.

Proposed amendment is "STAD Pro V8i or Any Other Equivalent Software may also be used for performing the same activities.





RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FACULTY OF SCIENCE & TECHNOLOGY

B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week**		
Total Credit: 00	**Lecture (L): 02 Hrs**	**Tutorial/Activity (T/A): 0 Hrs.**	**Practical (P): 0 Hrs.**
Subject Code	**BTCVE508AU**	**Name of Subject: Organizational Behaviour**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
50 Marks	**AUDIT**	**--**	**--**

Course Objective	
1	The objective of the course is to create awareness among learners about the various essential aspects of organizational processes and structure and motivation in organization.

Course Outcome	
After completion of syllabus student able to	
1	Understand the concept and importance of organizational behaviour.
2	Acquire the knowledge of interpersonal behaviour and transaction analysis
3	Know different traits and theories of personality
4	Analyze the importance of motivation in organization and types of leadership

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BECVE508AU1									3	2		1
BECVE508AU2									3	2		1
BECVE508AU3									3	2		1
BECVE508AU4									3	2		1

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1: Introduction to organizational behaviour			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Concept of organization behavior	**01**		**1**
Importance of organization behaviour	**02**		**1**
Key elements of organization behaviour	**01**		**1**
Scope of organizational behaviour.	**02**		**1**
	06		
Unit No.2: Introduction to interpersonal behavior			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Nature and meaning of interpersonal behaviour	**01**		**2**
Concept of transaction analysis	**02**		**2**
Benefits and uses of transaction analysis	**01**		**2**
Johari window model.	**02**		**2**
	06		
Unit No.3: Introduction to personality			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Definition and meaning of personality	**02**		**3**
Importance of personality	**02**		**3**
Theories of personality, personality traits.	**02**		**3**
	06		

Unit No.4 : Introduction to Motivation and leadership			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Concept and importance of motivation	**01**		**4**
Maslow's two factor theory of motivation.	**02**		**4**
Significance of motivation in organization.	**01**		**4**
Types of leadership styles	**02**		**4**
	06		

References							
Applicable for Unit No.	**Name of Book**	**Name of Author**	**Name of Publisher**	**Edition**	**Category**		
					Text Book	**Research paper**	**Reference book**
I,II, III,IV	Organizational behaviour	MN Mishra					
	The human side of organization	Michale Drafke					
	Management and Organizational behaviour	Laurie.J. Mullins					
	Organizational behaviour	K. Aaswathappa					

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shirkhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week: 3-0-0**		
Total Credit:3	**Lecture (L): 3 Hrs**	**Tutorial/Activity (T/A):0 Hrs.**	**Practical (P): 0 Hrs.**
Subject Code	**BTCVE505T**	**Name of Subject: Elective – I (Advanced Structural Analysis)**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks (15 Marks for sessional examination) (15 Marks for Activity based)	**70 Marks**	**45 Marks**	**3 Hours**

Course Objectives	
1	To provide the knowledge about strain energy methods
2	To provide the knowledge about buckling of columns and analysis of arches
3	To analyse multi-storeyed frame structures using approximate methods
4	To develop an understanding, the basic principles of the matrix method of structural analysis
5	To analyse non-prismatic structures (beams and frames) using column analogy method
6	To introduce finite element method and provide knowledge of structural dynamics

Course Outcomes	
After completion of syllabus students will be able to	
1	Compute deflections in two dimensional structures using Strain energy method
2	Understand response of long columns
3	Use the approximate method for analysis of multi-storied frame structures
4	Understand Flexibility matrix method and application of column analogy
5	Understand the concepts related to structural dynamics & finite element method

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Subject Code &CO NO.												
BECVE505T.1	3	3	3	3	3	-	-	-	-	-	-	2
BECVE505T.2	3	3	2	3	3	-	-	-	-	-	-	1
BECVE505T.3	3	3	3	3	3	-	-	-	-	-	-	1
BECVE505T.4	3	3	3	3	1	-	-	-	-	-	-	2
BECVE505T.5	3	3	2	2	3	-	-	-	-	-	-	2

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1:			
Details of Topic:	**Allotment of Hours**		**Mapped with CO Number**
	L	T/A	CO
Strain energy method as applied to the analysis of redundant frames and redundant truss up to two Degrees, Determination of deflection of trusses. Castigliano's theorems. Maxwells reciprocal theorem. Bettis theorem.	**7**		**1**
	7		
Unit No.2			
Bucking of columns: Euler's and Rankine's formula, Secant Formula Analysis of Two-Hinged Arches S.F. and normal thrust, parabolic arches.	**5**		**2**
	5		
Unit No.3			
Approximate method: Analysis of multi-stored frame, portal, cantilever and substitute frame methods. (max. three bay three storey).	**7**		**3**
	7		
Unit No.4			
Introduction to Flexibility Method up to two DOF. Analysis of Grid Member using Stiffness Method Column Analogy Method – Application to fixed beams, Stiffness and carryover factor	**9**		**4**
	9		

Unit No.5			
Introduction to structural dynamics, D' Alembert Principle, inertia force, equation of motion (free vibration), SDOF system, Damping, natural frequency, MDOF (up to 3 DOF), Mode shape and nodal frequency. Introduction to Finite Element method, basic concepts, discretization of structures, Rayleigh Ritz method for bar elements (prismatic/non-prismatic) Displacement based bar elements (prismatic/non- prismatic)	**8**		**5**
	8		

References

Applicable for Unit No.	Name of Book	Name of Author	Name of Publisher	Edition	Category		
					Text Book	Research paper	Reference book
All	Theory of Structures	Timoshenko S. P.&Young D.H.	McGraw Hill 1965	International Edition	-	-	√
All	Theory and Analysis of Structures; Vol. I & II",	Jain, O.P. & Arya, A.S.	Nemchand Brothers, Roorkee		√	-	-
	Matrix Analysis	Wear & Gear					

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shirkhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE &TECHNOLOGY
B.TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week**		
Total Credit: 3	**Lecture : 3 Hours**	**Tutorial//Activity(T/A):N.A**	**Practical(P): N.A**
Subject Code	**BTCVE505T**	**Subject:- Geo Synthetics Engineering (Elective-I)**	

Examination Scheme			
Internal Marks-	**University Marks**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks (l5 Marks for sessional Examination) (15 Marks for Activity based)	**70 Marks**	**45 Marks**	**3Hours**

Course Objective	
1	To determine the properties, functions and applications of various geosynthetic materials.
2	To impart knowledge about manufacturing methods.
3	Introduce to the students, Mechanism, improvement of Bearing capacity.
4	To impart knowledge about applications and functions of geosynthetics.
5	To design reinforced soil structures.

Course Outcome	
After completion of syllabus student able to	
1	To understand types of geosynthetics and its techniques to use properly in suitable construction site.
2	Understand the different functions of Geosynthetics .
3	Understand the applications of geosynthetics in Civil engineering field.
4	Study and identify about various reinforced soil structures.
5	Understand reinforced soil embankments.

MAPPING OF CO WITH PO

CO/ P0	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C 01	3	2	2	2	--	2	2	1	--	--	2	2
C 02	3	2	1	2	1	--	2	1	--	1	--	2
C 03	3	--	2	2	1	2	--	1	--	2	--	2
C 04	3	--	1	1	1	2	2	1	--	2	--	2
C 05	3	2	2	2	2	--	--	1	--	--	2	2
AVG.	**3**	**2**	**1.67**	**1.83**	**1.4**	**2**	**2**	**1**	**--**	**1.67**	**2**	**2**

1Low 2Medium 3High

SYLLABUS

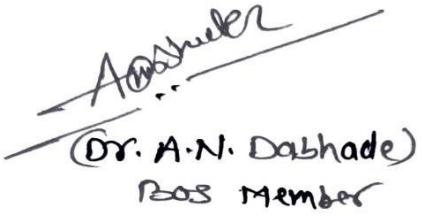
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**co**
UNIT NO.1 Properties and Laboratory Testing of Geosynthetics			
Geotextiles: Basic properties and its determination.	**01**		**1**
Determination of Hydraulic properties, Mechanical properties and its determination – Results of the tests Geotextile Interface friction evaluation –Modified Direct Shear Test, pull out test, Results of the test Survivability Characteristics – puncture test, CBR Push through test, Tear test, Diaphragm bursting Test, Cone drop	**03**		**1**
Test Durability Characteristics – Abrasion resistance Geogrid: Mechanical properties-Tension test, Geogrid-soil interaction, Geogrid Interface friction evaluation –Modified Direct Shear Test, pull out test. Range of values of important properties,	**03**		**1**
Functional Requirements of Geosynthetics, Minimum Values specified by regulatory authorities IS Code provisions	**01**		**1**
	08		
UNIT NO.2 Erosion Control and Pavement Construction			
Erosion control products, Mechanism of erosion control with reinforced vegetation, Installation of REPs on slopes, Functions of coir Geotextile, Geotextile silt fences for sediment control, silt fence installation	**03**		**2**
: Functions of Geotextile in Pavement, Advantages, U.S. forest Service Design method, Construction procedure	**03**		**2**
	06		

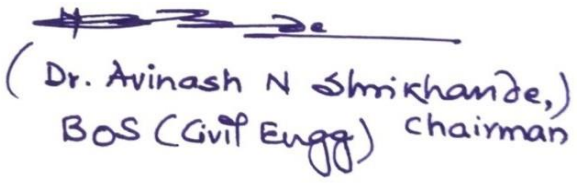
UNIT NO.3 Filtration and drainage applications & Bearing capacity improvement			
Geotextile filter mechanism, Filter criteria, Geotextile survivability, Installation of Geotextile under riprap slope protection, Geotextile chimney drains	**03**		**3**
Reinforced soil bed, Mechanism, Modes offailure (Binquet and Lee theory), Results of Experimental Investigations for optimizing the parameters of reinforced soil bed, Bearing capacity ratio and its variation with various parameters	**04**		**3**
	07		
UNIT NO.4 Reinforced retaining walls			
Applications, Advantages, Types, Components of reinforced soil wall, Types of facing units, Construction sequence of Geotextile reinforced wall and Geogrid soil wall,	**04**		**4**
Failure mechanism and Analysis of reinforced retaining wall Design of Geotextile reinforced retaining wall – General consideration, Design procedure	**03**		**4**
	07		
UNIT NO.5 Reinforced soil embankments			
Applications, Advantages	**02**		**5**
Containment systems using Geomembrane: advantages of using composite barrier for Liners and Covers, Single composite liner system for MSW landfill, Double composite liner system for HW landfil	**06**		**5**
	08		

References

Applicable for Unit No.	Name of Book	Name of Author	Name of Publisher	Edition	Category		
					Text Book	Research paper	Reference book
1,2,3	Engineering with Geosynthetics	G.V.Rao and G.V.S.S Raju	Tata-McGraw Hill Publication, New Delhi	2004	**Text Book**	-	-
1,2,3,	Ground Improvement Techniques, P	Purushothams Raj	University Science Press, 1 st Ed.	2011			
1,2,3,4,5	Geosynthetics.	J. N. Mandal,	World, New Age International Publishers Pvt. Ltd., I st Ed.,	2007			
1,2,3,4,5	Construction and Geotechnical Engineering using Synthetic Fabrics,.	R.M. Koerner and J.P. Welsh,	John Willey and Sons,	1980			
1,2,3	Designing with Geosynthetics	R.M. Koerner, 4th edition, PHI, 1997	PHI	1997			
1,2,3	Fundamentals of Geosynthetic Engineering	Sanjay Kumar Shukla and Jian-Hua Yin,	,Taylor and Francis Group UK,	2002			
4	Reinforced Soil and its Engineering Applications,	Swami Saran, 1st edition	I. K. Internationals	2006			

List of Code/Handbook			
Applicable for Unit No.	**Title of Code**	**Type of code**	**Year of Publication**
1	Indian Standard GLOSSARY OF TERMSFOR GEOSYNTHETICS PART 1 TERMS USED IN MATERIALS AND PROPERTIES	Indian Standard	Februar y 1992
2	Indian Standard GEOTEXTILES - METHODS OF TEST PART 5 DETERMINATION OF TENSILE PROPERTIES USING A WIDE WIDTH STRIP	Indian Standard	Feb rua ry 199 2





RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week**		
Total Credit:03	**Lecture (L): 3 Hrs**	**Tutorial/Activity (T/A): 3 Hrs.**	**Practical (P): Nil Hrs.**
Subject Code	**BTCVE505T**	**Name of Subject: Geo Environmental Engineering (Elective-I)**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks (15 Marks for sessional examination) (15 Marks for Activity based)	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	To create a awareness in the field of Geo-Environmental Engineering.
2	To impart the knowledge on Geotechnical aspects in the disposal of waste materials and the remediation of contaminated sites.
3	To familiarise design of landfill and know the effect of change in environment on soil properties.
4	Explain the effects of pollutants in soil properties.

Course Outcome	
After completion of syllabus student able to	
1	Deal with geo-environmental engineering problems
2	Utilize waste in Geotechnical applications
3	Design Landfill & Mange leachate and landfill gas
4	Do investigation on contaminated site and soil remediation
5	Assess variation in engineering properties of soil due to change in environment

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	2	2	1	1	-	-	-	1	1	2	2
CO 2	2	2	2	2	1	-	-	-	1	2	2	2
CO 3	2	2	2	1	1	-	-	-	1	1	2	2
CO 4	2	2	2	1	1	-	-	-	1	2	2	2
CO 5	2	2	2	1	1	-	-	-	1	1	2	2

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Introduction and Soil-water-environment interaction :	**01**		**1**
Introduction to geo-environmental Engineering,	**01**		
Soil-water-environment interaction relating to geotechnical problems,	**01**		
Waste:-source, classification and management of waste,	**01**		
Physical, chemical and geotechnical characterization of municipal solid waste,	**01**		
Impact of waste dump and its remediation	**01**		
	06		

Unit No.2			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Geotechnical application of waste and disposal:	**01**		**2**
Geotechnical use of different types such as Thermal power plant waste,	**01**		
Municipal Solid Waste, mine waste,	**01**		
Industrial waste.	**01**		
Waste disposal facilities,	**01**		

Parameters controlling the selection of site for sanitary and industrial landfill.	**01**		
Site characterization. MoEF guidelines.	**01**		
	07		

Unit No.3

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Landfill Components:Landfill layout and capacity, components of landfill and its functions.	**01**		**3**
Types and functions of liner and cover systems,.	**01**		
Compacted clay liner, selection of soil for liner, methodology of construction	**02**		
Leachate, Gas Management and Geosynthetics: Management of Leachate and gas.	**02**		
Various components of leachate collection and removal system and its design. gas disposal/utilization. Closure and post closure monitoring system,	**01**		
Geosynthetics- Geo membranes - geosynthetics clay liners -testing and design aspects.	**02**		
	09		

Unit No.4

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Soil remediation: Investigation of contaminated soil, sampling, assessment.	**02**		**4**
Transport of contaminants in saturated soil	**01**		
Remediation of contaminated soil- in-situ / exit remediation, bio remediation,	**01**		
thermal remediation, pump and treat method,	**01**		
phyto remediation and electro-kinetic remediation	**01**		
	06		

Unit No.5

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Variation in Engineering properties of soil	**02**		**5**
atterberg limit, shear strength,	**01**		
Permeability and swelling due to change in environment/pore fluid.	**02**		
	05		

References							
Applicable for Unit No.	**Name of Book**	**Name of Author**	**Name of Publisher**	**Edition**	**Category**		
					Text Book	**Research paper**	**Reference book**
1	Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies,	Hari D. Sharma, Krishna R. Reddy	John Wiley & Sons Inc.	**2004**			
2	Geoenvironmental Engineering: Principles and Applications	Reddi L.N and Inyang HI	Marcel Dekker Inc Publication	**2000**			
3	Geoenvironmental Engineering: Contaminated Soils, Pollutant Fate	R. N. Yong,	Mitigation Lewis Publication	**2000**			
4	Waste Disposal in Engineered landfills	Manoj Datta	Narosa Publishing House	**1997**			

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shrikhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE &TECHNOLOGY
B.TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total HoursDistribution per week**		
Total Credit: 3	**Lecture : 3 Hours**	**Tutorial//Activity(T/A): 0 Hrs**	**Practical(P): 0 Hrs**
Subject Code	**BTCVE505T**	**Subject: Advanced Building Materials (Elective-I)**	

Examination Scheme			
Internal Marks-	**University**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks (l5marks. for sessional Examination) (15 Marks for Activity based)	**70 Marks**	**45 Marks**	**3 Hrs**

Course Objectives	
This course will enable students to	
1	Understand composition and microstructure of various materials used in civil engineering application.
2	Understand the manufacturing and types of mortars.
3	Understand engineering behavior of various materials.
4	Understand the use of advanced materials in construction projects.
5	Understand the sustainable materials used in construction.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Understand the structural, physical and long term performance of building materials used in construction.
2	Understand special mortars and admixtures used in Civil engineering applications.
3	Understand the properties of Ceramic materials in construction projects.
4	Understand the uses of polymeric materials in construction.
5	Understand green building concept and materials.

MAPPING OF CO WITH PO

CO/ P0	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C 01	2	2	2	2	1	-	-	-	1	1	2	2
C 02	2	2	2	2	1	-	-	-	1	2	2	2
C 03	2	2	2	1	1	-	-	-	1	1	2	2
C 04	2	2	2	1	1	-	-	-	1	2	2	2
CO5	2	2	2	1	1	-	-	-	1	1	2	2
AVG.	2	2	2	1.4	1	-	-	-	1	1.4	2	2

1Low 2Medium 3High

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CONumber**
	L	**T/A**	**co**
UNIT NO.1(CONSTRUCTION MATERIALS)			
a) Classifications of Construction Materials.	**01**		**1**
b) Consideration of physical, Mechanical, thermo-physical Properties, Characteristics behaviour under stress.	**03**		**1**
c) Selection criteria for construction materials, waste products, reuse and recycling.	**03**		**1**
	07		
UNIT NO.2(MATERIALS FOR MAKING MORTAR AND CONCRETE)			
a)Lime manufacture, properties, hardening of lime, types of lime, lime concrete uses, cement, aggregates, water, characteristics, properties and uses of Pozzolana materials	**03**		**2**
b) Types of mortars, special mortars, properties and applications, admixtures	**03**		**2**
	06		

UNIT NO.3 (CERAMIC MATERIALS)			
a)Classification, Refractories, glass, glass wool.	**02**		**3**
b) Mechanical, thermal and electrical properties	**03**		**3**
c)Fire resistance materials, Uses and application.	**03**		**3**
	08		
UNIT NO.4 (POLYMERIC MATERIALS AND STEEL)			
a) Polymerization mechanism and depolymerisation.	**02**		**4**
b)Rubber and plastics, properties, effect of temperature on mechanical properties. Uses and application.	**03**		**4**
c) Types of structural steels, special steel, alloy steel, stainless steel, light gauge steel.	**02**		**4**
	07		
UNIT NO.5 (SUSTAINABLE MATERIALS)			
a)Green concepts in buildings, Green building materials ,Green building ratings IGBC and LEED manuals – mandatory requirements.	**04**		**5**
b)Rainwater harvesting &solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions.	**03**		**5**
	07		

References

Applicable for Unit No.	Name of Book	Name of Author	Name of Publisher	Edition	Category		
					Text Book	Research paper	Reference book
1&2	Engineering Materials	Rangwala S.C.	Chortor Publication	1991	**TextBook**		

3&4	Building Material	S.K Duggal	New Age International Publication	2006	**Textbook**		
5	The ideas of green building	A.K.Jain	Khanna publisher		**Textbook**		
2&3	Building Materials Technology Structural Performance & Environmental Impact	Bruntley L.R	McGraw Hill Inc	1995	**Textbook**		

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shirkhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week**		
Total Credit: 03	**Lecture (L): 3 Hrs.**	**Tutorial/Activity (T/A): 0 Hrs.**	**Practical (P): 0 Hrs.**
Subject Code	**BTCVE505T**	**Name of Subject: Ground Water Hydrology (Elective-I)**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks (15marks for sessional Examination) (15 Marks for Activity based)	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	To equip the students with capabilities required to explain groundwater occurrences, aquifer classification and aquifer properties in the many different geological environments.
2	Carrying out comprehensive hydrological flow systems analysis in groundwater systems.
3	Performing detailed groundwater balances, interpreting and working with the concepts of groundwater recharge, storage, and discharge.
4	Knowledge of the steady-state and transient groundwater flow processes and their physical description.
5	Application of analytical solutions to solve the groundwater management problems.

Course Outcome	
After completion of syllabus student able to	
1	Define groundwater and its occurrences, classify the aquifers and illustrate aquifer properties
2	Analyse the comprehensive hydrological flow systems in groundwater systems
3	Perform detailed groundwater balances, interpreting and working with the concepts of groundwater recharge, storage, and discharge
4	Interpret the steady-state and transient groundwater flow processes and their physical description
5	Solve the groundwater management problems

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P
BECVE505T CO1		3										2
BECVE505T CO2		3	3	1								2
BECVE505T CO3		2	3	1								2
BECVE505T CO4		3	2									2
BECVE505T CO5		2	1									2

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1			
Details of Topic Introduction:	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Ground water utilization & historical background, Role of groundwater in the hydrologic cycle, problems and perspectives, groundwater resources status in India, ground water budget.	**02**		**1**
Occurrence and movement of groundwater, Origin & age of ground water, rock properties affecting groundwater, groundwater column, zones of aeration & saturation	**02**		**1**
Aquifers and their characteristics/classification, groundwater basins & springs,	**02**		**1**
Darcy's Law, permeability & its determination, Dupuit's equation with assumptions, heterogeneity &anisotropy,	**02**		**1**
	08		
Unit No.2			
Details of Topic: Well Hydraulics:	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Types of wells, methods of construction, tube well design, dug wells, pumps for lifting water, working principles, power requirement,	**01**		**2**
Steady Flow, Radial flow in confined and unconfined aquifers, pumping test	**02**		**2**
Unsteady Flow, General equation, derivation; thesis method, Cooper and Jacob method, Chow's method	**02**		**2**
Leaky aquifers (only introduction), interference of well, image well theory.	**02**		**2**
	07		

Unit No.3			
Details of Topic: Surface and Subsurface investigations of Groundwater:	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Geologic methods, remote sensing, geophysical exploration,	**01**		**3**
Electrical resistivity and seismic refraction, logging techniques, test drilling & ground water level measurement	**02**		**3**
ARTIFICIAL GROUND WATER RECHARGE: Concept & methods of artificial ground water recharge,	**02**		**3**
Recharge mounds & induced recharge, wastewater recharge for reuse, water spreading.	**01**		**3**
	06		
Unit No.4			
Details of Topic: POLLUTION AND QUALITY ANALYSIS OF GROUND WATER	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Municipal /industrial /agricultural /miscellaneous sources & causes of pollution,	**02**		**4**
Attenuation/ underground distribution / potential evaluation of pollution, physical /chemical /biological analysis of ground water quality, criteria & measures of ground water quality,	**03**		**4**
Ground water salinity & samples, graphical representations of ground water quality.	**03**		**4**
Ground Water Development: Conjunctive use, necessity, techniques and economics.	**02**		**4**
	10		
Unit No.5			
Details of Topic : Modelling and Management of Groundwater:	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Ground water modelling through porous media /analog / electric analog / digital computer models,	**03**		**5**
Ground water basin management concept, hydrologic equilibrium equation, ground water basin investigations	**02**		**5**
Data collection & field work, dynamic equilibrium in natural aquifers, management potential & safe yield of aquifers, stream-aquifer interaction.	**03**		**5**
	08		

References							
Applicable for Unit No.	**Name of Book**	**Name of Author**	**Name of Publisher**	**Edition**	**Category**		
					Text Book	**Research paper**	**Reference book**
1	Ground Water	H.M. Raghunath	Wiley Eastern Publication, New Delhi		**Yes**		
2 to 5	Ground Water Hydrology	K. Todd	Wiley and Sons, New Delhi.		**Yes**		
2 to 5	Ground Water Hydrology	Bower. H.	McGraw Hill, New Delhi				**Tes**

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shirkhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week**		
Total Credit: 3	**Lecture (L): 3 Hrs**	**Tutorial/Activity (T/A): 0 Hrs**	**Practical (P) : 0 Hrs**
Subject Code:	**BTCVE505T**	**Name of Subject: Advanced Surveying (Elective-I)**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15 Marks for sessional examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	To impart knowledge of Advanced surveying methods.
2	Develop skill to use advance surveying instruments and analyse data
3	Understand different errors and elimination of errors
4	To make aware of the use of modern surveying instruments for real life problems.

Course Outcome	
After completion of syllabus student able to	
1.	Understand Remote Sensing, terms involved in Remote Sensing and its applications.
2.	Apply drone and LiDAR technology for surveying
3.	Process digital images and interpret images using different tools.
4.	Understand Geographical concepts and terminology involved in GIS and its Applications.
5.	Handle GPS and DGPS for surveying

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	3	-	-	-	-	1	-	1
CO2	3	2	2	1	3	-	-	-	-	-	-	1
CO3	2	2	2	1	2	-	-	-	-	1	-	1
CO4	3	2	2	1	3	-	-	-	-	-	-	1
CO5	3	2	2	1	3	-	-	-	-	-	-	1

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1 Remote Sensing			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Introduction and definition of remote sensing terms,remote sensing system, principles of remote sensing,	**02**		**1**
Interaction of EMR, Fundamentals of aerial photography, platforms and orbits,	**02**		**1**
Sensors,data products, principles of visual interpretation, principles and uses;	**02**		**1**
Thermal remote sensitize, microwave remote sensing.	**02**		**1**
	08		
Unit No.2 UAV Drone & LiDAR			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Types of Drone and its applications	**01**		**2**
LiDAR Techniques and its types	**02**		**2**
Application of Drone Technology for large area mapping	**02**		**2**
Generation of 3D data from Drone/LiDAR and preparation of DSM,DTM and detailed contour maps	**03**		**2**
	08		

Unit No.3 : Image Interpretation			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Principles of interpretation of aerial and satellite images,	**02**		**3**
Equipments and aids required for interpretation,	**02**		**3**
Ground truth collection and verification,advantages of multi date and multi band images,	**02**		**3**
Digital image processing; introduction, image enhancementtechniques, digital image classification.	**02**		**3**
	08		
Unit No.4 Geographic Information System (GIS)			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Geographic Information System (GIS)- Definition of GIS,Geographical concepts and terminology	**02**		**4**
Components of GIS, Data acquisition, Raster and vector formats, scanners and digitizers.	**03**		**4**
Advantages of GPS and GIS in the storage of the matic information extracted from remotely sensed image	**03**		**4**
	08		
Unit No.5 Global Positioning System (GPS) & Differential GPS			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Introduction to navigation and positioning Geodesy;	**01**		**5**
Geospatial reference systems, overview of GPS;	**01**		**5**
DGPS Techniques Post Process Kinematic and Real Time Kinematic technique.	**02**		**5**
DGPS Triangulation and closing techniques	**02**		**5**
Advance DGPS applications	**02**		**5**
	08		

References							
Applicable for Unit No.	**Name of Book**	**Name of Author**	**Name of Publisher**	**Edition**	**Category**		
					Text Book	**Research paper**	**Reference book**
I	Remote Sensing and Geographical Information Systems	M. Anji Reddy			**Y**		
I,III, IV, V	**Advanced Surveying**: Total Station, GPS,	GopiSatheesh, R.Sathikumar, N Madhu	Pearson	2017	**Y**		

	GIS & Remote Sensing						
II	Fundamentals of Capturing and Processing Drone Imagery and Data	Amy E Frazier, Kumar K Singh	**CRC Press**				**Y**
IV	Concepts and techniques of Geographic Information Systems.	- C.P LO Albert KW Yeung,	Pritince Hall of India	Edition 2002	**Y**		

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shrikhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week 3-0-0**		
Total Credit: 03	**Lecture (L): 03 Hrs**	**Tutorial/Activity (T/A): 0 Hrs.**	**Practical (P): 0 Hrs.**
Subject Code	**BTCVE506T**	**Name of Subject: Advanced Concrete Structure (Elective-II)**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15 Marks for sessional examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**04 Hours**

Course Objective	
1	To understand the design concepts and learning various codes related to advanced reinforced concrete structure.
2	To understand the structural behavior of steel and concrete.
3	To apply conventional methods for design structural components of building.

Course Outcome	
After completion of syllabus student able to	
1	Understand the behaviour and failure modes of different RC structural members
2	Analyze and apply the results in designing various RC structural members.
3	Apply the knowledge and skills in practical problems
4	Understand the relevant software and use the same in the analysis and design of RC members.

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Subject Code &CO NO.												
CO1	3	3	3	-	-	-	-	-	-	2	-	3
CO2	3	3	3	-	-	-	-	-	-	2	-	3
CO3	3	3	3	-	-	-	-	-	-	2	-	3
CO4	3	3	3	-	-	-	-	-	-	2	-	3
Avg CO	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**3**

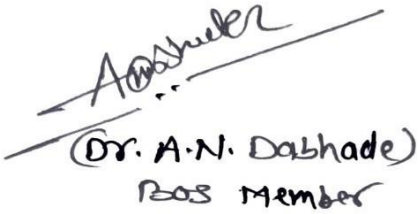
1 Low 2 Medium 3 High

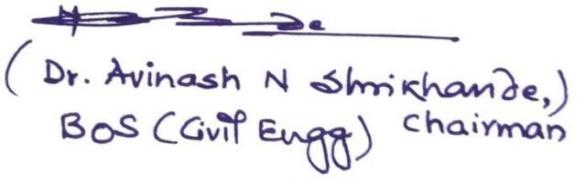
SYLLABUS

Unit No.1			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Design of RC columns subjected to biaxial moments. Design of Isolated footing, for axial load & uniaxialmoment.(square, rectangular footing)	**09**		**1**
	09		
Unit No.2			
Design of circular water tank resting on ground by IS code method (IS 3370:2021). Design of Dog-legged and Open well Staircase	**09**		**2**
	09		
Unit No.3			
Design of RCC Cantilever and Counter fort Retaining wall.	**09**		**3**
	09		
Unit No.4			
Analysis and design of portal frames (single bay single storey) hinged or fixed at base. Design of hinge connection at base Design of combined footing. Rectangular / Trapezoidal.	**09**		**4**
	09		

1. DevdasMenon, Structural Analysis, Narosa Publishing House, 2008. (ISBN: 9781842653371)
2. Hibbeler, R. C. (2002). Structural Analysis, 6/e, Pearson Education
3. Norris, C.H., Wilbur, J.B., and Utku, S., Elementary Structural Analysis, McGraw Hill
4. Wang, C.K., Intermediate Structural Analysis, McGraw Hill, 1983

List of Code/Handbook			
Applicable for Unit No.	Title of Code	Type of code	Year of Publication
All	IS 459-2000		2000
All	SP-16		





RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week**		
Total Credit: 3	**Lecture (L): 3 Hrs**	**Tutorial/Activity: 0 Hrs**	**Practical (P): 0 Hrs**
Subject Code	**BTCVE506T**	**Name of Subject: Earth Retaining Structures (Elective-II)**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks (l5 Marks. for Sessional Examination) (15 Marks for Activity based)	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	To know the in-depth knowledge of various failures mechanism related to earth retaining structures.
2	To understand the types of retaining wall, stability of retaining walls.
3	To understand sheet pile and cofferdam, method of construction and distribution of earth pressure.
4	To understand the historical failures of geotechnical structures.
5	To understand the effect of water table on slopes.

Course Outcome	
After completion of syllabus student able to	
1	Think logically for mechanism of earth retaining structures.
2	Differentiate different types of retaining wall and Understand the engineering concepts of stability of retaining walls.
3	Understand about sheet pile and cofferdam and best suitable techniques for construction.
4	Gain an experience in from historical failures of geotechnical structures.
5	Gain the knowledge of effect of water table on slopes.

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	-	-	1	1	1	1	-	-	2
CO2	2	2	2	2	-	1	1	1	1	1	2	2
CO3	3	3	2	2	1	1	1	1	2	1	1	2
CO4	3	3	2	1	-	1	1		-		-	2
CO5	1	2	2	-	-	-		-	-	-	-	2
Avg	**2.2**	**2.6**	**2**	**1.67**	**1**	**1**	**0.8**	**1**	**1.3**	`	**1.5**	**2**

1 Low 2 Medium 3 High

SYLLABUS

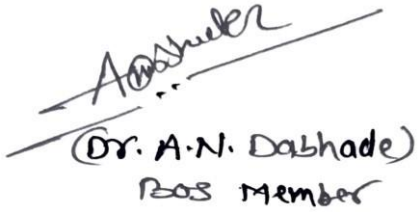
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT NO.1 Earth Pressure Theories			
Theories of earth pressure, general and local states of plastic equilibrium,	**01**		**1**
Active and Passive states in cohesive and cohesion less soil, Rankine's and Coulomb's approaches,	**03**		**1**
Effect of wall movement, uniform surcharge, wall angle, wall friction, back fill slope. Lateral pressure on wall due to concentrated construction, Culmanns method, earth pressure at rest.	**03**		**1**
Introduction to seismic design of retaining wall.	**01**		**1**
	08		
UNIT NO.2 Stability of Earth Retaining Structures			
Types of retaining wall, stability analysis of rigid type and R.C. Cantilever type retaining walls.	**03**		**2**
Introduction of Geo reinforce Wall, Gabion Wall, Soil Nailing.	**03**		**2**
	06		

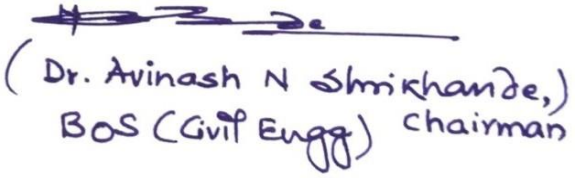
References			
UNIT NO.3 Sheet Pile and Cofferdam			
Sheet pile and cofferdam. Type, material, method of construction.	**02**		**3**
Distribution of earth pressure and related approximation. Distinction between Sheet Pile and Retaining Wall, Analysis and Design.	**05**		**3**
	07		
UNIT NO.4 Characterization of failures & Stability Of Slopes			
Historical Failures of geotechnical structures(finite and infinite slopes, high embankments such as earthen dams, tunnels, excavations, Rockfall, landslides and retaining structures etc.,)	**03**		**4**
Stability Of Slopes- Causes and types of slope failure, stability analysis of infinite slopes and finite slopes, center of critical slip circle, slices method and friction circle. Slopes with pore pressure consideration. Taylor's stability numbers & stability charts, method of improving stability of slopes.	**04**		**4**
	07		
UNIT NO.5 Effect of water table on slopes			
Effect of water table on slopes, tension cracks, Stability of earth dams during different stages-during and at end of construction.	**04**		**5**
Steady seepage, Sudden draw down, estimation of pore water pressure, Use of stability charts.	**04**		**5**
	08		

Applicable for Unit No.	Name of Book	Name of Author	Name of Publisher	Edition	Category		
					Text Book	Research paper	Reference book
1,2,3,4,5	Basic and Applied Soil Mechanics	Gopal Ranjan and Rao	New Age International Publisher	2005	Text Book		
1,2,3,4,5	Principles of Geotechnical Engineering	Das B.M.	Thomson Bksm Cengage Publication	2002	Text Book		
1,2,3,4,5	Soil Mechanics and Foundation Engineering, Vol-I	VNS Murthy	Saikripa Consultan, Banglore	1991	Text Book		
1,2,3,4,5	Foundation Engineering Handbook	Winterkon H.F. and Fang H	--				Reference Book

List of Code/Handbook			
Applicable for Unit No.	**Title of Code**	**Type of code**	**Year of Publication**
1	Indian Standard Ports And Harbours - Plasning And Design - Code Of Practice Part 2 Earth Pressures (First Revision)	Indian Standard	Reaffirmed 2005
2	Indian Standard. Retaining Wall For Hill Area - Guidelines Part 2 Design Of Retaining/Breast Walls	Indian Standard	October 1997
3	Indian Standard Safety Code For Piling And Other Deep Foundations	Indian Standard	August 1969
4	Indian Standard Selection And Development Of Site For Building In Hill Areas - Guidelines Part 2 Selection And Development.	Indian Standard	March 1995

Applicable for Unit No.	Website address
1	https://nptel.ac.in/content/storage2/courses/105101083/download/lec7.pdf
2	https://nptel.ac.in/content/storage2/courses/105101083/download/lec26.pdf
3	https://documents.pub/document/advanced-foundation-engineering nptelacin-3-chapter-5-sheet-pile-wall-51.html
4	https://nptel.ac.in/content/storage2/courses/105101001/downloads/L22.pdf
5	https://nptel.ac.in/content/storage2/courses/105101001/downloads/L22.pdf





RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week**		
Total Credit: 3	**Lecture (L): 03 Hrs**	**Tutorial/Activity (T/A): 0 Hrs.**	**Practical (P): 0 Hrs.**
Subject Code	**BTCVE506T**	**Name of Subject: Climate Change and its Mitigation (Elective-II)**	

Examination Scheme			
Internal Marks:	**Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15 Marks for sessional examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	Students should be able to get knowledge about Climate system, its changes and causes
2	Students should able to learn about Green house gases and its chemistry, sources, effects & instruments used for quantification
3	Students should able to learn about the impacts of global climate change
4	Provide the knowledge of clean technology and alternate energy sources
5	To introduce the students about the mitigation of climate change

Course Outcome	
After completion of syllabus student able to	
1	To be able to understand the problem of economics of energy – environmental interaction with respect to global climate change
2	To be in a position to analysis Green house effect
3	To be in a position to analyze impact of climate change
4	To be in a position to understand the clean technology and alternate energy sources
5	To demonstrate in producing research/project report on mitigation strategies for global climate change.

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	1	-	-	-	1	1	2	2
CO2	2	2	2	2	1	-	-	-	1	2	2	2
CO3	2	2	2	1	1	-	-	-	1	1	2	2
CO4	2	2	2	1	1	-	-	-	1	2	2	2
CO5	2	2	2	1	1	-	-	-	1	1	2	2
AVG	2	2	2	1.4	1	-	-	-	1	1.4	2	2

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1 Earth's Climate System

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Introduction to Climate Change; History and Trends of Climate	02		1
Atmosphere – weather and Climate	01		
Causes of global and regional climate change	01		
climate parameters – Temperature, Rainfall, Humidity	01		
Wind – Global ocean circulation and its effect	01		
Carbon cycle	01		
	07		

Unit No.2 Greenhouse Gases

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Introduction and effect of Carbon dioxide, methane, nitrous oxide, water vapor, ozone and chlorofluorocarbons	02		2
Chemistry of greenhouse gases	01		
Sources and sinks, their cycle in atmosphere	01		
Radiative forcing	01		
Effects on plants and animals	01		
instruments used for quantification	01		
	07		

Unit No.3 Impacts of Global Climate Change			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Impacts of Climate Change on various sectors – Agriculture, Forestry	**02**		**3**
Methods and Scenarios, changes in agricultural production	**02**		
Impact on Human Health, Industry and society	**01**		
Spread of epidemics and Risk of Irreversible Changes.	**01**		
Traditional practices to cope with climate change impacts	**01**		
	07		
Unit No.4 Waste to Energy, Clean Technologies and Greener Fuels			
Details of Topic :	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Introduction to MSW & Bio waste, Biomedical, Industrial waste, International and Regional cooperation.	**02**		**4**
Alternate Energy: Hydrogen, CBS, Bio-fuels, Solar Energy, Wind, Hydroelectric Power	**02**		
Examples of future Clean Technologies, Biodiesel, Natural Compost, Eco- Friendly Plastic	**02**		
Study of waste to energy projects	**01**		
	07		
Unit No.5 Climate Change Mitigation			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Climate change response measures: definition and evolution..	**02**		**5**
Introduction to mitigation of GHGs and stabilization scenario	**01**		
characteristics of mitigation in regional and national context	**01**		
mainstreaming climate change in development agenda	**01**		
short-term mitigation options Role of fossil fuels in climate change	**01**		
Role of Governments, industries, and individuals	**01**		
	07		

References							
Applicable for Unit No.	**Name of Book**	**Name of Author**	**Name of Publisher**	**Edition**	**Category**		
					Text Book	**Research paper**	**Reference book**
1	Essentials of the Earth's Climate System	Roger G. Barry & Eileen A. Hall-McKim	Cambridge University Press	1st	Text Book		
2,3	Climate Change and Greenhouse	Pratap Bhattacharya(Author),S	CRC Press	1st	Text Book		

	Gases Emissions	ushmitaMunda&Pradeep Kumar Dash					
2,3,4	Global Climate Change	Suruchi Singh, Pardeep Singh, S. Rangabhashiyam, K.K. Srivastava	Elsevier	1st	Text Book		
1,2,3	Implementing the climate regime	Jon Hovi, Olav Stokke and GeirUlfstein	International compliance, Earthscan	2005	Text Book		
5	Energy Systems and Sustainability: Power for a Sustainable Future	G Boylr, B Everest, J Ramage	Oxford	2003	Text Book		
6	Climate change and it's control	Dr. R.N.Patil, Dr. R.M. Dhoble, Dr. A. M. Bhamburkar	Book Rivers Publication ISBN: 978-93-5515-329-6	2022	Text Book		

List of Code/Handbook			
Applicable for Unit No.	**Title of Code**	**Type of code**	**Year of Publication**
1,2	Climate change and carbon markets : a handbook of emission reduction mechanisms, Earthscan by F. Yamin		2005.
1,2,3,4	Handbook of Climate Change and India by Navroz K. Dubash		2011
2,3,5	Handbook of Climate Change Management by Walter Leal Filho, Johannes M. Luetz&Dr.DesalegnYayehAyal published by Springer		2021

Applicable for Unit No.	Website address
1,2,3	Climate Change 2007: Impacts, Adaptation and Vulnerability, Summary for Policymakers, IPCC. Available at: http://www.ipcc.ch/SPM13apr07.pdf
4,5	Climate Change 2007: Mitigation of Climate Change, Summary for Policymakers, IPCC. Available at: http://www.ipcc.ch/SPM040507.pdf
1,2,3	Climate Change, The Physical Science Basis, IPCC. Available at: http://ipccwg1. ucar.edu/wg1/wg1-report.html

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shirkhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week**		
Total Credit: 3	**Lecture : 3 Hours**	**Tutorial//Activity (T/A): 0 Hrs**	**Practical (P): 0 Hrs**
Subject Code:-	**BTCVE506T**	**Subject: - Advanced Concrete Technology (Elective-II)**	

Examination Scheme			
Internal Marks-	**University**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(l5marks. for sessional Examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**3 Hours**

Course Objectives	
1	To know different types of cement as per their properties for different field applications, properties of Aggregates and Admixture
2	To understand the knowledge of Special Concrete To know tests on concrete in plastic and hardened stage as well as behavior of concrete structure
3	To understand Design economic concrete mix proportion for different exposure conditions and intended purpose.
4	To understand the behavior and strength of concrete structure.
5	To understand the concept of durability and testing of concrete

Course Outcomes	
After completion of syllabus, students would be able to	
1	Think logically for development Concrete technology application in field of Civil Engineering
2	Differentiate special concrete from conventional concrete Gain an experience in the implementation of Concrete Materials on Engineering concepts which are applied on Construction Fields
3.	Understand the process of mix design of concrete.
4.	Gain an experience in the implementation of Concrete Materials on Engineering concepts which are applied on Construction Fields.
5.	To Understand the various factors affecting the concrete and Advanced Non-Destructive Testing Methods.

MAPPING OF CO WITH PO

CO/ P0	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C 01	2	3	2	-	-	1	1	1	1	-	-	2
C 02	2	2	2	2	-	1	1	1	1	1	2	2
C 03	3	3	2	2	1	1	1	1	2	1	1	2
C 04	3	3	2	1	-	1	1		-		-	2
CO5	1	2	2	-	-	-		-	-	-	-	2
AVG.	2.2	2.6	2.00	1.00	0.2	0.8	0.8	0.75	1	0.5	0.75	2.00

1 Low 2 Medium 3 High

SYLLABUS

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
UNIT NO.1 INTRODUCTION TO CONCRETE			
Historical background, composition of concrete, general note on strength mechanism, recent practice and future trends	**01**		**1**
Cement - Chemical composition, hydration, heat of hydration, hydrated structure, various types of cement, grades of cement, testing, Hydration Process and Hydrated Cement Paste of blended cement, of cement as per Indian standard.	**03**		**1**
Aggregates - Utility in concrete, classification, effect of geometry & texture, strength, mechanical properties, moisture content, water absorption, bulking of sand, deleterious substances, sieve analysis,various grading and grading requirements	**03**		**1**
Water - General Requirements & limiting values of impurities	**01**		**1**
	08		
UNIT NO.2 SPECIAL CONCRETE AND CONCRETING TECHNIQUES			
a)Concrete with difference cementatious materials: fly ash, GGBS, Silica fume. b) Concrete with different Aggregates: No fines, high weight, gap graded, Recycled Aggregate,Auto clave aerated concrete.	**03**		**2**
c) Modified property: high density, high performance, ultra rapid hardening concrete, transportation concrete, Fiber reinforcement concrete. d) Techniques: RMC, Underwater concrete , Shot crete, nano concrete.	**03**		**2**
	06		

UNIT NO.3 DESIGN OF CONCRETE			
Concept of Design of concrete, Quality control (field and statistical) Indian Standard Method, Comparison with British and .American Method of Mix Design. Acceptance criteria..	**02**		**3**
Design of High Strength Concrete Mixes, Design of Light Weight Aggregate Concrete Mixes, Design of Fly Ash Cement Concrete Mixes, Design of High Density Concrete Mixes, Standards, Specifications and Code of Practice.	**05**		**3**
	07		
UNIT NO.4 BEHAVIOR AND STRENGTH OF CONCRETE			
Failure modes in concrete, type deformation stress strain relation and modulus of elasticity, Shrinkage cause, Factors Affecting and control, creep, causes, Factores influencing and effects.Effects of temperature.	**04**		**4**
Compressive strength, Tensile strength, Fatigue strength, and impact strength, Factors influencing strength of concrete..	**03**		**4**
	07		
UNIT NO.5 DURABILITY AND TESTING OF CONCRETE			
Water As An Agent Of Deterioration, Permeability Of Concrete, Classification of Causes of Concrete Deterioration, Deterioration By Surface Wear/Abrasion, Freezing And Thawing of Concrete, Alkali-Aggregate Reaction (Alkali-Silica Reaction / Alkali-Carbonate Reaction), Deterioration By Fire,Guide To Durable Concrete	**04**		**5**
Advanced Non-Destructive Testing Methods: Ground Penetration Radar, Probe Penetration, Pull Out Test, Break off Maturity Method, Stress Wave Prorogation Method, Electrical/Magnetic Methods, Nuclear Methods And Infrared Thermograph, Core Test	**04**		**5**
	08		

References

Applicable for Unit No.	Name of Book	Name of Author	Name of Publisher	Edition	Category		
					Text Book	**Research paper**	**Reference book**
1&2	Concrete Technology	MS Shetty;	S.Chand Publication New Delhi		**Text Book**		
3	Concrete Technology	PKumar Mehta,	Indian Concrete Institute		**Text Book**		
4&5	Properties Of Concrete	AM.Neville	Pearson Education		**Text Book**		
3	Concrete Technology	ML Gambhir;	Tata McGraw Hill		**Text Book**		

3	Concrete mix design for flyash and superplasticizer	Kishore kaushal	ICI bulletin	Apr-june 1997		**Researchpaper**	

List of Code/Handbook			
Applicable for Unit No.	**Title of Code**	**Type of code**	**Year of Publication**
2	IS 269-2013		**2013**
	IS 516-1959		**1959**
2	IS 1786-1985		
4	IS 3812 part 1	Specification of fly ash	
3	IS 10262 - 2009		**2009**

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shrikhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week**		
Total Credit: 03	**Lecture (L): 3 Hrs**	**Tutorial/Activity (T/A): 0 Hr.**	**Practical (P): 0 Hrs.**
Subject Code	**BTCVE506T**	**Name of Subject: Flood Control and Drainage (Elective-II)**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15marks for sessional Examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
This course will enable students to:	
1	Understand the Concept of Flood, its effect and Causes.
2	Understand various methods of Flood Mitigation
3	Understand clearly flood routine and its effect in flood management and control
4	Understand the Problems of Drainage system in urbanization and apply the knowledge in operation and maintenance of Urban drainage system.
5	Familiarize with the concepts of systems for drainage of irrigation lands.

Course Outcome	
After Studying this course, Students will be able to:	
1	Understand the role and responsibility of engineers in Flood Mitigation.
2	Understand the role and responsibility of engineers in Estimation of Design Flood
3	Learn and apply the knowledge of GIS, remote Sensing in Natural Hazard Mitigation.
4	Apply the Concept in Operation and Maintenance of Urban Drainage System.
5	Apply the knowledge of pattern of Drainage system at Irrigation area.

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BECVE506 T CO1	3	2	2									2
BECVE506 T CO2	3	2	2	2								2
BECVE506 T CO3	3	2	3									2
BECVE506 T CO4	3	2	3									2
BECVE506 T CO5	3	2	3									2

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1 Flood Engineering			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Flood Engineering: General: Introduction, Basics of floods, Natural and man-made floods, Flows in catchments, Causes of flooding, Environmental and economic losses, Flood control structures. **FLOOD HAZARD MITIGATION:** Flood management measures, Flood control strategies.	**07**		**1**
	07		

Unit No.2 ESTIMATION OF DESIGN FLOOD: & FLOOD ROUTING THROUGH RESERVOIRS AND CHANNELS			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
ESTIMATION OF DESIGN FLOOD: Introduction, Methods of design flood computations: Observation of Highest Flood, Empirical flood formulae, Flood frequency studies- Gumbel's method– Design flood and design storm	**08**		**2**

(**FLOOD ROUTING THROUGH RESERVOIRS AND CHANNELS** Flood routing through reservoirs—general, basic principles of flood routing ISD method- Modified Pulse method. Flood routing through channels – Muskingum method.			
	08		

Unit No.3 Risk Management			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Risk Management: Risk assessment, Risk reduction and management, Advanced Warning Systems: Global positioning systems, Applications of remote sensing and GIS, Role of Information Technology in natural hazard mitigation management	**07**		**3**
	07		

Unit No.4 Drainage Engineering			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Drainage Engineering: Land Drainage systems: necessity-types-surfaces and subsurface drainage-design considerations. Introduction to Drainage Problems in Different Climates: Urbanisation - Its effects and consequences for drainage. Operation and Maintenance of Urban Drainage Systems: Maintenance requirements and planning, Cleansing of sewers and drains, repair options,	**07**		**4**
	07		

Unit No.5 Patterns of drainage system			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Patterns of drainage system- Drainage criteria formulation for off season drainage, crop season drainage, salt drainage- use of steady state and unsteady state approaches in formulation. - criteria for irrigated area. –incorporation of intentional and	**07**		**5**

unavoidable losses			
	07		

Text Books:

1. S.N.Ghosh, Assitant Professor in Civil Engineering Department, IIT, Kharagpur.
2. H M Reghunath, Hydrology, New Age International (P) Limited, Publishers (1987)
3. Dr. P. Jayarami Reddy, A text book of Hydrology, Laxmi publications (2005)
4. Linsley .R.K, Kohler.M.A & Palhus.J.L, Applied Hydrology, Mc Graw Hill (1949)
5. Bhattacharya A K and Michael A M, Land Drainage Principles: Methods and Applications, Konark Publishers Pvt. Ltd., New Delhi, 2003.

Reference Book:

1. Centre for Science & Environment, Wrath of Nature: Impact of Environmental Destruction on Floods and Droughts, Centre for Science & Environment, New Delhi.
2. Beven, K. and Carling, P., (eds.), Floods: Hydrological, Sedimentological and Geomorphological Implications, British Geomorphological Research Group Symposia Series, Wiley, Chichester, 1989.
3. B.H.R.A., Hydraulic Aspects of Floods & Flood Control, B.H.R.A., England, 1983.
4. Brown, J.P., Economic Effects of Floods, Springer-Verlag, Berlin, 1972.
5. Prasad, P., Famines and Droughts: Survival Strategies, Rawat, Jaipur, 1998.
6. A.K. Schwab, K. Eschelbach, David J. Brower, Hazard Mitigation and Preparedness, John Wiley, 2007.
7. Gribbin,J.E., 2014, Introduction to Hydraulics and Hydrology with Applications for Storm water Management, Cengage
8. Mays, L.W., 2001, Storm water Collection Systems Design Handbook, McGraw Hill
9. Butler and Davis, Urban Drainage, 3rd edition, 2010
10. Irrigation and Drainage paper 24. Crop water requirement. FAO, Rome, 1977.
11. Irrigation and Drainage paper 56. Crop water requirement. FAO, Rome, 1988.

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shrikhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: V	**Total Hours Distribution per week**		
Total Credit: 3	**Lecture (L): 3Hrs**	**Tutorial/Activity (T/A): 0 hrs**	**Practical (P): 0 Hrs.**
Subject Code	**BTCVE506T**	**Name of Subject: Railway Engineering (Elective-II)**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15 Marks for sessional examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	Students should be able to explain and describe various terms in railway engineering.
2	Students should be able to explain, discriminate and design various geometric features of railway track.
3	Students should be able to define and describe the construction and maintenance steps of railway track.
4	Understand the influence of railway transportations in the society.
5	Understand the cooperation, interaction & philosophy of railway safety.

Course Outcome	
After completion of syllabus student able to	
1	Explain Components of Railway Track, different Railway Gauges
2	Design track Gradients as per given requirements
3	Discuss various Types of Track Turnouts
4	Explain Interlocking and modern signal system
5	Describe Surface Defects on Railway Track and Their Remedial Measures

MAPPING OF CO WITH PO

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 11	PO 12
Subject Code &CO												
CO1	3	3										
CO2	3	2										
CO3	3	3	2									
CO4	3	3	1									
CO5	3	2	2	1								

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1 Railways Terminology			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Railway track	**08**		**1**
Gauge			**1**
Alignment of railway lines			
Engineering surveys			
Construction of new lines,			
Tracks & track stresses			**1**
	08		
Unit No.2 Rail Terminology			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Rails, sleepers, Ballast	**08**		**2**
Subgrade and formation			**2**
Track fittings and fastenings			
Creep of rails			
Geometric design of track			**2**
Curves and super-elevation			**2**
	08		
Unit No.3 Points & Crossing			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Points and crossings	**08**		**3**
Track junctions			

Simple track layouts			**3**
Rail joints and welding of rails			**3**
Track maintenance			
Track drainage			**3**
	08		

Unit No.4 Modernization of Railway Track			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Modern methods of track maintenance	**08**		
Rehabilitation of track			**4**
Renewal of track			
Tractive resistance and power			
Railway stations			
Railway yards			
	08		

Unit No.5 Signalling & Control system			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Railway tunnelling	**08**		**5**
Signalling			
Interlocking			
Modern development in railways			**5**
Development of high speed and super high speed railway track			**5**
Maintenance of railway tracks for high speed trains			**5**
	08		

References							
Applicable for Unit No.	**Name of Book**	**Name of Author**	**Name of Publisher**	**Edition**	**Category**		
					Text Book	**Research paper**	**Reference book**
I,II,III, IV&V	Railway Engineering	Saxena and Arora, Dhanpat Rai& Sons	Dhanpat Rai& Sons	I	✓	-	
I,II,III, IV&V	Railway Engineering	S.C.Rangawala	Charotar Publishing House Pvt. Ltd.	I	✓	-	

III	Railway Tracks Engineering	J.S.Mundrey, Tata McGraw-Hill Publishing	Tata McGraw-Hill Publishing	I		-	✓

(Dr. A.N. Dabhade)
BOS Member

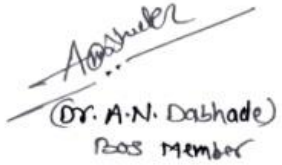
(Dr. Avinash N Shrikhande,)
BOS (Civil Engg) Chairman

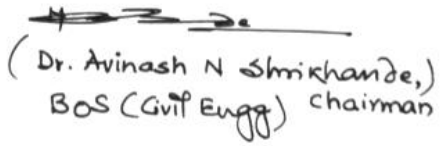
RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
SCHEME OF EXAMINATION & EVALUATION
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)
SEMESTER: SIXTH

Sr. No	Subject Code	Subject	Workload in Hours			Credit				Marks					Minimum passing marks	
										Theory		Practical		Total	Theory	Practical
			L	T/A	P	L	T	P	Total	Int	Uni	Int	Uni			
1	BTCVE601T	Estimating & Costing	3	1	0	3	1	0	4	30	70	--	--	100	45	--
2	BTCVE601P	Estimating & Costing (Practical)	0	0	2	0	0	1	1	--	--	25	25	50	--	25
3	BTCVE602T	Construction Engineering & Management	2	1	0	2	1	0	3	30	70	--	--	100	45	--
4	BTCVE603T	Water Resource Engineering	3	0	0	3	0	0	3	30	70	--	--	100	45	--
5	BTCVE604T	Elective-III	3	0	0	3	0	0	3	30	70	--	--	100	45	--
6	BTCVE605T	Open Elective-I	3	0	0	3	0	0	3	30	70	--	--	100	45	--
7	BTCVE606P	Computer Aided Civil Engineering Drawing (Practical)	0	0	2	0	0	1	1	--	--	50	50	100	--	50
TOTAL			14	2	4	14	2	2	18	150	350	75	75	650	--	--

- L- Lecture , P-Practical, T- Tutorial , A- Activity (Half Credit per Hour)

Note: In summer vacation after 6th Semester, student have to complete 3 to 4 weeks industrial / Government / NGO / MSME / Rural Internship / Innovation / Entrepreneurship training. In the beginning of 7th semester, student have to submit detailed report of summer vacation training to department.





RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: VI	**Total Hours Distribution per week**		
Total Credit: 04	**Lecture (L): 3 Hrs.**	**Tutorial/Activity (T/A): 1 Hrs.**	**Practical (P): 2 Hrs.**
Subject Code	**BTCVE601T**	**Name of Subject: Estimating and Costing**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15marks for sessional Examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**4 Hours**

Course Objective	
1	To differentiate the types of Estimation, adopt specification and Unit Rates.
2	To analyse rates for different items of works.
3	To interpret the drawings and estimate the Quantities of various items in civil engineering structures.
4	To understand departmental procedures and Take measurement of completed work On successful completion of this course.
5	To understand different techniques of preliminary & detailed estimation of buildings & roads.

Course Outcome	
After completion of syllabus student able to	
1	Prepare the preliminary estimate for administrative approval & technical sanction for a civil engineering project.
2	Write the specification of the works to be undertaken, prepare the tender documents, fill the contracts and make use of knowledge of different contract submission & opening in awarding the work to the contractor.
3.	Use the concept of SD, EMD, MAS, Running Bill, Final Bill during the entire project
4.	Use the technique of Rate analysis in estimating the exact cost of material & manpower and hence the entire project.
5.	Estimate the bill of quantities using different techniques of preliminary & detailed estimation of buildings & roads & Arrive the exact value of the asset (movable & immovable) using different Valuation techniques

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Subject Code &CO NO.												
1	2	2									1	3
2	1	2									2	
3									2		3	
4			2	3	2						2	
5	3	2									2	
6	3		2			2					2	

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1 Introduction			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Introduction: Importance and purpose of the subject, Units of measurement as per I.S.1200. Items of work and Description of items of work,,	**01**		**1**
Administrative approvals, technical sanction, preliminary estimates. objectives, and its methods	**02**		**1**
Study of Earthwork estimates in road, hill roads and canals, methods of consumptions of earthwork.	**01**		
Detailed estimates, objects, importance, accuracy. Methods of detailed estimates, Detailed estimates of load bearing and framed structures.	**04**		
	08		
Unit No.2 Calculation of steel , Tender and contracts			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Calculation of reinforcing steel with Bar bending Schedule.	**03**		
Tenders and Contracts: Method of carrying out works, tender notice, acceptance of tender, essentials of contract, type of contracts, contract documents, land acquisition act, Legal aspects of various contract provisions, Arbitration.	**03**		**2**
Public work department procedure of work: Organisation of Engineering department, Methods of carrying out works, stores, stucks, Tools and plants, Mode of payment, Public work account, Power of sanctions	**01**		**2**
	07		

Unit No.3 Specifications:			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Specifications: IS 1200 Introduction, Purpose and principles of specifications writing, Types of specifications, writing and developing	**02**		
Detailed specifications of Important items of building and road work.	**03**		
Classification of cost, direct and indirect charges, distribution of overheads, M.A.S Account, issue rates and stores account.	**02**		**3**
	07		
Unit No.4 Rate Analysis			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Introduction, Purpose and principles of CSR, Factors affecting analysis of rates, labour guidelines from National Building Organization, Task work.	**04**		**4**
Market rates of materials and labour, Rate analysis of major items of work	**03**		**4**
	07		
Unit No.5 Valuation			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Purpose of valuation, Factors affecting property price and cost, Types of Value.	**03**		**5**
Real Estate, Tenure of land, Free hold and lease hold, sinking fund, Depreciation, and its methods, Capitalised value, Methods of valuation, Net & Gross income, Rent fixation.	**04**		**5**
	07		

(Dr. A.N. Dabhade)
BoS Member

(Dr. Avinash N Shrikhande,)
BoS (Civil Engg) Chairman

ESTIMATING AND COSTING

BTCVE601P **Evaluation Scheme: (25-Internal/25-External)**

(P-2 Hrs/Week); Total Credits-01

PRACTICAL – Minimum 8 practical assignments based on

1. Preliminary estimate using Plinth area method.
2. Detailed estimate of Load bearing structure
3. Detailed estimate of Frame structure.
4. Calculation of steel with Bar bending Schedule.
5. Detailed estimate of earthwork of road for Approximate 1km length.
6. Draft Detailed specification for 8 major items.
7. Collection of four different types of Tender
8. Calculation of annual and total Depreciation and book value of the end of each year.
9. Fixation of standard rent of property.
10. Analysis the unit rate of 8 major items of work contained.
11. Market survey for material and labour rates for various items.
12. Detailed planning and estimate of plumbing work.

Note: Collection of different bank rates of nearby location, Comparative study of different units eg- Brass, foot, meter, cm, cum etc is compulsory.

References							
Applicable for Unit No.	Name of Book	Name of Author	Name of Publisher	Edition	Category		
					Text Book	Research paper	Reference book
1 to 5	Estimating and Costing	by Dutta					
1 to 5	Estimating and Costing	by Chakraborty					
5	Valuation	by Roshan Namavati					
5	Philosophy of Valuation	S. S. Rathore.					

List of Code/Handbook			
Applicable for Unit No.	Title of Code	Type of code	Year of Publication
1 to 5	Handbook for quick cost estimates. By Ball, J R		
4	IS 14835 (2000): Guidelines for Estimating Unit Rate of Items		

(Dr. A.N. Dabhade) BoS Member

(Dr. Avinash N Shirkhande,) BoS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem:VI	**Total Hours Distribution per week**		
Total Credit: 03	**Lecture (L): 02 Hrs.**	**Tutorial/Activity (T/A):01Hrs.**	**Practical (P): 00 Hrs.**
Subject Code	**BTCVE602T**	**Name of Subject:Construction Engineering and Management**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15 Marks for sessional examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**3 Hours**

Course Outcome	
After completion of syllabus student able to	
1	Get themselves acquainted with various economic and managerial aspects of construction industry
2	Understand the tools and techniques of economic analysis for improving their decision making skills
3	Analyze the structure of market and effects of inflation with special reference to construction industry.
4	Understand the importance of marketing management and its effect on construction industry.
5	Acquire financial acumen for construction business.

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BECVE602T1			2	2		1					3	1
BECVE602T2			2	2		1					3	1
BECVE602T3			2	2		1					3	1
BECVE602T4			2	2		1					3	1
BECVE602T5			2	2		1					3	1

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Importance of construction industry in economic development and economic growth of India. Construction- akey industry of India, Law of Demand, Law of supply, Laws of returns to the scale, types of costs	04	04	1

Unit No.2

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Factors of production with special reference to construction industry, Turnkeyconstructionprojects,Deprecation- its types and methods, The concept of business cycle, Affordable housing schemes by Government of India	04	04	2

Unit No.3

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Types of market structure, Monopoly, oligopoly and monopolisticcompetition, Recession,inflation and Deflation, Direct	04	04	3

Details of Topic	L	T/A	CO
and indirect taxes			
Unit No.4			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Meaning of Marketing managements, concepts of Marketing, Marketing Mix, Administrative and cost plus pricing, Channels of distribution, Advertising and sales promotion	**03**	**03**	**4**
Unit No.5			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Meaning, Nature and scope of Financial management, Sources of Finance, profit and loss account, Balance sheet, merger and acquisitions of business, Concept of stock market	**04**	**04**	**5**

References

Applicable for Unit No.	Name of Book	Name of Author	Name of Publisher	Edition	Category		
					Text Book	Research paper	Reference book
I.II,III,IV,V	Modern Economics	H.L. Ahuja					YES
	Monetary Economics	M.L. Seth					YES
	Industrial Management	I.K. Chopde, A.M. Sheikh					YES
	Business Organization and Management	S.A. Sherlekar					YES
	Modern Economic Theory	K.K. Dewett					YES

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shrikhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FACULTY OF SCIENCE & TECHNOLOGY

B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: VI	**Total Hours Distribution per week**		
Total Credit: 03	**Lecture (L): 3 Hrs**	**Tutorial/Activity (T/A): 0 Hrs.**	**Practical (P): 0 Hrs.**
Subject Code	**BTCVE603T**	**Name of Subject: Water Resource Engineering**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15 Marks for sessional examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	To describe occurrence, movement and distribution of water and to estimate water abstractions, runoff and hydrographs
2	To study the concepts of irrigation and different systems and methods of irrigation and to estimate the quantity of water required by crops.
3	To determine storage capacity of reservoir and to analyse and design earth dams
4	To analyse and design gravity dams and to study types of spillways and energy dissipators
5	To design unlined and lined channels and study the concept of other irrigation structures

Course Outcome	
After completion of syllabus student able to	
1	Understand occurrence, movement and distribution of water and estimate water abstractions, runoff and hydrographs
2	Illustrate different systems and methods of irrigation and estimate the quantity of water required by crops and estimate the quantity of water required by crops.
3	Estimate reservoir capacity and analyse and design earth dams
4	Design and analyse gravity dams and illustrate types of Spillways and energy dissipators
5	Design unlined and lined channels and illustrate concepts of other irrigation structures

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BECVE603T CO1	1	3	3	2								2
BECVE603T CO2		3	2									2
BECVE603T CO3	1	3	3	2								2
BECVE603T CO4	1	3	3	2								2
BECVE603T CO5		3	3	2								2

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1 Hydrology

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Hydrologic cycle, Water availability in India, Water balances, National Water Policy	**01**		**1**
Precipitation: Types, Measurement, Data analysis and presentation, Probable Maximum Precipitation	**02**		**1**
Evaporation and its measurement, Evapotranspiration and its measurement, Penman Monteith method, Infiltration: Horton's equation and Green Ampt method.	**02**		**1**
Concept of basin as a unit for development, Runoff: drainage basin characteristics, Estimation of runoff, Streamflow measurement	**02**		**1**
Concepts of unit hydrograph, S-curve hydrograph, Synthetic hydrograph, Stage discharge curve	**02**		**1**
	09		

Unit No.2 Water application and Irrigation methods

Details of Topic:	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Systems of Irrigation: Lift irrigation, Tank irrigation, Well irrigation,	**02**		**2**

Irrigation methods: Surface and Sub-Surface Irrigation, Sprinkler and Drip Irrigation	**02**		**2**
Duty, Delta and Base period, Computation of duty and frequency of Irrigation	**02**		**2**
Soil Moisture and Consumptive use, Irrigation water quality, Crop rotation and Irrigation assessment	**02**		**2**
	08		
Unit No.3 Reservoir and Earthen dam			
Details of Topic:	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Reservoir: Types, Investigations, Site selection, Zones of storage,	**01**		**3**
Safe yield, Reservoir storage capacity, Reservoir sedimentation and control.	**02**		**3**
Dams: Types of dams, Earth and rockfill dams, typical sections of earth and rockfill dams	**02**		**3**
Analysis and design of earthen embankments, seepage control in earth dams	**03**		**3**
	08		
Unit No.4 Gravity Dams and spillways			
Details of Topic:	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Gravity dams, overflow and non-overflow sections, Forces acting on Gravity dams	**02**		**4**
analysis and design of gravity dams, Foundation treatment in concrete dams, joints, water seals, galleries in concrete dams	**03**		**4**
Types of spillways, design of Ogee spillway,	**01**		**4**
Types of gates in spillways and types of energy dissipation below spillways	**01**		**4**
	07		

Unit No.5 (Canals and hydraulic structures)			
Details of Topic:	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Alignment of canals, canal capacity, losses, FSL of canal, Kennedy's silt theory, Lacey's regime theory, use of Garrets diagrams and Lacey's Regime diagrams	**03**		**5**
Lining of irrigation channels, design of lined canal, balancing depth, Cross section of an Irrigation channel	**02**		**5**
Water logging: Causes, surface and sub-surface drains	**01**		**5**
Introduction: hydraulic structures, storage, diversion, conveyance and distribution structures	**01**		**5**
	07		

References

Applicable for Unit No.	Name of Book	Name of Author	Name of Publisher	Edition	Category		
					Text Book	**Research paper**	**Reference book**
1	A Textbook of Hydrology	Dr. P. Jaya Rami Reddy	University Science Press		Yes		
1	Engineering Hydrology	Subramanya, K.	Tata McGraw Hill, New Delhi				Yes
2 to 5	Irrigation Water Resources and Water Power Engineering,	Modi, P.N.	Standard Book House, New Delhi		Yes		
2 to 5	Irrigation Engineering	G. S. Birdie and R. C. Das	Dhanpat Rai Publishing Company pvt. Ltd., New Delhi				Yes
2 to 5	Irrigation Engineering and Hydraulic Structures	Garg Santosh Kumar	Khanna Publishers, New Delhi.		Yes		

Applicable for Unit No.	Website address
1	http://nptel.iitm.ac.in
2 to 5	http://www.uiowa.edu
2 to 5	http://www.ngwa.org
2 to 5	http://nptel.iitm.ac.in/video.php?courseId=1029&v=XmO2pltg7YBz /m3l09.pdf
2 to 5	http://nptel.iitm.ac.in/video.php?courseId=1029&v=SO0suW7TLiCs
2 to 5	http://nptel.iitm.ac.in/courses/Webcourse contents/IIT%20Kharagpur/Water%20Resource%20Engg/pdf/m3l02.pdf
2 to 5	http://nptel.iitm.ac.in/courses/Webcourse contents/IIT%20Kharagpur/Water%20Resource%20Engg/pdf/m3l03.pdf
2 to 5	http://nptel.iitm.ac.in/courses/Webcourse contents/IIT%20Kharagpur/Water%20Resource%20Engg/pdf/m3l05.pdf
2 to 5	http://nptel.iitm.ac.in/courses/Webcourse contents/IIT%20Kharagpur/Water%20Resource%20Engg/pdf/m3l0

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shrikhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: VI	**Total Hours Distribution per week**		
Total Credit:01	**Practical (P): 2Hrs.**		
Subject Code	**BTCVE606P**	**Name of Subject: Computer Aided Civil Engineering Drawing**	
Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	
50 Marks	**50 Marks**	**50 Marks**	

List of Practical's- (Any Eight)

1. Introduction to Auto-CAD
2. Auto CAD – Basics Drawing, Editing and Dimensioning
3. Preparation of 2-D drawings using Auto CAD – Plan, Elevation, section and layout of Building. Preparation of Submission drawing for the local sanctioning authority- Residential Building.
4. Preparation of 2-D drawings using Auto CAD – Plan, Elevation, section and layout of Building. Preparation of Submission drawing for the local sanctioning authority- Public Building.
5. Preparation of 2-D drawings using Auto CAD of reinforcement detailing of Civil Engineering Structures specially foundation,slab,beam and staircase.
6. To prepare submission drawing of Bridge.
7. To prepare submission drawing of Slab and culvert.
8. To prepare submission drawing of underground water reservoir
9. 3-D drawing of residential building by using Auto CAD
10. Creation of 3 D models of simple objects and obtaining 2-D Multiview drawings by using Auto CAD.

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shrikhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: VI	**Total Hours Distribution per week 3-0-0**		
Total Credit:	**Lecture (L): 03Hrs**	**Tutorial/Activity (T/A): 0 Hrs.**	**Practical (P): 00 Hrs.**
Subject Code	**BTCVE604T**	**Name of Subject: Prestressed Concrete (Elective-III)**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15 Marks for sessional examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	To familiarize the students with concept of pre-stressed concrete.
2	To impart knowledge to design pre-stressed concrete structures.

Course Outcome	
After completion of syllabus student able to	
1	Understand the behaviour of pre-stressed concrete.
2	Design of the pre-stressed concrete structures.
3	Understand the knowledge of basic theories and fundamental behaviour of prestress concrete.
4	Perform the analysis and design of pre-stress elements.
5	Apply the fundamental knowledge to the solution of practical problems.

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Subject Code &CO NO.												
CO1	3	3	3	2	-	-	-	-	-	-	-	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3
Avg CO	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

1 Low 2 Medium 3 High

SYLLABUS

	Allotment of Hours		**Mapped with CO Number**
	L	**T/A**	**CO**
Unit No.1			
Partial pre-stressing, Analysis and design of End Blocks as per IS 1343 Method. (Only comparative study with the other methods is expected) Use of un-tensioned reinforcement. Types of pre-stressed concrete structures - Type – I, II, and III. Effect of Post-tensioning on axial Compression and tension members	**09**		**1**
	09		
Unit No.2			
Design of pre-stressed concrete Rectangular beam and one way slab by Limit state method, cable profile, Limiting zone of cable profile. Deflection of pre-stressed concrete beams (short-term, and long term) Shear and Torsional resistance of the pre-stressed concrete members, principal tension. Behavior of unbounded and bonded pre-stressed concrete beams	**09**		**2**
	09		

Unit No.3			
Composite construction of pre-stressed concrete structures and in-situ concrete, Differential shrinkage, deflection, flexural strength, serviceability (Limit state) of the composite sections. Introduction to application of pre-stressing to continuous beams, primary and secondary moment, Linear transformation and concordant cables	**09**		**3**
	09		
Unit No.4			
Flexibility Influence coefficient, Analysis of single-storey, single-bay fixed portal frame. Analysis and design of circular water tank, fixed, hinged, use of (IS-3370-2021)	**05**		**4**
	05		
Unit No.5			
Design of pre-stressed concrete poles, Special problems in pre-stressed concrete structures like corrosion, fatigue, dynamic behavior of pre-stressed concrete beams, behavior of pre-stressed concrete structures under fire.	**04**		**5**
	04		

RECOMMENDED BOOKS:

1 Pre-stressed Concrete by Dr, N. Krishna Raju

2 Pre-stressed Concrete by Dr. TY Lin

3 Pre-stressed Concrete by N. Rajgopalan, Narosa Publishing House, Mumbai, Ed. II- 2007.

4 Pre-stressed Concrete Design & Construction- Leonhardt F. Ernst Wilhelm and Sohen, Publ

List of Code/Handbook			
Applicable for Unit No.	**Title of Code**	**Type of code**	**Year of Publication**
All	**IS 1343** ***Prestress Concrete-Code of Practice***		**2012**

(Dr. Avinash N Shrikhande,)
BOS (Civil Engg) Chairman

(Dr. A.N. Dabhade)
BOS Member

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE &TECHNOLOGY
B.TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: VIth	**Total Hours Distribution per week**		
Total Credit: - 03	**Lecture : 03 Hours**	**Tutorial//Activity: 0 Hrs**	**Practical(P): 0 Hrs**
Subject Code	**BTCVE604T**	**Subject: - Soil Dynamics (Elective-III)**	

Examination Scheme			
Internal Marks-	**University Marks**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks (l5 Marks for sessional Examination) (15 Marks for Activity based)	**70 Marks**	**45 Marks**	**3Hours**

Course Objectives	
1	To enchance students knowledge in dynamic loading
2	To enchance students knowledge in theory of vibrations.
3	To know the dynamic soil Properties, to train the students in machine foundation design.
4	To know the occurrence of liquefaction and the analyzing it.
5	Learn procedure of analysis & Design of different types of Machine foundation.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Understand basics of soil dynamics, theory of vibration, propagation of body waves and surface waves through soil.
2	Understand different laboratory and field tests to determine dynamic soil properties required for design purpose
3	Understand liquefaction mechanism and evaluation of liquefaction potential studies by various tests
4	Understand the general requirements of machine foundation, and criteria for its design.
5	Understand analysis & design of different types of Machine foundation required in the field

MAPPING OF CO WITH PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	2	2	1	--	--	2	2
CO2	3	2	1	2	--	--	2	1	--	1	--	2
CO3	2	1	2	2	--	2	--	2	--	--	--	1
CO4	3	2	1	1	1	2	2	1	--	2	--	2
CO5	3	2	2	2	2	--	--	1	--	--	2	2
Avg	**2.8**	**1.8**	**1.6**	**1.6**	**1.33**	**2**	**2**	**1.2**	**--**	**1.5**	**2**	**1.8**

1 Low 2 Medium 3 High

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	**T/A**	**CO**
UNIT NO.1 Introduction to Dynamic loading			
Earthquake loading, machine vibrations, blast loading, background and lessons leant from damages in past earthquakes due to soil and ground failure,	**04**		**1**
Effect of soil properties on seismic response of structures, seismic waves and their characteristics.	**03**		**1**
	07		
UNIT NO.2 Soil Dynamics and its applications			
Fundamentals of vibrations: single, two and multiple degree of freedom systems, vibration isolation, vibration absorbers, vibration measuring instruments.	**03**		**2**
Wave propagation: elastic continuum medium, semi-infinite elastic continuum medium, soil behaviour under dynamic loading.	**04**		**2**
	07		
UNIT NO.3 Dynamic elastic constant of soil			
Stress-strain behaviour of cyclically loaded soils, effect of strain level on the dynamic soil properties, measurement of seismic response of soil at low and high strain, using laboratory tests	**03**		**3**
Cyclic triaxial, cyclic direct simple shear, resonant column, shaking table, centrifuge and using field tests - block vibration test, cross bore hole, their suitability and limitations, Interpretation of results, IS Codes	**04**		**3**
	07		
UNIT NO.4 Liquefaction of soils			
Liquefaction mechanism, factors affecting liquefaction, liquefaction of cohesionless soils and sensitive clays, liquefaction susceptibility,	**4**		**4**
Evaluation of liquefaction potential studies by dynamic tri-axial	**3**		**4**

testing, oscillatory shear box, shake table and blast tests.			
	07		
UNITNO.5 Machine Foundation			
Introduction: Types of machines, Types of machine foundations, Modes of vibrations, General requirements of machine foundation, General criteria for design, permissible amplitude	**02**		**5**
Analysis & Design of Machine foundation: Elastic homogeneous half space and lumped parameter solutions, analysis and design of foundations for reciprocating and impact type machines, turbines, effect of machine foundation on adjoining structures.	**03**		**5**
vibration isolation& control: Force isolation & motion isolation, Methods of isolation in machine foundations Isolating materials and their properties Bearing capacity of foundations: Introduction to bearing capacity of dynamically loaded foundations	**03**		**5**
	08		

References

Applicable for Unit No.	Name of Book	Name of Author	Name of Publisher	Edition	Category		
					Text Book	Research paper	Reference book
1,2,3,4,5	Advanced Soil Dynamics and Earthquake Engineering	Bharat Bhushan Prasad	PHI (1 December 2010)		Yes		
1,2,3,4,5	Fundamentals of Soil Dynamics	Braja M. Das	Elsevier, 1983				Yes

List of Code/Handbook			
Applicable for Unit No.	**Title of Code**	**Type of code**	**Year of Publication**
5	Indian Standard Code Of Practice For Design And Construction Of Machine Foundations Part 1 Foundation For Reciprocating Type Machines	Indian Standard	December 1982
1,2,3,4	Handbook of Soil Mechanics: Soil Mechanics of Earthworks, Foundations and Highway Engineering v.3 Hardcover – Import, 1 September 1988.	Elsevier Science Ltd; Revised, Subsequent edition	1 September 1988

Curtes G. Ronde

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shirkhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: VI	**Total Hours Distribution per week**		
Total Credit: 03	**Lecture (L): 03 Hrs**	**Tutorial/Activity (T/A): 00Hrs.**	**Practical (P): 00Hrs.**
Subject Code	**BTCVE604T**	**Name of Subject: Environment Management (Elective-III)**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Maximum Passing Marks:**	**Examination Duration:**
30 Marks **(15 Marks for sessional examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**3 Hours**

List of Course Objective	
1	To develop, implement, monitor and maintain environmental strategies, policies, programmes and systems that promote sustainable development.
2	To identify and understand the major environmental management systems responsible for carrying out any sustainable development.
3	To oversee the environmental performance including compliance with environmental legislation across the organization.
4	To lead the implementation of environmental policies and practices and raise awareness, at all levels of an organization, about the emerging environmental issues.
5	To coordinate all aspects of pollution control, waste management, environmental health and conservation.

List of Course Outcome	
After completion of syllabus student should be able to	
1	Identify the scientific and social aspects of environmental issues.
2	Understand the procedure of environmental impact assessment.
3	Identify and evaluate and the environmental risk assessment involved in the EMP.
4	Understand the importance of the process of Environmental Audit and vital parameters associated with it.
5	Understand the role of environmental management system in protecting the resources using environmental legislations.

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	1	1	2	3	1	2	2	1	2
CO2	3	2	3	1	1	2	3	1	2	2	1	2
CO3	3	2	3	1	1	2	3	1	2	2	1	2
CO4	3	2	3	1	1	2	3	1	2	2	1	2
CO5	3	2	3	1	1	2	3	1	2	2	1	2

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1 (Introduction)			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Introduction to Environmental Management: Objectives, Standards of living	**2**		**1**
Goals and components of Environmental Management, Socio-economic context.	**2**		**1**
Environmental Sustainability and sustainable development, issues and constraints	**2**		**1**
Environmental values and ethics	**1**		**1**
	7		
Unit No.2 (Environmental Impact Assessment)			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Environmental Impact Assessment (EIA) – Definition, History and Objective	**1**		**2**
Role, Benefits and flaws of EIA in India,	**1**		**2**
EIA Procedures	**1**		**2**
Key elements of EIA: Screening, scoping identifying and evaluating impacts	**2**		**2**
Mitigations and issuing environmental statements.	**1**		**2**
Environmental Impact Statement	**1**		**2**
	7		
Unit No.3 (Environmental Risk Analysis)			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Environmental Risk Analysis: Fundamentals of hazards, exposure & risk assessment management.	**2**		**3**
Basic Steps in risk management- hazard identification, exposure assessment & risk characterization.	**2**		**3**
Stages in the prior Environmental Clearance (EC), Process for New Projects: Screening, scoping, public consultation	**3**		**3**

Critical environmental issues and formulation of strategies of Environmental Management Plan (EMP)	**2**		**CO3**
	9		

Unit No.4(Environmental Audit)

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Environmental Audit (EA)- Concept of EA, procedural aspects of conducting environmental audit,	**2**		**4**
Environmental Management System (EMS), Life Cycle Assessment and Management (LCA),	**2**		**4**
ISO environmental standards: Introduction to ISO 1400 series, International voluntary standards	**1**		**4**
Eco marks and eco labelling: Assuring the quality.	**1**		**4**
Post Project Monitoring	**1**		**4**
	7		

Unit No.5 (Environmental legislation)

Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Environmental Policy, Law And Appraisals –various enactment and their provisions	**2**		**5**
Role of State & Central boards of pollution control	**1**		**5**
Cleaner Technology of production	**1**		**5**
Energy Impact Analysis: Energy sources, Importance of energy impact analysis	**2**		**5**
Resource Management: Mineral, Energy, Water, Renewable, Food, Land and its depletion– causes & effects, Optimization of resource utilization.	**2**		**5**
	8		

References

Applicable for Unit No.	**Name of Book**	**Name of Author**	**Name of Publisher**	**Edition**	**Category**		
					Text Book	**Research paper**	**Reference book**
Unit I	An Introduction to Environmental Management	Anand Bal	Himalaya Publishing House				
Unit II,III,IV	Environmental Impact Assessment	John Rau & Wooten	Mc Graw Hill				
Unit II,III,IV	Environmental Impact Assessment	Larry Canter	Mc Graw Hill				
Unit II,III,IV	The New Environmental Age	R.K. Sapra, S. Bhardwaj	Ashish Pub. House, New Delhi				
Unit V	Environmental Law and Policy in india, Cases, Materials And Statutes	Rosencrannz, S. Divan, M.L. Nobal	Tripathi Pvt. Ltd. Bombay.				

Unit V	Environmental Legislation of India	Gupta, K.R.,	Atlantic Publishers, 2006				

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shirkhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: VI	**Total Hours Distribution per week**		
Total Credit: 3	**Lecture (L): 3Hrs**	**Tutorial/Activity (T/A): 1 Hrs.**	**Practical (P):**
Subject Code	**BTCVE604T**	**Name of Subject: Repairs & Rehabilitation of Civil Engineering Structures (Elective- III)**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks (15marks for sessional Examination) (15 Marks for Activity based)	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	Familiarize Students with deterioration of concrete in structures
2	Equip student with concepts of NDT and evaluation
3	Understand failures and causes for failures in structures
4	Familiarize different materials and techniques for repairs
5	Understand procedure to carryout Physical evaluation of buildingsand prepare report

Course Outcome	
After completion of syllabus student able to	
1	Explain deterioration of concrete in structures
2	Carryout analysis using NDT and evaluate structures
3.	Assess failures and causes of failures in structures
4.	Carryout Physical evaluation and submit report on condition of the structure
5.	Carryout analysis of structures and take preventive action as per conditions & Requirement

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Subject Code &CO NO.												
1	2						2					3
2	2	2	3			2					2	2
3	2	2					2		2		3	2
4	2				2	2	2				2	2
5	3	2	2	2			2		1	1	2	2

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1 Deterioration of concrete in structures			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Physical processes of deterioration like Freezing and Thawing, Wetting and Drying,	**02**		**1**
Abrasion, Erosion, Pitting, Chemical processes like Carbonation, Chloride ingress, Corrosion,	**02**		**1**
Alkali aggregate reaction, Sulphate attack Acid attack, temperature and their causes,Mechanism, Effect, preventive measures. -	**02**		**1**
Cracks: Cracks in concrete, type, pattern, quantification, measurement & preventive measures.	**02**		**1**
	08		

Unit No.2 Non Destructive Testing			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Nondestructive test methods for concrete including Rebound hammer, Ultrasonic pulse velocity,	**03**		**2**
Rebar locator, Corrosion meter, Penetration resistance and Pull out test, Core cutting-	**02**		**2**
Corrosion: Methods for corrosion measurement and assessment including half-cell potential and resistivity, Mapping of data.	**02**		**2**
	07		

Unit No.3 Failure of buildings			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Definition of building failure-types of failures- Causes of Failures- Faulty Design,	**02**		**3**
Accidental over Loading, Poor quality of material and Poor Construction practices-	**02**		**3**
Fire damage - Methodology for investigation of failures-diagnostic testing methods and equipments-repair of cracks in concrete	**03**		**3**
	07		
Unit No.4 Materials for repair and rehabilitation			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Admixtures- types of admixtures- purposes of using admixtures- chemical composition- Natural admixtures- Fibres- wraps- Glass and Carbon fibre wraps- Steel Plates- Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects –	**04**		**4**
Visual investigation- Acoustical emission methods- Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull out tests.	**03**		**3**
	07		
Unit No.5 Investigation of structures &Repair Techniques			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Distress, observation and preliminary test methods. Case studies: related to rehabilitation of bridge piers, dams, canals, heritage structures, corrosion and erosion damaged structures.	**03**		**3**
Grouting, Jacketing, Shotcreting, externally bonded plates, Nailing, Underpinning and under water repair; Materials, Equipments, Precautions and Processes.	**04**		**5**
	07		

References							
Applicable for Unit No.	**Name of Book**	**Name of Author**	**Name of Publisher**	**Edition**	**Category**		
					Text Book	**Research paper**	**Refer ence book**
1 to 5	Maintenance & Repair of Civil Structures	B.L. Gupta & AmitGupta			yes		
1 to 5	Rehabilitation of Concrete Structures	B. Vidivelli	Standard Publishers		yes		
1 to 5	Concrete Bridge Practice Construction, Maintenance & Rehabilitation	V. K. Raina			yes		
1 to 5	Concrete Structures-protection Repair and Rehabilitation	R. Doodge Woodson	BH Publishers				
1 to 5	Repair and protection of concrete structures by	Noel P.Mailvaganam,	CRC Press,	1991		yes	
1 to 5	Concrete repair and maintenance Illustrated	Peter.H.Emmons,	Galgotia publications Pvt. Ltd.,	2001.			yes
1 to 5	Earthquake resistant design of structures	Pankaj Agarwal & Manish shrikande	PHI,	2006.	yes		

List of Code/Handbook			
Applicable for Unit No.	**Title of Code**	**Type of code**	**Year of Publication**
1 to 5	Handbook on repair and rehabilitation of RCC buildings	CPWD, Government of India.	
1 to 5	Handbook on seismic retrofit of buildings A. Chakrabarti et.al., Narosa PublishingHouse, 2010.		

(Dr. A.N. Dabhade) BOS Member

(Dr. Avinash N Shrikhande,) BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: VI	**Total Hours Distribution per week**		
Total Credit: 03	**Lecture (L): 3 Hrs**	**Tutorial/Activity (T/A): 0 Hrs.**	**Practical (P): 0 Hrs.**
Subject Code	**BTCVE604T**	**Name of Subject: Water Transmission and Distribution Systems (Elective-III)**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15marks for sessional Examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	To learn the concept of computation of optimal diameter of rising main based on the various cost elements involved in it
2	To estimate the storage capacity of a distribution reservoir and to discuss various components of distribution reservoir
3	To discuss various methods of analysis of a water distribution network
4	To study various criteria of planning of an optimal water distribution network
5	To know the methods of the optimal design of water distribution network and their suitability

Course Outcome	
After completion of syllabus student able to	
1	Understanding the various head loss formula used for water distribution design and also know the methodology of optimal diameter of pumping main
2	Estimation of storage capacity of a distribution reservoir and also to understand the utility of various appurtenance used in WDN
3	Understand the concepts of various methods of analysis of WDN
4	Understanding various techniques of the optimal planning of water distribution network
5	Implementation of various methods of optimal water distribution network design

MAPPING OF CO WITH PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BECVE604T CO1	3	3	3	2	2	3						
BECVE604T CO2	3	3	3	2	2	2	1					
BECVE604T CO3	3	3	3	2	2	2	1					
BECVE604T CO4	3	3	3	2	2	2	1					
BECVE604T CO5	3	3	3	2	2	2	1					

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1			
	Allotment of Hours		**Mapped with CO Number**
	L	**T/A**	**CO**
Introduction- General principle used in pipe line design, various components of water transmission and distribution systems, Head loss formula, minor losses, equivalent pipe concept	**04**		**1**
Rising main- Basic requirements, Types, diameter computation by considering various cost elements. Optimal diameter of rising main	**04**		**1**
	08		
Unit No.2			
	Allotment of Hours		**Mapped with CO Number**
	L	**T/A**	**CO**
Distribution reservoirs- impounding and service reservoirs, necessity, various storages, location and height, various component parts, capacity computation.	**03**		**2**
Design principle of water distribution system- Planning, design and analysis of WDN, component parts	**01**		**2**
Pipe appurtenances- Various valves and fittings, pumps, pressure release valve and check valves	**03**		**2**
	07		
Unit No.3			
	Allotment of Hours		**Mapped with CO Number**
	L	**T/A**	**CO**
Analysis of water distribution network- Parameter inter relationship,	**08**		**3**

formulation of equations, types of problem, Hardy cross method, Newton Raphson method, Linear theory method, Electrical analogy method, Multi reservoir system analysis			
	08		

Unit No.4

	Allotment of Hours		**Mapped with CO Number**
	L	**T/A**	**CO**
Node Flow analysis- Node Head Analysis (NHA) and Node Flow Analysis (NFA), Node classification, Node flow compatibility, NFA of serial network	**04**		**4**
Planning of an optimal network-Branching of network, selection of branches computation of first trial HGL values	**04**		**4**
	08		

Unit No.5

	Allotment of Hours		**Mapped with CO Number**
	L	**T/A**	**CO**
Design of optimal WDN- Various approaches, cost head loss ratio criterion, Linear Programming technique, introduction to non linear programming	**8**		**5**
	08		

References

Applicable for Unit No.	**Name of Book**	**Name of Author**	**Name of Publisher**	**Edition**	**Category**		
					Text Book	**Research paper**	**Reference book**
1 and 2	Analysis of Water distribution Systems	T.M.Walski	C.B.S.Publication	1984	Yes		
3	Analysis of Flow in pipe network	Jepson R.W.	Ann Arbor Science, Michigan USA	1997		Yes	
3	Analysis of Flow in pipe network	Gupta Rajesh Bhave P.R.	Narosha Publishing House New Delhi	2013	Yes		
3	Analysis of Water Distribution Network Part I	Dr. P.R.Bhave	Journal of IWWA Vol XIII No. 2	1981			Yes

	to Part III						
3	Node Flow analysis of Serial water distribution System	Dr. P.R.Bhave	Journal of IWWA Vol XII	1981			Yes
4 and 5	Non Computer Optimisation of Single source network	P.R. Bhave	Journal of Environmental Engg. Div. ASCE	1978			Yes

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shirkhande,)
BOS (Civil Engg) Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B. TECH CIVIL ENGINEERING (CHOICE BASED CREDIT SYSTEM)

Sem: VI	**Total Hours Distribution per week**		
Total Credit: 3	**Lecture (L): 3Hrs**	**Tutorial/Activity (T/A): 0hrs.**	**Practical (P): 0 Hrs.**
Subject Code	**BTCVE604T**	**Name of Subject: Urban Transportation Planning (Elective III)**	

Examination Scheme			
Internal Marks:	**University Marks:**	**Minimum Passing Marks:**	**Examination Duration:**
30 Marks **(15 Marks for sessional examination)** **(15 Marks for Activity based)**	**70 Marks**	**45 Marks**	**3 Hours**

Course Objective	
1	Students should be able to explain and describe improving transport economic efficiency for transport providers and business user
2	Students should be able to explain, generate alternatives for improving transportation system
3	Students should be able to describe the future demand and selecting the best alternative after proper evaluation
4	Improve mobility levels for the urban poor through promotion of affordable urban transport plans, programmes and technologies
5	Increase the efficiency of existing transport operations through improved planning and management of all modes of transport

Course Outcome	
After completion of syllabus student able to	
1	Explain the characteristic of urban transportation, structure of urban transportation and classification of urban roads.
2	Describe the objectives of transportation planning, data collection for planning and environmental impact analysis.
3	Explain the process of travel demand forecasting & need for interation in different modes of transportation.
4	Describe the use of intelligent Transport System and need to accommodate non-motorized transports.

MAPPING OF CO WITH PO

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 11	PO 12
Subject Code &CO												
CO1	3	3										
CO2	3	2										
CO3	3	3	2									
CO4	3	3	1									
CO5	3	2	2	1								

1 Low 2 Medium 3 High

SYLLABUS

Unit No.1 Urbanization and Transportation			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Importance of urban area	**08**		**1**
Structure of urban area			**1**
Urban design			
Use of road space			
Classification of urban roads			
	08		
Unit No.2 Urban Transportation Characteristics			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Factors influencing transportation needs	**08**		**2**
Transportation demand			**2**
Type of trips			
Mode of travel, urban transportation scene in India			
Road congestion			**2**
Impact of transport on environment			**2**
	08		
Unit No.3 Transportation Planning Process			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Urban transportation planning objectives	**08**		**3**
Urban transportation system			

Urban transportation planning process			**3**
Data collection			**3**
Surveys for data collection			
Environmental impact analysis			**3**
	08		

Unit No.4 Travel Demand Forecasting			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Trip generation and attraction analysis	**08**		
Trip distribution models			**4**
Model split analysis			
Route assignment analysis			
	08		

Unit No.5 Public Transportation, Innovations in Urban Transportation			
Details of Topic	**Allotment of Hours**		**Mapped with CO Number**
	L	**T/A**	**CO**
Bus transport characteristics, bus route planning, performance indicator	**08**		**5**
Types of rail transit, rail transit system development in Indian cities, Integrated Transport System, Modes of Integrated transport systems			
Need for innovative approaches			
Track guided bus			**5**
BRT, GIS, ITS			**5**
Functional areas of ITS			**5**

References

Applicable for Unit No.	**Name of Book**	**Name of Author**	**Name of Publisher**	**Edition**	**Category**		
					Text Book	**Research paper**	**Reference book**
I,II,III, IV&V	Traffic Engineering and Transport Planning	L R Kadiyali	Khanna	I	✓	-	
I,II,III, IV&V	Urban Transportation	D. J. Victor & S. Ponnuswamy	Tata McGraw - Hill	I	✓	-	
III	Transport Planning and Traffic engineering	C A O' Flaherty	Butter Worth-Heinemann	I		-	✓
I,II,III,	Urban	P. Anbalagan	Bookwell	I		-	✓

IV&V	Development and Sustainable Transport		Publications				
I,II,III, IV&V	Urban Transporation Planning	Michael Meyer & Eric Miller	McGraw - Hill	II		-	✓

(Dr. A.N. Dabhade)
BOS Member

(Dr. Avinash N Shirkhande,)
BOS (Civil Engg) Chairman