GALGOTIAS UNIVERSITY

Syllabus of

B.TECH

Name of School: SCHOOL OF CIVIL ENGINEERING

Department: CIVIL ENGINEERING

Year: 2018-22

Curriculum and Syllabi

B. Tech: Civil Engineering

School of Civil Engineering
JULY, 2018

Plot no-2, Sector-17A, Yamuna Expressway,Gautam Budh Nagar, UP (India) 203201
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Curriculum Plan - B. Tech. Civil Engineering

Semester 1

Sl. No.	Course Code	Course Title	L	T	P	C
1	BTCE1001	Introduction to Civil Engineering	0	0	2	1
2	BCSE1002	Computer Programming and Problem Solving	0	0	4	2
3	PSSO1001	Psychology and Sociology	2	0	0	2
4	MATH1001	Multivariable Calculus	3	0	0	3
5	MATH1002	Exploration with CAS- I	0	0	2	1
6	PHYS1001	Engineering Physics	3	0	0	3
7	PHYS1002	Engineering Physics Lab	0	0	2	1
8	CHEM1001	Engineering Chemistry	3	0	0	3
9	CHEM1003	Engineering Chemistry Lab	0	0	2	1
10	BTME1002	Product Design using Graphics	0	0	4	2
11	SLBT-1001	Basic English (Soft Skill-1)	0	0	4	2
12	JAPA1001/FREN1001/GERN1001	Japnese-I/French-I/German-I	0	0	2	1
		Total				**22**

Semester 2

Sl. No.	Course Code	Course Title	L	T	P	C
1	BEEE1002	Basic Electrical and Electronics Engineering	3	0	0	3
2	BCSE1003	Application Oriented Programming using Python	0	0	4	2
3	UHVE1001	Universal Human Values and Ethics	0	0	4	2
4	MATH1003	Matrices and Differential Equations	3	0	0	3
5	MATH1004	Exploration with CAS- II	0	0	2	1
6	PHYS1003	Physics of Materials	3	0	0	3
7	PHYS1005	Advanced Physics Lab	0	0	2	1
8	ENVS1001	Environmental Science	3	0	0	3
9	BEEE1003	Basic Electrical and Electronics Engineering Lab	0	0	2	1

10	BTME1003	Product Manufacturing	0	0	2	1
11	SLBT1002	English Proficiency and Aptitude Building-1 (Soft Skill-2)	0	0	4	2
12	JAPA1002/FREN1002/GERN1002	Japnese-II/French-II/German-II	0	0	2	1
		Total				**23**

Semester 3

Sl. No.	Course Code	Course Title	L	T	P	C
1	MATH2001	Functions of Complex Variables and Transforms	3	0	0	3
2	BTME2001	Engineering Mechanics	3	0	0	3
3	BTCE2001	Fluid Mechanics	3	0	0	3
4	BTCE2002	Surveying	3	0	0	3
5	BTCE2003	Construction Engineering	3	0	0	3
6	BTCE2004	Fluid Mechanics Lab	0	0	2	1
7	BTCE2005	Surveying Practices	0	0	2	1
8	BTCE2006	Construction Engineering Lab	0	0	2	1
9	BTCE2007	PBL-1	0	0	2	1
10	SLBT2001	English Proficiency and Aptitude Building - 2 (Soft Skill - 3)	0	0	4	2
		Total				**21**

Semester 4

Sl. No.	Course Code	Course Title	L	T	P	C
1	MATH2003	Probability and Statistics	3	0	0	3
2	BTME2002	Engineering Thermodynamics	3	0	0	3
3	UE2	Science Course (from basket)	3	0	0	3
4	BTCE2008	Mechanics of Materials	3	0	0	3
5	BTCE2009	Hydrology & Hydraulic Systems	3	0	0	3
6	BTCE2010	Water Supply & Treatment Systems	3	0	0	3
7	BTCE2011	Mechanics of Materials Lab	0	0	2	1

8	BTCE2012	Water Quality Analysis Lab	0	0	2	1
9	BTCE2013	PBL-2	0	0	2	1
10	SLBT2002	English Proficiency and Aptitude Building - 3 (Soft Skill - 4)	0	0	4	2
		Total				**23**

Semester 5

Sl. No.	Course Code	Course Title	L	T	P	C
1	MATH2002	Numerical Methods	2	0	0	2
2	BTCE3001	Structural Analysis	3	0	0	3
3	BTCE3002	Design of Reinforced Concrete Structures	3	0	0	3
4	BTCE3003	Geotechnical Engineering	3	0	0	3
5	BTCE3004	Waste Water Treatment & Disposal Systems	3	0	0	3
6	MATH2002	Numerical Methods Lab	0	0	2	1
7	BTCE3005	Structural Analysis Lab	0	0	2	1
8	BTCE3006	Geotechnical Engineering Lab	0	0	2	1
9	BTCE3007	PBL-3	0	0	2	1
10	SLBT3001	English Proficiency and Aptitude Building - 4 (Soft Skill-5)	0	0	4	2
11	BTCE3008	CAD Lab - I (AUTOCAD) (Skill Course- 1)	0	0	4	2
		Total				**22**

Semester 6

Sl. No.	Course Code	Course Title	L	T	P	C
1	UE1	Management Systems	3	0	0	3
2	UE3	Humanities Course (from basket)	3	0	0	3
3	BTCE3009	Design of Steel Structures	3	0	0	3
4	BTCE3010	Transportation Engineering	3	0	0	3
5		Program Elective (from basket) - 1	3	0	0	3
6	BTCE3011	Transportation Engineering Lab	0	0	2	1
7	SLBT3002	Campus to Corporate (Soft Skill - 6)	0	0	4	2

8	BTCE3012	PBL-4	0	0	2	1
9	BTCE3013	CAD Lab - II (STAAD PRO) (Skill Course- 2)	0	0	4	2
		Total				**21**

Semester 7

Sl. No.	Course Code	Course Title	L	T	P	C
1	UC23	Management Course (From Basket)	3	0	0	3
2		Program Elective (from basket) - 2	3	0	0	3
3		Program Elective (from basket) - 3	3	0	0	3
4		Program Elective (from basket) - 4	3	0	0	3
5		Program Elective (from basket) - 5	3	0	0	3
6	BTCE4001	Internship	0	0	0	1
7	BTCE9998	Project Work -1	0	0	6	3
		Total				**19**

Semester 8

Sl. No.	Course Code	Course Title	L	T	P	C
1	BTCE9999	Project Work -2	0	0	18	9
2	UC4	Comprehensive Examination	0	0	0	0
3	UC28	Professional Ethics and Values	0	0	0	0
		Total				**9**

PROGRAMME CORES

BTCE2001	Fluid Mechanics	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	MATH1003				
Co-requisites	--				

Course Objectives

1. Introduce concepts, laws, observations, models of fluids at rest and in motion and understanding fluid behavior for engineering design and control of fluid system.
2. Develop competence with mass, energy and momentum balances for determining resultant interactions of flows and engineered and natural systems.
3. The development of boundary layers and advancement of practical hydraulics and understanding the concept of advanced fluid mechanics.

Course Outcomes

On completion of this course, the students will be able to

1. To find frictional losses in a pipe when there is a flow between two places.
2. Calculation of conjugate depth in a flow and to analyse the model and prototype.
3. Find the dependent and independent parameters for a model of fluid flow.
4. Explain the various methods available for the boundary layer separation.

Catalog Description

Fluid mechanics including fluid statics and dynamics; conservation of mass, momentum, and energy; incompressible inviscid flow; flow of a real fluid--including laminar and turbulent flow; dimensional analysis and similitude; applications to engineering problems.

Text Books

1. R. K. Bansal (2010), A Textbook of Fluid Mechanics and Hydraulic Machines 9th Ed. Laxmi Publication, ISBN- 9788131808153.

Reference Books

1. P. N. Modi and S. M. Seth (2011), Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Publications. ISBN- 9788189401269.
2. D.S. Kumar (2004), Fluid Mechanics and Fluid Power Engineering, Katson Publishing House, ISBN - 9788185749181.
3. V.L. Streeter, (2001), Fluid Mechanics, McGraw Hill Book Co. ISBN – 9780071156004.

COURSE CONTENT

Unit I: Fluid Properties and Hydrostatics **9 lecture hours**

Density – Viscosity – Surface tension – compressibility – capillarity – Hydrostatic forces on plane – inclined and curved surfaces – buoyancy – centre of buoyancy – metacentre.

Unit II: Fluid Dynamics **10 lecture hours**

Control volume – Fluid Kinematics - Types of flows; Steady flow, Unsteady flow, Uniform and Non Uniform flow, Rotational flow, Irrotational flow, 1-D, 2-D, 3-D flows– Streamline and Velocity potential lines- Euler and Bernoulli's equations and their applications – moment of momentum – Momentum and Energy correction factors – Impulse – Momentum equation-Navier-Stokes Equations-Applications.

Unit III: Open Channel Flow **10 lecture hours**

Flow through pipes – Open Channels and Measurement pipe flow: Darcy's law – Minor losses – Multi reservoir problems – pipe network design – Moody's diagram – Hagen Poiseuille equation – Turbulent flow. Specific Energy – Critical flow concept – specific force – Hydraulic jump – uniform flow and gradually varying flow concepts. – Measurement of pressure – flow – velocity through pipes and open channels.

Unit IV: Dimensional Analysis **7 lecture hours**

Dimensional homogeneity – Raleigh and Buckingham π theorems – Non-dimensional numbers – Model laws and distorted models-Module quantities-Specific quantities

Unit V: Boundary layers **9 lecture hours**

Boundary layers – Laminar flow and Turbulent flow – Boundary layer thickness – momentum – Integral equation – Drag and lift-Separation of boundary layer-Methods of separation of boundary layer.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	To find frictional losses in a pipe when there is a flow between two places.	1
2	Calculation of conjugate depth in a flow and to analyse the model and prototype.	1, 2, 12
3	Find the dependent and independent parameters for a model of fluid flow.	1, 2, 9
4	Explain the various methods available for the boundary layer separation.	1, 2, 10

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE2001	Fluid Mechanics	2	2							2	1		1

1=addressed to small extent
2= addressed significantly
3=major part of course

BTCE2002	Surveying	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	--				
Co-requisites	--				

Course Objectives

1. To teach the students basics of surveying and expose different techniques of surveying.
2. To help the students to learn the field applicability of the different survey methods.
3. To teach students about types of errors encountered in different types of surveying.

Course Outcomes

On completion of this course, the students will be able to

1. Learn about basics involved in different types of surveying like tape, compass, leveling, and theodolite (total station).
2. Demonstrate skills in performing measurement of distance, angles, leveling, and curve setting.
3. Develop skills for estimating distance between given points, area of a given plot and earthwork involved in cuttings and fillings.
4. Develop skill to carry out tachometry, geodetic surveying wherever situation demands.
5. Develop skills to apply error adjustment to the recorded reading to get an accurate surveying output.

Catalog Description

Surveying is the most useful and necessary part in Civil Engineering. In the present curriculum the following topics are discussed. Introduction to the care and use of optical surveying instruments, Transits, Total Stations and Auto Levels, use of cloth tapes, steel tapes and electronic distance machines, reduction of slope measurements to horizontal and vertical components, Measurement, field data reduction and adjustment of a closed traverse, Horizontal and Vertical curves, earthwork, and coordinates, Extensive field work, field notes and electronic data collection, introduction to geodetic surveying and Triangulation surveying.

Text Books

1. Punmia B.C. (2005), Surveying, Volume 1, 16th Edition Laxmi Publications. ISBN: 9788170080794
2. Punmia B.C. (2005), Surveying, Volume 2, 15th Edition Laxmi Publications. ISBN: 9788170080800
3. Satheesh Gopi (2010), GPS Principles and Applications, Tata Mc Graw Hill publishing company Ltd. ISBN: 9780070141704

Reference Books

1. Subramaniyan R. (2010), Surveying and Levelling, Oxford University Press. ISBN: 9780195684247.
2. Kanetkar T.P. (2006), Surveying and Levelling, Vol I, Pune. ISBN: 9788185825113.
3. Kanetkar T.P. (2008), Surveying and Levelling, Vol II, Pune. ISBN: 9788185825007

Course Content

Unit I: Plane Surveying and Theodolite **10 lecture hours**

Introduction to plane surveying, conventional tape measurement, electronic distance measurement – Meridians, Azimuths and bearings – Theodolites – Temporary and permanent adjustment – Horizontal and Vertical angle measurements – Electronic total station.

Unit II: Leveling and Contouring **9 lecture hours**

Differential levelling, Longitudinal & cross section leveling, Refraction & curvature correction, Reciprocal leveling -Tachometry – Stadia tachometry, tangential tachometry & substance tachometry- Contouring.

Unit III: Calculation of Earthwork and GPS **9 lecture hours**

Area, volume calculation of earth work – Introduction to Global positioning system – GPS surveying methods.

Unit IV: Curve Surveying **7 lecture hours**

Definitions, designation of curve, elements of simple curve - Settings of simple circular curve, Compound and reverse curve- Transition curve – Introduction to vertical curves.

Unit V: Geodetic surveying **10 lecture hours**

Introduction to geodetic surveying, Triangulation surveying – Base line measurement & correction, Satellite station. Surveying adjustments – Principle of least square and adjustment of triangulation network.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Learn about basics involved in different types of surveying like tape, compass, leveling, and theodolite (total station).	**1**
2	Demonstrate skills in performing measurement of distance, angles, leveling, and curve setting.	**1, 2, 5**
3	Develop skills for estimating distance between given points, area of a given plot and earthwork involved in cuttings and fillings.	**1, 2, 5**
4	Develop skill to carry out tachometry, geodetic surveying wherever situation demands.	**1, 2, 5, 6, 9, 10**
5	Develop skills to apply error adjustment to the recorded reading to get an accurate surveying output.	**2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE2002	Surveying	2	3			3	2			2	2		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE2003	Construction Engineering	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	--				
Co-requisites	--				

Course Objectives

1. To know different types of modern construction materials and their uses.
2. To know different types of cement, mineral and chemical admixtures, aggregates and their Engineering properties and uses.
3. To understand the properties and application of various special concretes.
4. To know the methodology of mix design and their application in accordance with various field conditions.

Course Outcomes

On completion of this course, the students will be able to

1. Develop ability to choose the modern construction materials appropriate to the climate and functional aspects of the buildings.
2. Supervise the construction technique to be followed in brick and stone masonry, concreting, flooring, roofing and plastering etc.
3. Understand the properties of cement and its laboratory testing methods.
4. Determine quality of fine aggregate and course aggregate.
5. Learn about the different properties of concrete.

Catalogue Description

The construction of buildings and structures relies on having a thorough understanding of building materials. Without this knowledge it would not be possible to build safe, efficient and long-lasting buildings, structures and dwellings. This course provides an over-view of the basic properties of wide range of building material available to civil engineers for various usages. Students also learn the standard testing procedures of engineering materials as per provision of various IS Codes. Besides this students also learn about various bonds used for construction of brick and stone masonry widely, plastering, damp proofing its requirements and methods used in construction, need and significance of ventilation, methods of insulation, construction equipment used. Last module of course introduces students to repairs and rehabilitation of structures, crack pattern, causes of deterioration of structures, assessment of damages and methods employed for repairs and restoration. Upon completion, students should be able to demonstrate relevant BIS testing procedure to be carried out to ascertain the quality of building materials, able to choose the modern construction materials appropriate to the climate and functional aspects of the buildings, supervise the construction techniques to be followed in brick and stone masonry, concreting, flooring, roofing, plastering, damp proofing etc.

Text Books

1. Shetty, M.S. (2010), Concrete Technology, S. Chand & Company Ltd. ISBN-9788121900034.
2. IS: 10262-2009, Guidelines for concrete mix design proportioning, BIS, New Delhi.

Reference Books

1. Neville. A.M. (2010) Specification of Properties of Concrete, Standard Publishers Distributors. ISBN- 9780273755807
2. Gambhir, M. L. (2012), Concrete Technology, McGraw- Hill. ISBN- 9780070151369.

Course Content

Unit I: Properties of Construction Materials **9 lecture hours**

Physical and Mechanical properties of construction materials – Bricks - Stones - Structural Steel and Aluminum – Roofing Material – Physical descriptions of asbestos sheets, GI sheets, tubes and light weight roofing materials - Timber and its Products – Modern materials – Neoprene - Thermo Cole - Vinyl flooring - decorative panels and laminates - anodized aluminum - architectural glass and ceramics - Ferro cement – PVC - Polymer base materials and FRP.

Unit II: Construction Technology **9 lecture hours**

Introduction to Masonry design, Principles of construction– Bonding – Reinforced brick work — Stone masonry – Hollow block masonry - Pointing - Plastering – DPC Floor and Roof Construction: Floors, General Principles – Types of floors – Floor coverings – Types of roofs.

Unit III: Properties of cement **9 lecture hours**

ASTM classification of Cement – Properties of Cement - Testing of Cement – Field Testing – Laboratory Testing methods – Setting time of cement – soundness of cement – fineness and compressive strength of cement - Heat of Hydration.

Unit IV: Fine Aggregate and Coarse Aggregate **9 lecture hours**

Fine aggregate – Properties and testing methods – Bulking of Sand – sieve analysis – fineness modulus of sand - Cement mortar – properties and uses, Chemical Admixtures- Plasticizer – super plasticizer – air entraining agents etc.

Unit V: Properties of Concrete **9 lecture hours**

Concrete – selection of materials for concrete - water cement ratio - Properties of fresh concrete - workability – measurement of workability – Strength of concrete – gain of strength with age – testing of hardened concrete - Compressive strength - Tensile strength – Flexural strength – modulus of elasticity of concrete – Introduction to Mix Design of concrete.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	Theory	
	Internal	SEE
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and Pos		
Sl. No.	Course Outcomes (COs)	Mapped Programme Outcomes
1	Identify the suitability of materials for the construction works.	3
2	Know the various properties of concrete and methods for their testing.	5
3	Design the concrete mix by various method incorporating actual site conditions.	3
4	Understand the importance of various concrete properties and types of concrete on sustainability.	7

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct and investigation of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE2003	Construction Engineering			3		2		2					

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE2004	Fluid Mechanics Lab	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites	BTCE2001				
Co-requisites	--				

Course Objectives

1. Introduce concepts, laws, observations, models of fluids at rest and in motion and understanding fluid behavior for engineering design and control of fluid system.
2. Develop competence with mass, energy and momentum balances for determining resultant interactions of flows and engineered and natural systems.
3. The development of boundary layers and advancement of practical hydraulics and understanding the concept of advanced fluid mechanics.

Course Outcomes

On completion of this course, the students will be able to

1. To find frictional losses in a pipe when there is a flow between two places.
2. Calculation of conjugate depth in a flow and to analyse the model and prototype.
3. Find the dependent and independent parameters for a model of fluid flow.
4. Explain the various methods available for the boundary layer separation.

Catalog Description

Fluid mechanics including fluid statics and dynamics; conservation of mass, momentum, and energy; incompressible inviscid flow; flow of a real fluid--including laminar and turbulent flow; dimensional analysis and similitude; applications to engineering problems.

Text Books

1. R. K. Bansal (2010), A Textbook of Fluid Mechanics and Hydraulic Machines 9th Ed. Laxmi Publication, ISBN- 9788131808153.

Reference Books

1. P. N. Modi and S. M. Seth (2011), Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Publications. ISBN- 9788189401269.
2. D.S. Kumar (2004), Fluid Mechanics and Fluid Power Engineering, Katson Publishing House, ISBN - 9788185749181.
3. V.L. Streeter, (2001), Fluid Mechanics, McGraw Hill Book Co. ISBN – 9780071156004.

COURSE CONTENT

1. Verification of Bernoullis Theorem
2. Metacentric Height
3. Calibration of V- Notch
4. Calibration of Rectangular Notch

5. Calibration of Trapezoidal Notch
6. Calibration of Venturimeter
7. Calibration of Orificemeter
8. Losses in Pipes

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**		**laboratory**
	Internal	**SEE**	
Marks	50	50	
Total Marks	100		

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and Pos		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	To find frictional losses in a pipe when there is a flow between two places.	**1, 2**
2	Calculation of conjugate depth in a flow and to analyse the model and prototype.	**1, 9**
3	Find the dependent and independent parameters for a model of fluid flow.	**1, 2, 3, 10**
4	Explain the various methods available for the boundary layer separation.	**1, 2, 3, 9, 10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE2004	Fluid Mechanics Lab	2	1	1						2	1		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE2005	Surveying Practices	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites	**BTCE2002**				
Co-requisites	--				

Course Objectives

1. To teach the students basics of surveying and expose different techniques of surveying.
2. To help the students to learn the field applicability of the different survey methods.
3. To teach students about types of errors encountered in different types of surveying.

Course Outcomes

On completion of this course, the students will be able to

1. Learn about basics involved in different types of surveying like tape, compass, leveling, and theodolite (total station).
2. Demonstrate skills in performing measurement of distance, angles, leveling, and curve setting.
3. Develop skills for estimating distance between given points, area of a given plot and earthwork involved in cuttings and fillings.
4. Develop skill to carry out tachometry, geodetic surveying wherever situation demands.
5. Develop skills to apply error adjustment to the recorded reading to get an accurate surveying output.

Catalog Description

Surveying is the most useful and necessary part in Civil Engineering. In the present curriculum the following topics are discussed. Introduction to the care and use of optical surveying instruments, Transits, Total Stations and Auto Levels, use of cloth tapes, steel tapes and electronic distance machines, reduction of slope measurements to horizontal and vertical components, Measurement, field data reduction and adjustment of a closed traverse, Horizontal and Vertical curves, earthwork, and coordinates, Extensive field work, field notes and electronic data collection, introduction to geodetic surveying and Triangulation surveying.

Text Books

1. Punmia B.C. (2005), Surveying, Volume 1, 16th Edition Laxmi Publications. ISBN: 9788170080794
2. Punmia B.C. (2005), Surveying, Volume 2, 15th Edition Laxmi Publications. ISBN: 9788170080800
3. Satheesh Gopi (2010), GPS Principles and Applications, Tata Mc Graw Hill publishing company Ltd. ISBN: 9780070141704

Reference Books

1. Subramaniyan R. (2010), Surveying and Levelling, Oxford University Press. ISBN: 9780195684247.
2. Kanetkar T.P. (2006), Surveying and Levelling, Vol I, Pune. ISBN: 9788185825113.

3. Kanetkar T.P. (2008), Surveying and Levelling, Vol II, Pune. ISBN: 9788185825007

List of Experiments

1. Chain Survey- Determination of area by perpendicular offsets
2. Chain Survey- Measurement of distance by chaining & ranging
3. Compass Survey- Plotting & adjustment of closed traverse
4. Theodolite Survey- Measurement of horizontal angles by method of repetition
5. Measurement of Vertical Angles and Determination of Height of an Object
6. Plane Table Survey- Radiation method
7. Levelling- Rise & Fall method
8. Levelling- Height of collimation method
9. Trignometrical Levelling- Single plane method
10. Curve Surveying- Setting out a simple circular curve by Rankine's method
11. Contouring- To determine the contours for a given location
12. GPS Survey- Coordinates & Distance measurement using GPS
13. Total Station- Measurement of Altitude of Given Elevated Points
14. Total Station- Measurement of distance & coordinates of given points
15. Stereoscope- Use of stereoscope for 3D viewing
16. Stereoscope- Determination of height of objects from a stereo pair using the parallax bar

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Learn about basics involved in different types of surveying like tape, compass, leveling, and theodolite (total station).	**1**
2	Demonstrate skills in performing measurement of distance, angles, leveling, and curve setting.	**1, 2, 5**
3	Develop skills for estimating distance between given points, area of a given plot and earthwork involved in cuttings and fillings.	**1, 2, 5**
4	Develop skill to carry out tachometry, geodetic surveying wherever situation demands.	**1, 2, 5, 6, 9, 10**
5	Develop skills to apply error adjustment to the recorded reading to get an accurate surveying output.	**2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE2005	Surveying Practices	2	3			3	2			2	2		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE2006	Construction Engineering Lab	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites	**BTCE2003**				
Co-requisites	--				

Course Objectives

1. To know the concept and procedure of different type of test conducted on cement, aggregate and concrete.
2. To understand the properties of different building materials and their Civil Engineering Significance.
3. To understand the IS Code provision of testing different types of building materials.

Course Outcomes

On completion of this course, the students will be able to

1. Identify the suitability of materials for construction work.
2. Perform different test conducted on cement, aggregate and concrete as per relevant Codal provision.
3. Demonstrate the relevant BIS testing procedure to be carried out to ascertain the quality of building materials.

Catalogue Description

The construction of buildings and structures relies on having a thorough understanding of building materials. Without this knowledge it would not be possible to build safe, efficient and long-lasting buildings, structures and dwellings. This course provides an over-view of the basic properties of wide range of building material available to civil engineers for various usages. Students also learn the standard testing procedures of engineering materials as per provision of various IS Codes.

Text Books

1. Rangwala, (2011), *Engineering Materials*, 38th edition, Charotar Publishing House Pvt. Ltd. ISBN: 978-93-80358-26-0.
2. Ashok Kumar Jain, Dr. B.C. Punmia, Arun Kumar Jain (2009), *Building Construction*, Laxmi Publications Pvt. Ltd, ISBN: 978-81-318-0428-5.
3. M. L. Gambhir, (2009), *Concrete Technology*, Tata McGraw Hill Education, ISBN: 978-00-701-5136-9.
4. P. C. Varghese, (2009), Engineering Materials, 1st edition, PHI Learning, ISBN: 978-81-203-2848-8.

Reference Books

1. S. K. Duggal, (2008), *Building Materials*, 3rd Edition, New Age International Publishers, ISBN: 978-81-224-2392-1

2. Sushil Kumar (2010), *Building Construction*, Standard Publishers Distributors, ISBN: 978-81-801-4168-3.
3. M. S. Shetty, (2009), *ConcreteTechnology: Theory and Practice*, S.Chand Publishers, ISBN: 978-81-219-0003-4
4. A. R. Santhakumar (2006), *Concrete Technology*, Oxford University Press, ISBN: 978-01-956-7153-7

List of Experiments

1. To determine the water content required producing a cement paste of normal consistency and also determining initial and final setting time of a given cement sample.
2. To determine the fineness of cement by Blain air permeability apparatus.
3. To determine the specific gravity of given sample of OPC.
4. To determine the particle size distribution of fine and coarse aggregate by sieve analysis method.
5. Determination of specific gravity of coarse and fine aggregate.
6. To determine the silt content in the given sample of fine aggregate and also determine necessary adjustment for the bulking of fine aggregate and draw curve between water content and bulking.
7. To determine the consistency of the concrete mixes for different W/C ratio by slump test with and without admixture.
8. To determine the workability of concrete mix of given proportion by compaction factor test.
9. To cast concrete cubes and to determine compressive strength of concrete by non-destructive and destructive method of testing.

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Identify the suitability of materials for construction work.	**1, 3**
2	Perform different test conducted on cement, aggregate and concrete as per relevant Codal provision.	**4, 5, 9, 10**
3	Demonstrate the relevant BIS testing procedure to be carried out to ascertain the quality of building materials.	**1, 4, 5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE2006	Construction Engineering Lab	2		2	1	1				2	1		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE2007	PBL-1	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites	**BTCE2002, BTCE2003**				
Co-requisites	--				

Course Objectives

1. To supplement the theoretical knowledge with project based learning.
2. To enable students to have a clear understanding in the courses.
3. To equip students with more technical knowledge and practical exposure.

Course Outcomes

On completion of this course, the students will be able to:

1. Compare between chain survey, compass survey and theodolite survey.
2. Understand GPS survey.
3. Survey any area by Total Station.
4. Understand high performance concrete and self compacting concrete.
5. Carry out Mix Design for preparing M40 grade of concrete.

Catalogue Description

Project based learning (PBL) is a teaching/learning technique in which students learn the courses by doing projects works in the related area. Although students do a major project in the last semester to apply their broad learning concept in real life world, the PBL gives them extra opportunity to apply concept in project `development to have experience in 'learning by doing'

Text Books

1. Punmia B.C. (2005), Surveying, Volume 1, 16th Edition Laxmi Publications. ISBN: 9788170080794.
2. Punmia B.C. (2005), Surveying, Volume 2, 15th Edition Laxmi Publications. ISBN: 9788170080800.
3. Rangwala, (2011), *Engineering Materials*, 38th edition, Charotar Publishing House Pvt. Ltd. ISBN: 978-93-80358-26-0.
4. Ashok Kumar Jain, Dr. B.C. Punmia, Arun Kumar Jain (2009), *Building Construction*, Laxmi Publications Pvt. Ltd, ISBN: 978-81-318-0428-5.

Reference Books

1. Kanetkar T.P. (2006), Surveying and Leveling, Vol I, Pune. ISBN: 9788185825113.
2. Kanetkar T.P. (2008), Surveying and Leveling, Vol II, Pune. ISBN: 9788185825007
3. M. L. Gambhir, (2009), *Concrete Technology*, Tata McGraw Hill Education, ISBN: 978-00-701-5136-9.
4. P. C. Varghese, (2009), Engineering Materials, 1st edition, PHI Learning, ISBN: 978-81-203-2848-8.

Thrust areas of projects with tentative project titles

1. Comparative study of chain survey, compass survey and theodolite survey.
2. Studies on GPS survey.
3. Surveying B – block in GU campus by Total Station.
4. Studies on high performance concrete.
5. Studies on self compacting concrete.
6. Studies on structural light weight concrete.
7. Mix Design for preparing M40 grade of concrete.

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Compare between chain survey, compass survey and theodolite survey.	**1, 9, 10**
2	Understand GPS survey.	**1, 9**
3	Survey any area by Total Station.	**1, 4, 5, 9, 10**
4	Understand high performance concrete and self compacting concrete.	**1, 9**
5	Carry out Mix Design for preparing M40 grade of concrete.	**3, 4, 9, 10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE2007	PBL1	2		2	1	1				2	1		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE2008	Mechanics of Materials	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites					
Co-requisites	--				

Course Objectives

1. To know the concept of stresses and strains.
2. To know the concept of shear force and bending moment.
3. To calculate deflection in beams and trusses.
4. To determine the buckling and crushing load of compression members.

Course Outcomes

On completion of this course, the students will be able to

1. Understand the concepts of stress and strain.
2. Analyse shear force and bending moment for different types of beams.
3. Calculate deflections in beams and trusses.
4. Study compression member, columns and finding buckling and crushing load.

Catalogue Description

Students learn the concept of stresses and strains, elastic constants, principal stresses and strains and torsion. Students learn the concept of shear force diagram and bending moment diagram. Students also learn to calculate deflection of beams by different methods and the concept of strain energy. Students understand different formulas to calculate critical load on columns. Upon completion, students should be able to calculate stresses, strains, shear force and bending moment for beams, deflections in beams by different methods and critical load on columns.

Text Books

1. Ramamrutham S. and Narayanan R. (2008), Strength of Materials, 3rd Edition, Dhanpat Rai Publications Company, ISBN: 9788187433545.

Reference Books

1. Gere J. M. and Thimoshenko S. P. (2008), Mechanics of Materials, 8th Edition, CBS Publishers & Distributors, ISBN: 9780534417932.
2. Popov E. P. (2009), Engineering Mechanics of Solids, 2nd Edition, Prentice Hall Publisher, ISBN: 9788120321076.
3. Bansal R. K. (2010), Strength of Materials, 4th Edition, Laxmi Publications, ISBN: 9788131808146.

Course Content

Unit I: Stresses – Strains and Torsion **9 lecture hours**

Axial Stress and Strain - Solution of simple problems – Tapered Section - One Dimensional Loading of members of varying cross-section – Stress - Strain Diagram of mild steel - Concepts of Elastic Constants - Principle stresses and strains - Mohr's circle – Introduction to torsion - Torsion of shafts of circular section - torque and twist - shear stress due to torque.

Unit II: Shear Force and Bending Moment **9 lecture hours**

Types of beams, supports and loadings - shear force and bending moment diagram - bending stresses and shear stresses in beams.

Unit III: Deflection of Beams **9 lecture hours**

Introduction - Theory of bending - deflection of beams by Macaulay's method - moment area method - conjugate beam method – Strain energy method - Castigliano's theorem.

Unit IV: Deflection of Plane Trusses **9 lecture hours**

Analysis of statically determinate plane trusses by method of joints - calculation of deflection in statically determinate trusses by Unit load method - Strain energy method - Williot Mohr's diagram.

Unit V: Theory of Columns **9 lecture hours**

Theory of Columns - long column and short column - Euler's formula - Rankine's formula - Secant formula - beam column.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Understand the concepts of stress and strain.	**1, 12**
2	Analyse shear force and bending moment for different types of beams.	**2, 9, 10**
3	Calculate deflections in beams and trusses.	**2, 3**
4	Study compression member, columns and finding buckling and crushing load.	**2, 3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE2008	Mechanics of Materials	2	3	2						1	1		1

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE2009	Hydrology & Hydraulic Systems	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE2001				
Co-requisites	--				

Course Objectives

1. To understand the concept of weather and hydrology.
2. To have an idea about precipitation and abstraction.
3. To understand the functions of pumps and turbines.

Course Outcomes

On completion of this course, the students will be able to

1. Know the precipitation potential & analysis of precipitation data.
2. Get exposure about evaporation and transpiration.
3. Know the functions of pumps and turbines.

Catalog Description

Introduction to Hydrology, Hydrologic Processes, Atmospheric and Subsurface Water and hydrologic measurements, diurnal and monsonic wind systems, rainfall measurement, process of evaporation, transpiration, pumps and turbines.

Text Books

1.Subramanya K. (2008), Engineering Hydrology, Tata McGraw Hill Co., Graw Hill Co. ISBN: 9780074624494.

Reference Books

1. Varshney R.S. (2012), Engineering Hydrology, Nem Chand & Brothers Publishers. ISBN: 8185240688.
2. Das (2009), Hydrology & Soil Conservation Engineering, Prentice-Hall of India. ISBN: 9788120335868.
3. Modi P. N. and Seth S. M. (2011), Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Publications, ISBN-9788189401269.
4. Bansal R. K. (2010), A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publication, ISBN-9788131808153.

Course Content

Unit I: Introduction **9 lecture hours**

Definition – Development of hydrology – hydrologic design – Hydrologic features – Importance in Engineering – Hydrological budget.

Unit II: Hydro Meteorology **9 lecture hours**

Weather and hydrology – General circulation Temperature humidity – Wind – Diurnal and monsonic wind systems.

Unit III: Precipitation and Abstraction **9 lecture hours**

Formation of precipitation – forms of precipitation – types of precipitation – Rainfall measurement – gauges – recorders – processing precipitation data – check for consistency – supply of missing data – Aerial mean mass curve technique – Intensity duration frequency curves. Process of evaporation, transpiration – Infiltration factors affecting evaporation – Measurement of evaporation and infiltration indices – Horton's equation.

Unit IV: Pumps **9 lecture hours**

Centrifugal pump – velocity triangle – characteristic curves – specific speed – applications – Reciprocating pump – types – Indicator diagram – acceleration and friction – air vessels.

Unit V: Turbines **9 lecture hours**

Classification – Pelton Turbine – Francis Turbine – Kaplan Turbine - velocity triangle – characteristic curves – specific speed.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and Pos		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Know the precipitation potential & analysis of precipitation data.	**1**
2	Get exposure about evaporation and transpiration.	**1,2**
3	Know the functions of pumps and turbines.	**4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE2009	Hydrology & Hydraulic Systems	1	2		1								

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE2010	Water Supply and Treatment Systems	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	--				
Co-requisites	--				

Course Objectives

1. Understand the basic principles and concepts of unit operations and processes involved in water treatment.
2. Design of unit operations and processes involved in water treatment.
3. Evaluation of the performance of water treatment plants.

Course Outcomes

On completion of this course, the students will be able to

1. The type of unit operations and processes involved in water treatment plants.
2. Unit operations and processes required for satisfactory treatment of water.
3. The design of unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.
4. To study unit operations & advanced Processes in Water treatment its disinfection and aeration and softening.
5. The design of water treatments units in a cost effective and sustainable way and evaluate its performance to meet the desired health and environment related goals.

Catalog Description

Water supply and its treatment system are attached with the life cycle of every human being. To identify the problems associated with the treatment of the water and its supply it is essential to have the knowledge this course. Students learn Effect of population dynamics on water demand, Physicochemical Principles applied in water treatment, Unit operations, principles and processes for pretreatment and treatment of raw water, Principles, functions and design of different treatment units and processes. Upon completion, students should be able to design and construct the water treatment plant for the single unit, residential area or for society.

Text Books

1. Garg S.K. (2010), Environmental Engineering Vol. I Water Supply Engineering, Khanna Publishers. ISBN: 9788174091208
2. H.S.Peavy, D.R.Rowe & George Tchobanoglous (2005), Environmental Engineering, McGraw-Hill Company, New Delhi. ISBN: 9789380358246

Reference Books

1. Nathanson, Jerry A. (2007), Basic Environmental Technology: Water Supply, Waste Management, and Pollution Control, 5th ed., PHI Learning Private Limited ISBN: 978-81-203-3836-4

2. Rangwala (1999), Water supply & Sanitary Engineering, Charotar Publishing House, Anand-16th Edition. ISBN: 9788185594590
3. Metcalf and Eddy (2003), Wastewater Engineering, Treatment and reuse, Tata McGraw-Hill Edition, Fourth edition. ISBN:9780070495395

Course Content

Unit I: Water sources- classification and Distribution **8 lecture hours**

Water demand, Factors governing water demands and seasonal variations, Effect of population dynamics on water demand, Principles for forecasting of water-demand and its calculations, Self-purification of surface water bodies – Oxygen sag curve, permissible values for drinking water.

Unit II: Water Treatments Units **9 lecture hours**

Physicochemical Principles applied in water treatment, Unit operations, principles and processes for pretreatment and treatment of raw water, pre-chlorination and chlorination, principles and objectives for designing chlorination systems, General design considerations for designing water treatment plants

Unit III: Unit Operations & Processes **10 lecture hours**

Principles, functions and design of screen, grit chambers, flash mixers, flocculators, sedimentation tanks and sand filters- Slow sand and rapid sand filters, layouts – Flash mixer – Clariflocculator – Slow sand and rapid sand filters.

Unit IV: Disinfection Processes in Water treatment **9 lecture hours**

Principles, Objectives, Unit Operations & Advanced Processes in Water treatment, Disinfection – Aeration – iron and manganese removal, Defluoridation and demineralization – Water softening.

Unit V: Water supply systems **9 lecture hours**

Various water supply systems - Water supply networks - Various water storage systems

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	The type of unit operations and processes involved in water treatment plants.	**6**
2	Unit operations and processes required for satisfactory treatment of water.	**7**
3	The design of unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.	**3, 10**
4	To study unit operations & advanced Processes in Water treatment its disinfection and aeration and softening.	**3, 10**
4	The design of water treatments units in a cost effective and sustainable way and evaluate its performance to meet the desired health and environment related goals.	**3, 8, 9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE2010	Water Supply and Treatment Systems			2			3	3	2	1	1		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE2011	Mechanics of Materials Lab	L	T	P	C
Version 1.04	Date of Approval	0	0	2	1
Pre-requisites / Exposure	BTCE2008				
Co-requisites					

Course Objectives

To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness.

Course Outcomes

On completion of this course, the students will be able to,

1. Conduct tension and compression tests on the components.
2. To determine hardness, impact strength, fatigue strength of the specimens.
3. Measure strain and load using specific gauges.
4. Measure torsion in mild steel.
5. Compression and tension test on helical springs.

List of Experiments

1. Tension test on a mild steel rod, thin and twisted bars.
2. Compression test on Bricks, Concrete blocks.
3. Double shear test on Mild steel and Aluminium rods.
4. Impact test on metal specimen (Charpy test and Izod test).
5. Hardness test on metals (Steel, Copper and Aluminium) - Brinnell Hardness Number.
6. Hardness test on metals (Steel, Copper and Aluminium) - Rockwell Hardness Number.
7. Deflection test – Verification of Maxwell theorem.
8. Compression and tension test on helical springs.
9. Fatigue test on Steel.
10. Torsion test on mild steel

Catalogue Description

Students learn the concept of stresses and strains. Students learn the concept of tension test, double shear test, impact test. They also understand deflection test, fatigue test and torsion test. Upon completion, students will know the importance of this course.

Text Books

1. Ramamrutham S. and Narayanan R. (2008), Strength of Materials, 3rd Edition, Dhanpat Rai Publications Company, ISBN: 9788187433545.

Reference Books

1. Gere J. M. and Thimoshenko S. P. (2008), Mechanics of Materials, 8th Edition, CBS Publishers & Distributors, ISBN: 9780534417932.

2. Popov E. P. (2009), Engineering Mechanics of Solids, 2nd Edition, Prentice Hall Publisher, ISBN: 9788120321076.
3. Bansal R. K. (2010), Strength of Materials, 4th Edition, Laxmi Publications, ISBN: 9788131808146.

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**		**laboratory**
	Internal	**SEE**	
Marks	50	50	
Total Marks	100		

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and Pos		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Conduct tension and compression tests on the components.	**1, 9**
2	To determine hardness, impact strength, fatigue strength of the specimens.	**1, 9**
3	Measure strain and load using specific gauges.	**1, 9**
4	Measure torsion in mild steel.	**1, 9**
5	Compression and tension test on helical springs.	**1, 9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE2011	Mechanics of Materials Lab	2								2			

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE2012	Water Quality Analysis Lab	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites	BTCE2010				
Co-requisites	--				

Course Objectives

1. Understand the basic principles and concepts of unit operations and processes involved in water treatment.
2. Design of unit operations and processes involved in water treatment.
3. Evaluation of the performance of water treatment plants.

Course Outcomes

On completion of this course, the students will be able to

1. The type of unit operations and processes involved in water treatment plants.
2. Unit operations and processes required for satisfactory treatment of water.
3. The design of unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.
4. To study unit operations & advanced processes in water treatment its disinfection and aeration and softening.
5. The design of water treatments units in a cost effective and sustainable way and evaluate its performance to meet the desired health and environment related goals.

Catalog Description

Water supply and its treatment system are attached with the life cycle of every human being. To identify the problems associated with the treatment of the water and its supply it is essential to have the knowledge this course. Students learn Effect of population dynamics on water demand, Physicochemical Principles applied in water treatment, Unit operations, principles and processes for pretreatment and treatment of raw water, Principles, functions and design of different treatment units and processes. Upon completion, students should be able to design and construct the water treatment plant for the single unit, residential area or for society.

Text Books

1. Garg S.K. (2010), Environmental Engineering Vol. I Water Supply Engineering, Khanna Publishers. ISBN: 9788174091208
2. H.S.Peavy, D.R.Rowe & George Tchobanoglous (2005), Environmental Engineering, McGraw-Hill Company, New Delhi. ISBN: 9789380358246

Reference Books

1. Nathanson, Jerry A. (2007), Basic Environmental Technology: Water Supply, Waste Management, and Pollution Control, 5th ed., PHI Learning Private Limited ISBN: 978-81-203-3836-4

2. Rangwala (1999), Water supply & Sanitary Engineering, Charotar Publishing House, Anand-16th Edition. ISBN: 9788185594590
3. Metcalf and Eddy (2003), Wastewater Engineering, Treatment and reuse, Tata McGraw-Hill Edition, Fourth edition. ISBN:9780070495395

List of Experiments:

1. To determine the pH of a given water sample.
2. To determine the total solids, suspended solids, dissolved solids and volatile solids in wastewater.
3. To determine the turbidity and specific conductivity of the given water samples.
4. To determine the Alkalinity of given water sample.
5. To determine total hardness, permanent hardness and temporary hardness for given water sample.
6. To determine the chloride concentration of a given water sample.
7. To determine amount of sulphates in a given sample
8. To determine the dissolved oxygen content in a given water sample.
9. To determine BOD of the given wastewater sample.
10. To determine the COD of given sample.
11. To determine the optimum dosage of coagulant for turbidity removal of a given water sample.

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	The type of unit operations and processes involved in water treatment plants.	**6**
2	Unit operations and processes required for satisfactory treatment of water.	**7**
3	The design of unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.	**3, 10**
4	To study unit operations & advanced processes in water treatment its disinfection and aeration and softening.	**3, 10**
5	The design of water treatments units in a cost effective and sustainable way and evaluate its performance to meet the desired health and environment related goals.	**3, 8, 9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE2012	Water Quality Analysis Lab			2			3	3	2	1	1		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE2013	PBL-2	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites	**BTCE2008, BTCE2009, BTCE2010**				
Co-requisites	--				

Course Objectives

1. To supplement the theoretical knowledge with project based learning.
2. To enable students to have a clear understanding in the courses.
3. To equip students with more technical knowledge and practical exposure.

Course Outcomes

On completion of this course, the students will be able to:

1. Calculate deflection of beams.
2. Calculate critical load for columns with different boundary conditions.
3. Study different types of pumps.
4. Study different types of turbines.
5. Study water treatment unit.
6. Study water supply network.

Catalogue Description

Project based learning (PBL) is a teaching/learning technique in which students learn the courses by doing projects works in the related area. Although students do a major project in the last semester to apply their broad learning concept in real life world, the PBL gives them extra opportunity to apply concept in project `development to have experience in 'learning by doing'

Text Books

1. Ramamrutham S. and Narayanan R. (2008), Strength of Materials, 3rd Edition, Dhanpat Rai Publications Company, ISBN: 9788187433545.
2. Gere J. M. and Thimoshenko S. P. (2008), Mechanics of Materials, 8th Edition, CBS Publishers & Distributors, ISBN: 9780534417932.
3. Modi P. N. and Seth S. M. (2011), Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Publications, ISBN-9788189401269.
4. Garg S.K. (2010), Environmental Engineering, Vol. I, Water Supply Engineering, Khanna Publishers. ISBN: 9788174091208
5. H.S.Peavy, D.R.Rowe & George Tchobanoglous (2005), Environmental Engineering, McGraw-Hill Company, New Delhi. ISBN: 9789380358246

Reference Books

1. Popov E. P. (2009), Engineering Mechanics of Solids, 2nd Edition, Prentice Hall Publisher, ISBN: 9788120321076.
2. Bansal R. K. (2010), Strength of Materials, 4th Edition, Laxmi Publications, ISBN: 9788131808146.
3. Bansal R. K. (2010), A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publication, ISBN-9788131808153.

4. Nathanson, Jerry A. (2007), Basic Environmental Technology: Water Supply, Waste Management, and Pollution Control, 5th ed., PHI Learning Private Limited ISBN: 978-81-203-3836-4
5. Rangwala (1999), Water supply & Sanitary Engineering, Charotar Publishing House, Anand-16th Edition. ISBN: 9788185594590

Thrust areas of projects with tentative project titles

1. Calculation of deflection of beams.
2. Calculation critical load for columns with different boundary conditions.
3. Study of different types of pumps.
4. Study of different types of turbines.
5. Study of water treatment unit.
6. Study of water supply network.

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Calculate deflection of beams.	**1, 5, 9, 10**
2	Calculate critical load for columns with different boundary conditions.	**1, 5, 9, 10**
3	Study of different types of pumps.	**1, 4, 9, 10**
4	Study different types of turbines.	**1, 4, 9, 10**
5	Study water treatment unit.	**3, 4, 9, 10**
6	Study water supply network.	**3, 4, 9, 10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE2013	PBL-2	2		2	1	1				2	1		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3001	Structural Analysis	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE2008				
Co-requisites	--				

Course Objectives

1. To understand the concept of static indeterminacy.
2. To know the different techniques available for the analysis of statically indeterminate structures.
3. To identify the best suitable method of analysis.

Course Outcomes

On completion of this course, the students will be able to

1. Identify the method of analysis for statically indeterminate structures.
2. Understand the difference between statically determinate structures and statically indeterminate structures.
3. Use the influence line diagram for analysing beam.
4. Understand strain energy method to analyse arches.
5. Apply moment distribution method.

Catalog Description

Structural analysis is the determination of the effects of loads on physical structures and their components. Structures subject to this type of analysis include all that must withstand loads, such as buildings, bridges, vehicles, machinery, furniture, attire, soil strata, prostheses and biological tissue. Structural analysis incorporates the fields of applied mechanics, materials science and applied mathematics to compute a structure's deformations, internal forces, stresses, support reactions, accelerations, and stability. The results of the analysis are used to verify a structure's fitness for use, often saving physical tests. Structural analysis is thus a key part of the engineering design of structures.

Text Books

1. Vazirani & Ratwani (2003), Analysis of Structures, Vol. 1 & II, Khanna Publishers, ISBN: 0125249853.

Reference Books

1. S. Ramamrutham (2004), Theory of Structures, 5th Edition, Dhanpat Rai Publications, ISBN: 978041528091
2. C. S. Reddy (2010), Structural Analysis, 3rd Edition, Tata McGraw Hill, ISBN:9780070702769.
3. Kenneth M. Leet, Gilbert A, Uang C. M. (2010), Fundamentals of Structural Analysis, 4th Edition, Tata McGraw Hill,ISBN:9780071289382

Course Content

Unit I: Theorem of Three Moments **9 lecture hours**

Static indeterminacy - Theorem of three moments - analysis of propped cantilevers - fixed & continuous beam - bending moment and shear force diagram.

Unit II: Strain Energy Method **9 lecture hours**

Static indeterminacy - Strain energy method - analysis of indeterminate structures, beams, pin jointed and rigid jointed structures - temperature effect - bending moment and shear force diagram.

Unit III: Influence Line **9 lecture hours**

Influence line - influence lines for bending moment and shear force for beams, Muller Breaslau's principle - Maxwell's reciprocal theorem - Maxwell Betti's theorem.

Unit IV: Analysis of Arches **9 lecture hours**

Two hinged and three hinged parabolic arches - circular arches - cables - tension forces in towers - influence line for horizontal thrust and bending moment.

Unit V: Moment distribution method **9 lecture hours**

Moment distribution method - analysis of continuous beams and portals - bending moment and shear force diagram.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Identify the method of analysis for statically indeterminate structures.	**1, 2**
2	Understand the difference between statically determinate structures and statically indeterminate structures.	**1, 2**
3	Use the influence line diagram for analysing beam.	**1, 2, 3**
4	Understand strain energy method to analyse arches.	**1, 2**
5	Apply moment distribution method.	**1, 2, 3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3001	Structural Analysis	**2**	**3**	**2**									

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3002	Design of Reinforced Concrete Structures	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE2003, BTCE2008				
Co-requisites	--				

Course Objectives

1. To teach the students about the design of beams, columns, slabs by working stress method.
2. To enable the students to understand the limit state method of design of beams, columns and slabs.

Course Outcomes

On completion of this course, the students will be able to

1. Understand the behavior of structural members and the concept of design.
2. Calculate moment of resistance for different types of RC beam sections.
3. Design different types of RC beam.
4. Understand the difference between one way slab and two way slab and design the slabs.
5. Know the concept of short column and long column and design the columns..

Catalogue Description

Students will learn the concept of working stress method and limit state method, tee beam and ell beam sections, under reinforced sections, balanced sections and over reinforced sections. Students will also learn the concept of designing one way slab and two way slab, short column and long column, axially and eccentrically loaded columns. Upon completion, students should be able to design beams, slabs and columns by different methods.

Text Books

1. Gambhir, M.L., (2011), "Fundamentals of Reinforced Concrete Design", Prentice-Hall of India. ISBN: 9788120330481.
2. S Unnikrishna Pillai & Devdas Menon, (2005), Reinforced Concrete Design, Tata Mcgraw Hill, ISBN: 9780070141100.
3. Varghese, P.C., (2009), Limit State Design of Reinforced Concrete, 2nd ed. ISBN: 9788120320390.

Reference Books

1. Varghese (2005), Advanced Reinforced Concrete Design, Prentice-Hall of India.
2. Gurcharan Singh (2005), Design of R.C.C. Structures in S. I. Units, Standard Publishers Distributors.
3. B. C. Punmia (2003), Design of reinforced concrete structures, Lakshmi Publishers.
4. IS:456 (2000) & SP:16

Course Content

Unit I: Material Properties and Design Concepts **9 lecture hours**

Material properties, design stress-strain curve of concrete - modulus of elasticity - grades of concrete - different types and grades of reinforcing steel - design stress-strain curve of steel.Introduction to design concepts, elastic behaviour of rectangular section, under, balanced and over reinforced section. Deflection and cracking in beams and slabs using IS code provisions. Moment of resistance of singly reinforced rectangular beam, Design of singly reinforced rectangular beams by working stress method.

Unit II: Introduction to Limit State Design and Design of Rectangular beams **9 lecture hours**

Philosophy and principle of limit state design along with the assumptions, partial safety factors, characteristic load and strength. Introduction to stress block parameters, concept of balanced, under reinforced and over reinforced sections, limit state of collapse in flexure of rectangular sections- Moment of resistance for singly and doubly reinforced rectangular beam sections, check for shear, with examples. Design of singly and doubly reinforced rectangular beam sections.

Unit III: Limit state design of Flanged Beams **9 lecture hours**

Limit state of collapse in flexure of flanged sections- Moment of resistance for reinforced flanged beam sections, check for shear, with examples. Design of reinforced flanged beam sections. Design of beam sections subjected to torsion.

Unit IV: Limit State Design of Slabs **9 lecture hours**

Introduction to one way and two way slabs, design of one way cantilever, simply supported and continuous slab, design of two way slabs.

Unit V: Limit State Design of Compression Members **9 lecture hours**

General design aspects of compression members. Design of short axially loaded columns with reinforcement detailing. Design of columns with uniaxial bending bending using SP- 16 charts, design of long column.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Demonstrate an understanding of Material Properties and Design Concepts of RC Structures	**1, 9**
2	Analyze and design reinforced concrete rectangular beams	**2**
3	Analyze and design reinforced concrete flanged beams	**3**
4	Analyze and design reinforced concrete slab	**6, 10**
5	Analyze and design reinforced concrete compression members	**1, 9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3002	Design of Reinforced Concrete Structures	2	2	3			2			1	1		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3003	Geotechnical Engineering	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites//Exposure	--				
Co-requisites	--				

Course Objectives

1. To impart the fundamental concepts of soil mechanics.
2. To understand the bearing capacity.
3. To know the importance of index properties like grain size, consistency limits, soil classification.
4. To understand the concept of compaction and consolidation of soils.

Course Outcomes

On completion of this course, the students will be able to

1. Give an engineering classification of a given soil.
2. Understand the principle of effective stress, and then calculate stresses that influence soil behavior.
3. Determine soil deformation parameters, and calculate settlement magnitude and rate of settlement.
4. Specify soil compaction requirements.
5. Conduct laboratory tests, and obtain soil properties and parameters from the test observations and results.

Catalog Description

Basics of soil mechanics is very essential for a civil engineers, its properties can be easily understand by weight volume relations and classification of soil by index properties. Effect of water and air within the soil has given the lot of scope for research, and results compressibility and consolidation respectively. The most important parameters of soil which affects the shear strength of soil are its cohesion and friction angles. Concept of stress distribution in soils has been analyzed by Boussinesq's equation, Westergaard's equation and earth pressure is also analyzed for various cases.

Text Books

1. K.R.Arora (2011), Soil Mechanics and Foundation Engineering, Standard Publishers Distributors, Delhi, ISBN: 978-81-801-4112-6.

2. Arun Kr. Jain, B.C. Punmia, Ashok Kr. Jain (2005), Soil Mechanics and Foundations, Sixteenth Edition, Laxmi Publications. ISBN: 978-81-700-8791-5.

Reference Books

1. Gopal Ranjan, A.S.R Rao (2000), Basic and Applied Soil Mechanics 2nd Edition, New Age International. ISBN: 978-81-224-1223-9.

2. William Powrie, Soil Mechanics: Concepts and Applications, Second Edition, Spon Press. ISBN: 978-04-153-1156-4.
3. Karl Terzaghi, Soil Mechanics in Engineering Practice, Warren Press. ISBN: 978-14-465-1039-1.
4. Aysen (2004), Problem Solving in Soil Mechanics, Taylor & Francis Group. ISBN: 978-04-153-8392-9.

Course Content

Unit I: Weight volume relations and Index properties **12 lecture hours**

Distribution of soil in India, Soil - Types, 3-phase diagram, Weight-volume relations, Classification, Index properties (Atterberg's limits), Theory of compaction, Importance of geotechnical engineering.

Unit II: Soil water and Permeability **8 lecture hours**

Soil water - Effective and neutral stresses – Flow of water through soils – Permeability – Darcy's law –Seepage and flow-nets - Quick sand conditions.

Unit III: Stress distribution in soils **8 lecture hours**

Vertical pressure distribution- Boussinesq's equation for point load and uniformly distributed loads of different shapes– Newmark's influence chart – Westergaard's equation – Isobar diagram – Pressure bulb - Contact pressure, Earth Pressures Theories.

Unit IV: Compressibility and Consolidation **8 lecture hours**

Compressibility – e-log p curve – Pre-consolidation pressure - Primary consolidation – Terzaghi'sconsolidation theory - Laboratory consolidation test – Determination of C_v by Taylor's and Casagrande's methods.

Unit V: Shear strength of soils **9 lecture hours**

Stress analysis by Mohr's circle - Mohr's strength theory – Shear strength of soils – Mohr-Coloumb strength envelope – Laboratory shear tests – Direct shear test – Triaxial compression – Unconfined compression test – Vane shear test – Shear strength of saturated cohesive soils – Shear strength of cohesion less soils - conditions for liquefaction.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Give an engineering classification of a given soil.	**1**
2	Understand the principle of effective stress, and then calculate stresses that influence soil behavior.	**2, 12**
3	Determine soil deformation parameters, and calculate settlement magnitude and rate of settlement.	**2, 4, 7**
4	Specify soil compaction requirements.	**5**
5	Conduct laboratory tests, and obtain soil properties and parameters from the test observations and results.	**8, 9, 10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigationsof complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3003	Geotechnical Engineering	2	2		1			2	1	2	1		1

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3004	Waste Water Treatment and Disposal Systems	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE2010				
Co-requisites	--				

Course Objectives

1. To teach students the basic principles and concepts of unit operations and processes involved in wastewater treatment.
2. To develop student's skill in the basic design of unit operations and processes involved in wastewater treatment.
3. To develop a student's skill in evaluating the performance of wastewater treatment plants.

Course Outcomes

On completion of this course, the students will be able to

1. Demonstrate an ability to recognize the type of unit operations and processes involved in wastewater treatment plants.
2. Demonstrate an ability to choose the appropriate unit operations and processes required for satisfactory treatment of wastewater.
3. Demonstrate an ability to design individual unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.
4. Demonstrate ability in design of wastewater treatments units in a cost effective and sustainable way and evaluate its performance to meet the desired health and environment related goals.
5. Recognize the importance of wastewater treatment to protect the water resources.

Catalog Description

Proper treatment of wastewater reduces health risks to humans and animals and prevents surface and groundwater contamination. Inadequate treatment of wastewater allows bacteria, viruses, and other disease-causing pathogens to enter groundwater and surface water. This course provides an overview of type of units operations and processes involved in wastewater treatment and disposal including design of primary and secondary treatment units. On completion of this course students will be able to identify the need for primary and secondary treatment of wastewater in a cost-effective and sustainable way. The students will also learn the importance of wastewater treatment to protect water resources.

Text Books

1. Garg.S.K, (2010), Environmental Engineering-Sewage Disposal and Air Pollution Engineering, 1st Edition, Khanna Publishers, ISBN- 978-81-740-9230-4.
2. Metcalf & Eddy, (2002), Wastewater Engineering Treatment & Reuse, Tata McGraw-Hill Education, ISBN: 978-00-704-9539-5

Reference Books

1. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, (2001), Environmental Engineering, Tata McGraw-Hill Education, ISBN No: 978-00-710-0231-8.
2. Hammer & Hammer Jr., Water and Wastewater Technology, 7th Edition, ISBN-978-81-203-4601-7.
3. Rakesh Kumar, R.N.Singh, (2009), Municipal Water and Wastewater Treatment, Teri Press, ISBN: 978-81-799-3188-2.
4. Dr.P.N.Modi, (2008), Sewage Treatment Disposal and Wastewater Engineering, 2nd Edition, ISBN-978-81-900-8932-4.
5. Shyam. R.Asolekar, Soli. J.Arceivala, Wastewater Treatment for Pollution Control and Reuse, 3rd Edition, Tata McGraw-Hill Education, ISBN: 978-00-706-2099-5.

Course Content

Unit I: Wastewater Treatment **9 lecture hours**

Physical, chemical and biological principles involved in wastewater treatment and designing of unit-operations and processes. Permissible standards for wastewater disposal.

Unit II: Pre and Primary Treatment **10 lecture hours**

Objectives-Unit operations and processes-Principles, functions and design of flash mixers, screens, sedimentation tanks and sand filters-Disinfection-Aeration, grit chambers and primary sedimentation tanks.

Unit III: Secondary Treatment **8 lecture hours**

Secondary Treatment-Activated Sludge Process and Trickling filters; other treatment methods-Stabilization Ponds and Septic Tanks-Advances in Sewage Treatment

Unit IV: Sewage Disposal and Sludge Management **9 lecture hours**

Methods-Dilution-Self-purification of surface water bodies-Oxygen Sag Curve-Land disposal-Sewage Farming-Deep well injection-Soil dispersion system-Thickening-Sludge digestion-Bio-gas recovery, Drying beds-Conditioning and Dewatering-Sludge disposal. Introduction to solid waste management, landfills and EIA

Unit V: Waste Disposal System **9 lecture hours**

Wastewater Treatment-Typical layouts-Screens-Grit Chamber-Sedimentation tanks-Trickling filter-Activated Sludge, sludge Digester-Septic tanks-Soil Dispersion System-Waste Stabilization pond.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	Theory	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and Pos		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Demonstrate an ability to recognize the type of unit operations and processes involved in wastewater treatment plants.	**2**
2	Demonstrate an ability to choose the appropriate unit operations and processes required for satisfactory treatment of wastewater	**6**
3	Demonstrate an ability to design individual unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles	**3, 6, 7**
4	Demonstrate ability in design of wastewater treatments units in a cost effective and sustainable way and evaluate its performance to meet the desired health and environment related goals	**3, 7, 8**
5	Recognize the importance of wastewater treatment to protect the water resources	**7, 8**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3004	WWTDS		2	2			2	3	2				

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3005	Structural Analysis Lab	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites	BTCE3001				
Co-requisites	--				

Course Objectives

1. To know the concept and procedure of different type of method to find slope and deflection for different type of structures.
2. To understand the advantage and disadvantage of different types of methods used for find slope.

Course Outcomes

On completion of this course, the students will be able to

1. Understand different methods used for finding slope and deflections.
2. Determine the deflection of indeterminate structures and will be able to calculate deflection of different types of structures.
3. Determine the slope of indeterminate structures and will be able to calculate slope of different types of structures.

Catalogue Description

Through this course students will learn various methods for finding slope and deflection of indeterminate structures. They will learn also difference between the methods used for find slope and deflections. They will understand advantage and disadvantage of different methods for solving indeterminate structures for design purposes.

Text Books

1. Vazirani & Ratwani (2003), Analysis of Structures, Vol. 1 & II, Khanna Publishers, ISBN: 0125249853.

Reference Books

1. S. Ramamrutham (2004), Theory of Structures, 5thEdition, Dhanpat Rai Publications, ISBN: 978041528091
2. C. S. Reddy (2010), Structural Analysis, 3rd Edition, Tata McGraw Hill, ISBN:9780070702769.
3. Kenneth M. Leet, Gilbert A, Uang C. M. (2010), Fundamentals of Structural Analysis, 4th Edition, Tata McGraw Hill,ISBN:9780071289382

List of Experiments

1. Deflection of a simply supported beam and verification of Clark-Maxwell's theorem.
2. To determine the Flexural Rigidity of a given beam.

3. To verify the Moment - area theorem for slope and deflection of a given beam.
4. Deflection of a fixed beam and influence line for reactions.
5. Deflection studies for a continuous beam and influence line for reactions.
6. Study of behaviour of columns and struts with different end conditions.
7. Experiment on three hinged arch.
8. Experiment on two hinged arch.
9. Deflection of a statically determinate pin jointed truss.
10. Unsymmetrical Bending of curved beam.

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**		**Laboratory**
	Internal	**SEE**	
Marks	50	50	
Total Marks	100		

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Identify the method of analysis for determinate structures	**1, 2**
2	Understand the importance of various methods of slop and deflections for determinate structures.	**1, 2**
3	Use the influence line diagram.	**1, 2, 3**
4	Understand the methods of analysis for multi-storeyed frames.	**1, 2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3005	Structural Analysis Lab	2	3	2									

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3006	Geotechnical Engineering Lab	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites//Exposure	BTCE3003				
Co-requisites	--				

Course Objectives

1. To impart the fundamental concepts of soil mechanics.
2. To understand the bearing capacity.
3. To know the importance of index properties like grain size, consistency limits, soil classification.
4. To understand the concept of compaction and consolidation of soils.

Course Outcomes

On completion of this course, the students will be able to

1. Give an engineering classification of a given soil.
2. Understand the principle of effective stress, and then calculate stresses that influence soil behavior.
3. Determine soil deformation parameters, and calculate settlement magnitude and rate of settlement.
4. Specify soil compaction requirements.
5. Conduct laboratory tests, and obtain soil properties and parameters from the test observations and results.

Catalog Description

Basics of soil mechanics is very essential for a civil engineers, its properties can be easily understand by weight volume relations and classification of soil by index properties. Effect of water and air within the soil has given the lot of scope for research, and results compressibility and consolidation respectively. The most important parameters of soil which affects the shear strength of soil are its cohesion and friction angles. Concept of stress distribution in soils has been analyzed by Boussinesq's equation, Westergaard's equation and earth pressure is also analyzed for various cases.

Text Books

1. Dr.K.R.Arora (2011), Soil Mechanics and Foundation Engineering, Standard Publishers Distributors, Delhi, ISBN: 978-81-801-4112-6.
2. Arun Kr. Jain, B.C. Punmia, Ashok Kr. Jain (2005), Soil Mechanics and Foundations Sixteenth Edition, Laxmi Publications. ISBN: 978-81-700-8791-5.

Reference Books

1. Gopal Ranjan, A.S.R Rao (2000), Basic and Applied Soil Mechanics 2nd Edition, New Age International. ISBN: 978-81-224-1223-9.
2. William Powrie, Soil Mechanics: Concepts and Applications, Second Edition, Spon Press. ISBN: 978-04-153-1156-4.

3. Karl Terzaghi, Soil Mechanics in Engineering Practice, Warren Press. ISBN: 978-14-465-1039-1.

List of Experiments:

1. To determine moisture content of soil
2. To determine the specific gravity of soil fraction passing 4.75mm I.S sieve by density bottle/Pycnometer bottle
3. To determine the grain size distribution curve for given soil sample by sieve analysis and hydrometer analysis.
4. To determine the consistency limits (i.e Liquid limit, Plastic limit & Shrinkage limit)of given samples
5. To determine in-situ density of compacted soils by using core cutter & pouring cylinder methods.
6. To determine the relative density of given coarse grained materials
7. To determine the maximum dry density and optimum moisture content for the given soil sample.
8. To determine coefficient of permeability of given soil sample by constant head and variable head method.
9. To determine unconfined compressive strength of a given soil sample
10. To determine shear strength of a given soil specimen using vane shear apparatus
11. To determine shear strength of a given soil specimen using direct shear apparatus
12. To determine the shear parameters of soil by Undrained Triaxial Test

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**		**Laboratory**
	Internal	**SEE**	
Marks	50	50	
Total Marks	100		

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Give an engineering classification of a given soil.	**1**
2	Understand the principle of effective stress, and then calculate stresses that influence soil behavior.	**2, 12**
3	Determine soil deformation parameters, and calculate settlement magnitude and rate of settlement.	**2, 4, 7**
4	Specify soil compaction requirements.	**5**
5	Conduct laboratory tests, and obtain soil properties and parameters from the test observations and results.	**8, 9, 10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3006	Geotechnical Engineering Lab	2	2		1	2		2	1	2	1		1

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3007	PBL-3	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites	**BTCE3001, BTCE3002, BTCE3003, BTCE3004**				
Co-requisites	--				

Course Objectives

1. To supplement the theoretical knowledge with project based learning.
2. To enable students to have a clear understanding in the courses.
3. To equip students with more technical knowledge and practical exposure.

Course Outcomes

On completion of this course, the students will be able to

1. Analyze statically indeterminate structures by strain energy method.
2. Design a two storey residential building.
3. Design a five storey RCC commercial building.
4. Study compressibility and consolidation of soil.
5. Study shear strength of soil.
6. Study waste water treatment plant.

Catalogue Description

Project based learning (PBL) is a teaching/learning technique in which students learn the courses by doing projects works in the related area. Although students do a major project in the last semester to apply their broad learning concept in real life world, the PBL gives them extra opportunity to apply concept in project `development to have experience in 'learning by doing'

Text Books

1. Vazirani & Ratwani (2003), Analysis of Structures, Vol. 1 & II, Khanna Publishers, ISBN: 0125249853.

2. Gambhir, M.L., (2011), "Fundamentals of Reinforced Concrete Design", Prentice-Hall of India. ISBN: 9788120330481.

3. Arun Kr. Jain, B.C. Punmia, Ashok Kr. Jain (2005), Soil Mechanics and Foundations, Sixteenth Edition, Laxmi Publications. ISBN: 978-81-700-8791-5.

4. Garg.S.K, (2010), Environmental Engineering-Sewage Disposal and Air Pollution Engineering, 1st Edition, Khanna Publishers, ISBN- 978-81-740-9230-4.

Reference Books

1. S. Ramamrutham (2004), Theory of Structures, 5thEdition, Dhanpat Rai Publications, ISBN: 978041528091.

2. S Unnikrishna Pillai & Devdas Menon, (2005), Reinforced Concrete Design, Tata Mcgraw Hill, ISBN: 9780070141100.

3. Arun Kr. Jain, B.C. Punmia, Ashok Kr. Jain (2005), Soil Mechanics and Foundations, Sixteenth Edition, Laxmi Publications. ISBN: 978-81-700-8791-5.

4. Metcalf & Eddy, (2002), Wastewater Engineering Treatment & Reuse, Tata McGraw-Hill Education, ISBN: 978-00-704-9539-5

Thrust areas of projects with tentative project titles

1. Analysis of statically indeterminate structures by strain energy method.
2. Design of a two storey residential building.
3. Design of a five storey RCC commercial building.
4. Study of compressibility and consolidation of soil.
5. Study of shear strength of soil.
6. Study of waste water treatment plant.

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Analyze statically indeterminate structures by strain energy method.	**1, 5, 9, 10**
2	Design a two storey residential building.	**1, 5, 9, 10**
3	Design a five storey RCC commercial building.	**1, 4, 9, 10**
4	Study compressibility and consolidation of soil.	**1, 4, 9, 10**
5	Study shear strength of soil.	**3, 4, 9, 10**
6	Study waste water treatment plant.	**3, 4, 9, 10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3007	PBL-3	2		2	1	1				2	1		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3008	CAD Lab-I (AUTOCAD)	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites//Exposure	BTCE3002				
Co-requisites	--				

Course Objectives

1. To understand the regulations as per National Building Code To analyse the structures.
2. To identify the functional requirements and building rules.
3. To understand the sketches and working drawings.

Course Outcomes

On completion of this course, the students will be able to

1. Implement the regulations for layout planning and preparation of drawings.
2. Prepare building drawings for residential building and hospital buildings by AUTOCAD.
3. Design the different projections of the buildings.

Catalogue Description

Building drawing is the important for the development of the knowledge about planning and regulations as per national building code. Students will learn about the Building Regulations as per National Building Code, Layout planning, preparation of line sketches and working drawing in accordance with functional requirements and building rules.

Text Books

1. V.B Sikka (2012), "Civil Engineering Drawing", S.K.Kataria & Sons, New Delhi. ISBN: 978-93-5014-272-1
2. N.Kumaraswamy (2012), A. Kameswara Rao "Building Planning & Drawing", Charotar Publishing House Pvt. Ltd. ISBN: 9789380358581
3. AUTOCAD Manuals

Reference Books

1. S.C Rangwala (2013), "Civil Engineering Drawing", Charotar Publishing House Pvt. Ltd. ISBN: 978-93-80358-68-0
2. Richard B. Eaton (2005), "Building Construction Drawing", Donhead Publisher. ISBN: 9780821805633.
3. Padmini Murugesan (1997), Civil Engineering Drawing, Prithiba Publishers and Distributors. ISBN: 81-7525-282-0.

Course Content

1. AUTOCAD commands, drawing of lines, circles and different types of polygon.
2. Drawing plan, elevation and cross-sectional views of one storey residential building.

3. Drawing of staircases.
4. Drawing plan, elevation and cross-sectional views of two storey residential building.
5. Drawing plan, elevation and cross-sectional views of five story commercial building.
6. Drawing plan, elevation and cross-sectional views of three story hospital building.
7. Drawing plan, elevation and cross-sectional views of ten story college building.
8. Drawing plan, elevation and cross-sectional views of workshop with trussed roof.

Mode of Evaluation: The subject understanding of students will be evaluated through lab performance, lab report and viva-voce.

Components	**Laboratory**		**laboratory**
	Internal	**SEE**	
Marks	50	50	
Total Marks	100		

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Implement the regulations for layout planning and preparation of drawings.	10
2	Prepare building drawings for residential building and hospital buildings by AUTOCAD.	5
3	Design the different projections of the buildings.	5

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3008	CAD Lab-I (AUTOCAD)					2					1		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3009	Design of Steel Structures	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3001				
Co-requisites	--				

Course Objectives

1. To understand the concepts of steel design.
2. To know the analysis and design of plate girder and gantry girder and its applications.
3. To know different types of roofs, calculation of forces and design of roof trusses.

Course Outcomes

On completion of this course, the student will be able to

1. Understand different types of structural rolled steel sections and their properties and design of connections.
2. Design laterally supported and unsupported beams.
3. Design built up column sections, lacings, battens, column bases and tension members.
4. Design plate girders and understand curtailment of flange plates and stiffeners.
5. Analyze and design roof trusses and purlins.

Catalogue Description

Students will understand the design of simple and built up beams, laterally supported and unsupported beams, design of plate girders, curtailment of flange plates, design of stiffeners and splices and design of gantry girder. Students will also understand the design of roof trusses, design of different types of overhead water tanks and design of beams and columns under combined stresses. Upon completion, students should be able to design simple and built up beams, plate girders, roof trusses and different types of overhead water tanks.

Text Book

1. Ramachandra (2004), Design of Steel structures, Vol. I & Vol. II, 4th Edition, Standard Publishers Distributors, ISBN: 9780071544115.

Reference Books

1. Vajrani V. N., Ratwani M. M. and Mehra H. (2012), Design and Analysis of Steel Structures, 18th Edition, Oscar Publications, ISBN: 9788174092953.
2. Syal I. C. (2009), Design of Steel Structures, Standard Publishers Distributors, New Delhi, ISBN: 9788180141270.
3. Ramchandra (2006), Non Linear Analysis of Steel Structures, Standard Publishers Distributors, ISBN:9788180140785.
4. IS: 800-2007 & Steel Table.

Course Content

Unit I: Introduction and Design of Connection **8 lecture hours**

Introduction, Types and properties of structural rolled steel sections, Design of connections – Riveted - Welded - Bolted – Solution of simple problems.

Unit II: Design of beams **8 lecture hours**

Simple and built-up beams – design of laterally supported and unsupported beams - concept of shear.

Unit III: Design of Compression Members and Tension Members **8 lecture hours**

Design of column – built up section – single and double lacing – batten – Column bases – design of tension members

Unit IV: Plate Girders **8 lecture hours**

Plate girders - design of plate girders - curtailment of flange plates – Concept of stiffeners and splices

Unit V: Roof Trusses **8 lecture hours**

Types of roof trusses - Calculation of dead load, live load, wind load – Analysis and design of roof truss – Design of purlins.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I&II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Understand different types of structural rolled steel sections and their properties and design of connections	**1,2,3,6**
2	Design laterally supported and unsupported beams	**1,2,3,6**
3	Design built up column sections, lacings, battens, column bases and tension members	**1,2,3,6**
4	Design plate girders and understand curtailment of flange plates and stiffeners	**1,2,3,6**
5	Analyze and design roof trusses and purlins	**1,2,3,6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3009	Design of Steel Structures	2	2	3			2						

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3010	Transportation Engineering	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	--				
Co-requisites	--				

Course Objectives

1. To teach the students about the different transportation systems.
2. To familiarise with various components involved in their respective modes and their basic design concepts.

Course Outcomes

On completion of this course, the students will be able to

1. Design various geometric elements of highways.
2. Understand the procedure to collect the traffic data for design and traffic management.
3. Test the highway materials as per IS/IRC guidelines.
4. Do structural design of flexible and rigid pavements.
5. Know various highway constructions techniques and its maintenance.

Catalogue Description

The importance of transportation engineering is very useful in our daily life. So the basics knowledge of transportation modes are important. The basic modes are railways, aircraft etc. So we will go through the introduction, characteristics, design and safety of railway, airport, dock and harbour. The understanding of the geometrical part of the transportation is more important.

Text Books

1. Khanna.S.K and Justo. C.E.G., (2011), Highway Engineering, Ninth Edition.

Reference Books

1. Kadiyali.L.R, and Lal.N.B, (2005), Principles and Practice of Highway Engineering, Fourth Edition, Khanna Publishers, ISBN- 9788174091659.
2. Chakroborthy Partha, and Das Animesh, (2003), Principles of Transportation Engineering, Eighth Printing, Prentice-Hall of India, ISBN-9788120320840.
3. Rao.G.V, (1996), Principles of Transportation and Highway Engineering, Tata McGraw-Hill Co, ISBN- 9780074623633.
4. Khisty.C.J, and Lall.B.K, (2003), Transportation Engineering, Indian Edition, Prentice-Hall of India, ISBN- 9788120322127.

Course Content

Unit I: Highway and Traffic Planning **8 lecture hours**

Introduction to Transportation modes – Highway alignment and field surveys – Master Plan – Transport economics – Traffic Studies – Volume, speed, origin and destination studies.
Introduction to Multi-modal Transportation, Automated Transport systems, High urban transport, Impact of transport on environment.

Unit II: Highway Geometrics **14 lecture hours**

Highway classification (Rural and Urban roads), Road Geometrics – Highway cross section elements – camber – Sight Distance, Horizontal Alignment Design, Super Elevation, Extra widening, Transition curves, Set back distance, Design of Vertical curves.

Unit III: Traffic Engineering **6 lecture hours**

Traffic characteristics, road user & vehicular characteristics, traffic studies, traffic operations, traffic control devices, intelligent transport systems, Intersections, Interchanges, Parking Layout & Road signs.

Unit IV: Highway Materials and Construction **8 lecture hours**

Material requirement for pavements – Soil classification for Highway – Soil tests – CBR and Plate Load Test, Aggregate – materials testing and specification, Bitumen – material testing and specification construction of bituminous and rigid pavements, Highway Maintenance – Material recycling.

Unit V: Highway Design **9 lecture hours**

Pavement Analysis – Factors affecting pavement thickness – Soil – Wheel load – Temperature – environmental factors; Flexible Pavement Design – Axle Load surveys – CBR method of Design, Rigid Pavement Design – IRC method.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Design various geometric elements of highways.	**2, 3, 12**
2	Understand the procedure to collect the traffic data for design and traffic management.	**3, 6, 11, 12**
3	Test the highway materials as per IS/IRC guidelines.	**6, 8, 12**
4	Do structural design of flexible and rigid pavements.	**3, 6, 11, 12**
5	Know various highway constructions techniques and its maintenance.	**1, 2, 11, 12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3010	Transportation Engineering	2	1	2			2		2			1	2

1=addressed to small extent
2= addressed significantly
3=major part of course

BTCE3011	Transportation Engineering Lab	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites//Exposure	BTCE3010				
Co-requisites	--				

Course Objectives

1. To impart the knowledge in testing of different highway materials as per IS/IRC guidelines.

Course Outcomes

On completion of this course, the students will be able to

1. Understand about aggregate crushing value test and aggregate impact test.
2. Perform Los Angeles Abrasion Test and Shape Test.
3. Understand different procedures for testing bitumen.
4. Test the highway materials as per IS/IRC guidelines.
5. Carry out Spot Test and California Bearing Ratio Test.

Catalogue Description

Highway Engineering is a prominent aspect of surface transport. With basic knowledge of materials and soil mechanics, highway engineering deals with planning, design, construction, operation and maintenance of all types of roads. During the course, the students learn all aspects of Highway Engineering in detail. Upon completion, the student shall possess the basic knowledge of Highway Engineering along with an overview of advanced concepts like multi modal transport and Intelligent Transport Systems. The students should be able to perform the basic duties of a Highway Engineer.

Text Books

1. Khanna.S.K., and Justo. C.E.G., (2011), Highway Engineering, Ninth Edition, Nem.

Reference Books

1. Kadiyali.L.R., and Lal.N.B., (2005), Principles and Practice of Highway Engineering, Fourth Edition, Khanna Publishers, ISBN- 9788174091659.
2. Chakroborthy Partha, and Das Animesh, (2003), Principles of Transportation Engineering, Eighth Printing, Prentice-Hall of India, ISBN-9788120320840.
3. Rao.G.V., (1996), Principles of Transportation and Highway Engineering, Tata McGraw-Hill Co, ISBN- 9780074623633.
4. Khisty.C.J., and Lall.B.K., (2003), Transportation Engineering, Indian Edition, Prentice-Hall of India, ISBN- 9788120322127.

List of Experiments:

1. Aggregate Crushing Value Test
2. Aggregate Impact Test
3. Los Angeles Abrasion Test
4. Shape Test
5. Penetration Test of Bitumen
6. Ductility Test of Bitumen
7. Softening Point Test of Bitumen
8. Flash and Fire Point Test of Bitumen
9. Viscosity Test of Bitumen
10. Spot Test
11. California Bearing Ratio Test

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**		**laboratory**
	Internal	**SEE**	
Marks	50	50	
Total Marks	100		

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and Pos		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Understand about aggregate crushing value test and aggregate impact test.	**2, 3**
2	Perform Los Angeles Abrasion Test and Shape Test.	**3**
3	Understand different procedures for testing bitumen.	**6, 9**
4	Test the highway materials as per IS/IRC guidelines.	**3, 7**
5	Carry out Spot Test and California Bearing Ratio Test.	**10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3011	Transportation Engineering Lab		2	3			3	2		1	1		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3012	PBL-4	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites	**BTCE3002, BTCE3009, BTCE3010**				
Co-requisites	--				

Course Objectives

1. To supplement the theoretical knowledge with project based learning.
2. To enable students to have a clear understanding in the courses.
3. To equip students with more technical knowledge and practical exposure.

Course Outcomes

On completion of this course, the students will be able to

1. Design a seismic resistant high rise residential apartment.
2. Design roof truss for an industrial building.
3. Design flexible pavement.
4. Carry out studies on traffic.

Catalogue Description

Project based learning (PBL) is a teaching/learning technique in which students learn the courses by doing projects works in the related area. Although students do a major project in the last semester to apply their broad learning concept in real life world, the PBL gives them extra opportunity to apply concept in project `development to have experience in 'learning by doing'

Text Books

1. Gambhir, M.L., (2011), "Fundamentals of Reinforced Concrete Design", Prentice-Hall of India. ISBN: 9788120330481.

2. Vajrani V. N., Ratwani M. M. and Mehra H. (2012), Design and Analysis of Steel Structures, 18th Edition, Oscar Publications, ISBN: 9788174092953.

3. Ramchandra (2006), Non Linear Analysis of Steel Structures, Standard Publishers Distributors, ISBN:9788180140785.

4. Khanna.S.K and Justo. C.E.G., (2011), Highway Engineering, Ninth Edition.

5. Kadiyali.L.R, and Lal.N.B, (2005), Principles and Practice of Highway Engineering, Fourth Edition, Khanna Publishers, ISBN- 9788174091659.

Reference Books

1. S. Ramamrutham (2004), Theory of Structures, 5thEdition, Dhanpat Rai Publications, ISBN: 978041528091.

2. S Unnikrishna Pillai & Devdas Menon, (2005), Reinforced Concrete Design, Tata Mcgraw Hill, ISBN: 9780070141100.

3. Ramchandra (2006), Non Linear Analysis of Steel Structures, Standard Publishers Distributors, ISBN:9788180140785.

4. Chakroborthy Partha, and Das Animesh, (2003), Principles of Transportation Engineering, Eighth Printing, Prentice-Hall of India, ISBN-9788120320840.

5. Rao.G.V, (1996), Principles of Transportation and Highway Engineering, Tata McGraw-Hill Co, ISBN- 9780074623633.

Thrust areas of projects with tentative project titles

1. Design of a seismic resistant high rise residential apartment.
2. Design of roof truss for an industrial building.
3. Design of flexible pavement.
4. Studies on traffic.

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Design a seismic resistant high rise residential apartment.	**1, 3, 4, 5, 9, 10**
2	Design roof truss for an industrial building.	**1, 3, 4, 5, 9, 10**
3	Design flexible pavement.	**1, 4, 9, 10**
4	Carry out studies on traffic.	**1, 4, 9, 10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3012	PBL-4	2		2	1	1				2	1		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3013	CAD Lab – II (STAAD PRO)	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites	BTCE3001, BTCE3002, BTCE3009				
Co-requisites	--				

Course Objectives

1. To teach the students to understand the details of STAAD – PRO software package.
2. To enable the students to know the behaviour of RCC and Steel structures.
3. To enable the students to design different components of structures

Course Outcomes

On completion of this course, the students will be able to

1. Understand the details of STAAD – PRO software package.
2. Know the behavior of RCC and Steel structures.
3. Know the bending moment diagram drawn in tension face and shear force diagram.
4. Design different components of structures.

Catalogue Description

Students will learn the details of STAAD - PRO software package and know the behaviour of RCC and Steel structures. Students will understand the bending moment diagram, drawn in tension face and shear force diagram. Upon completion, students should be able to design different components of RCC and Steel structures

Text Book

1. V. N. Vazirani & M. M. Ratwani, (1998), Analysis of Structures, Khanna Publishers
2. STAAD PRO Manuals

Reference Books

1. R. L. Jindal, (1996), Indeterminate Structures, Tata McGraw Hill Publishing House.
2. G. S. Pandit & Gupta S. P., (1998), Structural Analysis (A matrix approach), Tata McGraw Hill Publishing Ltd.
3. Wang C. K., (1996), Matrix Method of Structural Analysis, Jon Wiley publications.
4. IS:456 (2000), IS:800

5. Ramachandra (2004), Design of Steel structures, Vol. I & Vol. II, 4th Edition, Standard Publishers Distributors, ISBN: 9780071544115.

6. Gambhir, M.L., (2011), "Fundamentals of Reinforced Concrete Design", Prentice-Hall of India. ISBN: 9788120330481.

List of experiments:

1. Analysis and design of simply supported RCC beam.
2. Analysis and design of cantilever RCC beam.
3. Analysis and design of continuous RCC beam.
4. Analysis and design of simply supported Steel beam.
5. Analysis and design of continuous Steel beam.
6. Analysis and design of RCC columns with different end conditions.
7. Analysis and design of Steel columns with different end conditions.
8. Analysis and design of steel trusses.
9. Analysis and design of RCC portal frames.
10. Analysis and design of steel portal frames.

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**		**Laboratory**
	Internal	**SEE**	
Marks	50	50	
Total Marks	100		

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Understand the details of STAAD – PRO software package.	**5**
2	Know the behavior of RCC and Steel structures.	**5**
3	Know the bending moment diagram drawn in tension face and shear force diagram.	**5**
4	Design different components of structures.	**5, 9, 10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3013	CAD Lab – II (STAAD PRO)			3		3				2	1		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE4001	Internship	L	T	P	C
Version1.05	Date of Approval:	-	-	-	1
Pre-requisites	--				
Co-requisites	--				

Course Objectives

1. To gain first-hand experience of working as an engineering professional, including the technical application of engineering knowledge.
2. To experience the discipline of working in a professional organisation and multidisciplinary team.
3. To develop technical, interpersonal and communication skills.

Course Outcomes

On completion of this component of curriculum, the students will be able to

1. Apply engineering knowledge in solving real-life problems.
2. Attain new skills and be aware of the state-of-art in engineering disciplines of their own interest.
3. Get exposure to real-life-working environment & practices, and to attain the professionalisms.
4. Work with multi-tasking professionals and multidisciplinary team.
5. Prepare a technical report, to improve presentation and other soft skills.

Catalogue Description

The prime purpose of Industrial training is to prepare students for employment in their chosen profession. Studies at university should be enhanced by providing them opportunity to relate academic and professional aspects of engineering disciplines with industrial experience. The Industrial Internship Program is a three-way partnership of students, university and employer that has benefits for all participants. Industrial Internship ensures that interns get to learn the basics by doing and assisting senior engineers on real projects. Practical experience gained during internship is as important as grades in engineering courses. With the hands-on training, students learn how to apply class-taught skills in solving real life problems. Students will attend Industrial internship of four weeks in any industry or reputed organization after the examination in summer vacation.

Course Content

Exposure to real life problems at various reputed industries engaged in areas of Civil Engineering.

Mode of Evaluation

The evaluation of this training shall be included in the next semester evaluation. The student will be assigned a faculty guide who would be the supervisor of the student. The faculty will be identified before the end of the examination.

Students have to prepare an exhaustive technical report of the internship undertaken which will be duly signed by the officer under whom internship was taken in the industry/ organization. The covering format shall be signed by the concerned faculty in-charge of the student. The officer-in-charge would also give his rating of the student in a sealed envelope to the Dean of the SOCE. The student at the end of internship will present his report about the internship before a committee constituted by the Dean of the School which would be comprised of at least three members comprising of the Division Chair/Program Chair. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Dean.

The marks by the external examiner would be based on the report submitted by the student which shall be evaluated by the external examiner and cross examination done of the student concerned. Not more than three students would form a group for such industrial internship.The final evaluation of the Industrial Internship will be based on the following criteria:

1. Presentation and contents of the report demonstrating well developed communication skill.
2. The professionalism displayed by the student during industrial training including the scope of quality industrial training attained.
3. Contribution of the employer in providing quality training and relevance of the student's industrial training to their degree.
4. Marks/grades for this course will be withheld until students complete the training. Without this mark/grade students cannot graduate.

Components	**Internship Progress Report**		**Final Evaluation**	
	Internal Supervisor	**Industry Supervisor**	**Project Report**	**Presentation and Viva voice**
Marks	25	25	25	25
Total Marks	50		50	
Overall Marks	100			

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and Pos		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Apply engineering knowledge in solving real-life problems.	**1,2**
2	Attain new skills and be aware of the state-of-art in engineering disciplines of their own interest.	**5**
3	Get exposure to real-life-working environment & practices, and to attain the professionalisms.	**12**
4	Work with multi-tasking professionals and multidisciplinary team.	**9**
5	Prepare a technical report, to improve presentation and other soft skills.	**10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE4001	Internship	1	2			1				1	2		1

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE9998	Project Work - 1	L	T	P	C
Version1.05	Date of Approval:	0	0	6	3
Pre-requisites	--				
Co-requisites	--				

Course Objectives

1. To develop the capacity of students in correlating theoretical knowledge into practical systems either to perform creative works or to perform analysis and hence to suggest solutions to problems, pertaining to civil engineering domain.
2. Foster collaborative learning skills.
3. Develop self-directed inquiry and life-long skills.
4. To enhance the communication skills of the students by providing opportunities to discuss in groups and to present their observations, findings and report in formal reviews both in oral and written format.

Course Outcomes

On completion of this course, the students will be able to

1. Submit a project synopsis comprising of the application and feasibility of the project.
2. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health care, safety and sustainability.
3. Work and communicate efficiently in multidisciplinary teams.
4. Identify, formulate, and solve engineering problems.
5. Develop an understanding of professional and ethical responsibility.

Catalogue Description

The project work can be an investigative analysis of a technical problem in the relevant area, planning and/or design project, experimental project or computer application based project on any of the topics. Each project group will submit project synopsis within three weeks from start of seventh semester. Project evaluation committee consisting of three or four faculty members specialised in the various fields of department, shall study the feasibility of each project work before giving consent.

Course Content

Project work is of duration of two semesters and is expected to be completed in the eighth semester. Each student group consisting of not more than five members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project batches are expected to fix their topics, complete preliminary studies like literature survey, field measurements etc. in the seventh semester.

Mode of Evaluation:

The evaluation committee shall consist of faculty members constituted by the Dean of School which will comprise of at least three members comprising of the Division Chair/Program Chair a nominee of the Dean. The students guide would be a special invitee to the presentation. The seminar session shall be an

open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Dean. There will not be more than three students for a group for such project submission.

The assessment of all the projects should be done at the end of the seventh semester by the project evaluation committee formed. The students will present their project details and progress of their project to the committee. The complete project report is not expected at the end of the seventh semester. However, a three-four page typed report based on the work done should be submitted by each student to the assessing committee. The assessment committee and project guides will award the marks for the individual students in a project as follows:

- 20% of the marks is to be awarded by the guide
- 30% of the marks during the reviews (I, II and III)
- 50% by the evaluation committee during the final viva-voice examinations

Components	**Project Progress Report**	**Final Evaluation**	
	Internal Supervisor	**Project Report**	**Presentation and Viva voice**
Marks	20	30	50
Total Marks	100		

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and Pos		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Submit a project synopsis comprising of the application and feasibility of the project.	**1, 3, 5**
2	Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health care, safety and sustainability.	**6, 7, 8, 9, 10**
3	Work and communicate efficiently in multidisciplinary teams	**8, 9, 10**
4	Identify, formulate, and solve engineering problems.	**2, 3**
5	Develop an understanding of professional and ethical responsibility.	**8, 11, 12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE9998	Project - 1	3	3	3	3	2	2	2	2	3	3	2	2

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE9999	Project Work - 2	L	T	P	C
Version1.05	Date of Approval:	0	0	18	9
Pre-requisites	--				
Co-requisites	--				

Course Objectives

1. To develop the capacity of students in correlating theoretical knowledge into practical systems either to perform creative works or to perform analysis and hence to suggest solutions to problems, pertaining to civil engineering domain.
2. Foster collaborative learning skills.
3. Develop self-directed inquiry and life-long skills.
4. To enhance the communication skills of the students by providing opportunities to discuss in groups and to present their observations, findings and report in formal reviews both in oral and written format.

Course Outcomes

On completion of this course, the students will be able to

1. Submit a project synopsis comprising of the application and feasibility of the project.
2. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health care, safety and sustainability.
3. Work and communicate efficiently in multidisciplinary teams.
4. Identify, formulate, and solve engineering problems.
5. Develop an understanding of professional and ethical responsibility.

Catalogue Description

The project work can be an investigative analysis of a technical problem in the relevant area, planning and/or design project, experimental project or computer application based project on any of the topics. Each project group will submit project synopsis within three weeks from start of seventh semester. Project evaluation committee consisting of three or four faculty members specialised in the various fields of department, shall study the feasibility of each project work before giving consent.

Course Content

Project work is of duration of two semesters and is expected to be completed in the eighth semester. Each student group consisting of not more than five members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project batches are expected to fix their topics, complete preliminary studies like literature survey, field measurements etc. in the seventh semester.

Mode of Evaluation:

The evaluation committee shall consist of faculty members constituted by the Dean of School which will comprise of at least three members comprising of the Division Chair/Program Chair a nominee of the Dean. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the

committee separately in a sealed envelope to the Dean. There will not be more than three students for a group for such project submission.

The assessment of all the projects should be done at the end of the seventh semester by the project evaluation committee formed. The students will present their project details and progress of their project to the committee. The complete project report is not expected at the end of the seventh semester. However, a three-four page typed report based on the work done should be submitted by each student to the assessing committee. The assessment committee and project guides will award the marks for the individual students in a project as follows:

- 20% of the marks is to be awarded by the guide
- 30% of the marks during the reviews (I, II and III)
- 50% by the evaluation committee during the final viva-voice examinations

Components	**Project Progress Report**	**Final Evaluation**	
	Internal Supervisor	**Project Report**	**Presentation and Viva voice**
Marks	20	30	50
Total Marks	100		

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and Pos		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Submit a project synopsis comprising of the application and feasibility of the project.	**1, 3, 5**
2	Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health care, safety and sustainability.	**6, 7, 8, 9, 10**
3	Work and communicate efficiently in multidisciplinary teams	**8, 9, 10**
4	Identify, formulate, and solve engineering problems.	**2, 3**
5	Develop an understanding of professional and ethical responsibility.	**8, 11, 12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE9999	Project - 2	3	3	3	3	2	2	2	2	3	3	2	2

1=addressed to small extent

2= addressed significantly

3=major part of course

PROGRAMME ELECTIVES

BTCE3014	Advanced Structural Analysis	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3001				
Co-requisites	--				

Course Objectives

1. To enable the students to understand the behaviour of indeterminate structures.
2. To help the students to know the concepts of elastic analysis and plastic analysis.
3. To teach students about the concepts of matrix analysis of structures.

Course Outcomes

On completion of this course, the students will be able to

1. Understand the concept of kinematic indeterminacy, static indeterminacy and plastic analysis.
2. Analyse continuous beams, plane frames and pin jointed plane trusses.
3. Calculate flexibility matrix and stiffness matrix for different types of structures, shape factor and plastic moment of resistance for beam sections.

Catalogue Description

Students learn the behaviour of indeterminate structures, concepts of static indeterminacy and kinematic indeterminacy, use of slope deflection method, moment distribution method and theorem of three moments for analyzing structures. Students also learn the plastic analysis of structures. Students understand the use of matrix methods for analyzing structures. Upon completion, students should be able to analyze structures by slope deflection method, flexibility matrix method and stiffness matrix method.

Text Books

1. Ashok K. Jain, (2009), Advanced Structural Analysis with Finite Element & Computer Applications, Nem Chand & Brothers, ISBN 978-81-852-4081-7.
2. Hibbeler, R. C. (2005), Structural Analysis (5th Ed.), Pearson Education India, ISBN-10: 0131470892.
3. S. S. Bhavikatti, (2005), Structural Analysis, 2nd edition, Vikas Publishing House, ISBN: 812-59-171-60.

Reference Books

1. R. L. Jindal (1996), Indeterminate Structures, Tata McGraw Hill Publishing House.
2. Negi L. S. (2002), Theory & Problems in Structural Analysis, Tata McGraw Hill Publishing House.
3. G. S. Pandit & Gupta S. P. (1998), Structural Analysis (A matrix approach), Tata McGraw Hill Publishing Ltd.

Course Content

Unit I: Slope deflection method **9 lecture hours**

Kinematic indeterminacy - Slope deflection method - analysis of continuous beams and portals - bending moment and shear force diagram.

Unit II: Plastic Analysis **9 lecture hours**

Plastic moment of resistance - shape factor - collapse load - analysis of continuous beams and portals.

Unit III: Flexibility matrix **9 lecture hours**

Concept of flexibility matrix - analysis of continuous beams - plane frames and pin jointed plane trusses.

Unit IV: Stiffness matrix **9 lecture hours**

Stiffness matrix for beam element - analysis of continuous beams - plane frames & pin jointed plane trusses.

Unit V: Approximate Methods for Analysis of Multi-storeyed Frames **9 lecture hours**

Substitute frame method - portal method - cantilever method and Kani's method.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Understand the concept of kinematic indeterminacy, static indeterminacy and plastic analysis.	**1, 9, 10**
2	Analyse continuous beams, plane frames and pin jointed plane trusses.	**2**
3	Calculate flexibility matrix and stiffness matrix for different types of structures, shape factor and plastic moment of resistance for beam sections.	**3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3014	Advanced Structural Analysis	3	3	2						1	1		

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3015	Advanced Concrete Design	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3002				
Co-requisites	--				

Course Objectives

1. To enable the students to learn the limit state method of design of concrete members.
2. To enable the students to understand the concepts of advanced concrete design for different structures.

Course Outcomes

After completion of this course will be able to

1. Design different types of RC footings.
2. Design dog legged and open well stair case.
3. Design cantilever and counterfort retaining walls.
4. Understand the concept of yield line theory.
5. Design continuous beams and understand the concept of moment redistribution.

Catalogue Description

Students will learn the concept of designing footings, stair cases, cantilever and counterfort type of retaining walls. Students will also learn the concept of yield line theory, design of continuous beams.

Text Book

1. Gambhir, M.L., (2011), Design of Reinforced Concrete Structures, ISBN: 9788120331938.

Reference Books

1. Varghese, P.C., (2009), Advanced Reinforced Concrete Design, 2nd ed. ISBN: 9788120327870.
2. Jain, A.K., (1999) "Reinforced Concrete: Limit State Design 7th Edition, ISBN: 8185240663.
3. IS:456 (2000) & SP:16

Course Content

Unit I: Design of Footings **8 lecture hours**

Types of foundation - Design of isolated footing - combined footing – Concept of raft footing and well foundation

Unit II: Design of Stair Cases **8 lecture hours**

General specifications, Types of stair cases, Loads on stair cases, Effective span of stairs, Design of dog legged stair case, Design of open well stair case

Unit III: Retaining Walls **8 lecture hours**

General specifications, Forces acting on retaining walls, Stability consideration, Wall proportioning, Design of cantilever retaining walls and counterfort retaining walls

Unit IV: Yield Line Theory **8 lecture hours**

Yield line pattern, Moment capacity along yield line, Ultimate load on slabs, Analysis by virtual work method and equilibrium method.

Unit V: Design of Continuous Beams **8 lecture hours**

Design of continuous RC beams, Plastic hinge, Moment redistribution.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Design different types of RC footings	**1,2,3,4,6**
2	Design dog legged and open well stair case	**1,2,3,4,6**
3	Design cantilever and counterfort retaining walls	**1,2,3,4,6**
4	Understand the concept of yield line theory	**1,2,3,4,6**
5	Design continuous beams and understand the concept of moment redistribution	**1,2,3,4,6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3015	Advanced Concrete Design	2	2	3	2		1						

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3016	Quantity Surveying and Estimating	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE2003				
Co-requisites	--				

Course Objectives

1. To understand the types of estimates.
2. To identify the methods of quantity estimation used for different structural components.
3. To understand rate analysis and process of preparation of bill of quantity.

Course Outcomes

On completion of this course, the students will be able to

1. Prepare a detailed estimate for different types of structures.
2. Prepare valuation reports and cost quality control.
3. Estimates the quantity of items and analyse its rates considering material, labour and machinery cost with the help of software.

Catalog Description

Through this course the student will learn about various types of estimates and different estimating procedures for different structural elements. They also learn rate analysis and making bill of quantities.

Text Books

1. B.N. Datta (2010), Estimating and costing, USBPD. ISBN 9788174767295.

Reference Books

1. Rangwala (2011), Specifications of Estimating, Costing and Valuation, Charotar Publishing House Pvt. Ltd. ISBN 9789380358543.
2. Vazirani, V. N. (2013), Civil Engineering Estimating Costing & Valuation, Khanna publishers. ISBN 9788174091277.

Course Content

Unit I: Estimation of building **10 lecture hours**

Estimation of building works – Procedure of estimating, Types of estimates, detailed estimate of buildings including sanitary & electrical fittings.

Unit II: Estimate of R.C.C and Steel works **9 lecture hours**

Estimate of R.C.C and Steel works - Scheduling - Slab - beam - column & trusses, Road – earthwork fully in banking, cutting, partly cutting & partly filling - Detailed estimate for WBM, Bituminous road.

Unit III: Rate analysis & preparation of bills **8 lecture hours**

Rate analysis - preparation of bills – Data analysis of rates for various items of works – abstract estimates for Building projects – Introduction to software for Bill of Quantities & estimates.

Unit IV: Valuation **9 lecture hours**

Valuation- rent fixation, tenders, - contracts –accounting procedure, measurement book, stores, cost & quality control – PWD & CPWD practice.

Unit V: Detailed specifications and Schedule of Rates **9 lecture hours**

Specifications of various items of works - Schedule of Rates.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Prepare a detailed estimate for different types of structures.	**2**
2	Prepare valuation reports and cost quality control.	**2, 11**
3	Estimates the quantity of items and analyse its rates considering material, labour and machinery cost with the help of software.	**11**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3016	Quantity Surveying and Estimating		2									3	

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3017	Bridge Engineering	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3002				
Co-requisites	--				

Course Objectives

1. To understand the design and codal concepts of different types of bridges.

Course Outcomes

On completion of this course, the students will be able to

1. Understand IRC Code.
2. Use Pigeauds curves for designing deck slab for T-beam Bridge.
3. Understand Courbon's method of load distribution to analyze and design girders for T-beam Bridge.
4. Design plate girders and steel truss bridges.
5. Design piers and abutments.

Catalog Description

A bridge is a structure built to span physical obstacles such as a body of water, valley, or road, for the purpose of providing passage over the obstacle. There are many different designs that all serve unique purposes and apply to different situations. Designs of bridges vary depending on the function of the bridge, the nature of the terrain where the bridge is constructed and anchored, the material used to make it, and the funds available to build it.

Text Books

1. Victor D. J. (2008), Essentials of Bridge Engineering, 6th Edition, Oxford University Press, ISBN: 9788120417175.
2. Ramachandra (2004), Design of Steel structures, 4th Edition, Standard Publishers Distributors, ISBN: 9780071544115.

Reference Books

1. Duggal S. K. (2008), Design of Steel Structures, 3rd Edition, Tata McGraw-Hill, ISBN: 9780070260689.
2. IRC Bridge Code.

Unit I: Introduction and design of slab culvert **8 lecture hours**

Site selection, various types of bridges, loads on bridges according to IRC codes, Design of RC bridges under concentrated loads using effective width method

Unit II: Deck slab of T-Beam Bridges **8 lecture hours**

Pigeauds curves, Calculation of bending moments, Design of deck slab for T-beam Bridge for different types of vehicles

Unit III: Girders of T-Beam Bridge **8 lecture hours**

Courbon's method of load distribution, Analysis and design of girders for T-beam Bridge for different types of vehicles, Concept of box culverts.

Unit IV: Design of Plate Girders and Steel Trussed Bridges **8 lecture hours**

Design principles, Design and detailing of plate girder bridges, Types of trusses, Design of steel trussed bridges.

Unit V: Design of Substructures **8 lecture hours**

Types of piers, Forces acting on piers, Design of piers, General features of abutments, Forces acting on abutments, Design of abutments.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I&II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and Pos		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Understand IRC Code.	**1, 2, 3, 6**
2	Use Pigeauds curves for designing deck slab for T-beam Bridge	**1, 2, 3, 6**
3	Understand Courbon's method of load distribution to analyze and design girders for T-beam Bridge	**1, 2, 3, 6**
4	Design plate girders and steel truss bridges	**1, 2, 3, 6**
5	Design piers and abutments	**1, 2, 3, 6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3017	Bridge Engineering	2	1	2			1						

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3018	Applications of Matrix Methods in Structural Analysis	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3001				
Co-requisites	--				

Course Objectives

1. To understand the basic concepts of flexibility method and stiffness method.
2. To distinguish between force method and displacement method.
3. To understand the behaviour of plane trusses & plane frames.

Course Outcomes

On completion of this course, the students will be able to

1. Know the concept of static and kinematic indeterminacy.
2. Understand the concept of flexibility matrix method and stiffness matrix method.
3. Analyze plane trusses & plane frames.

Catalogue Description

Students learn the behaviour of indeterminate structures, concepts of static indeterminacy and kinematic indeterminacy. Students understand the use of flexibility matrix method and stiffness matrix method for analyzing structures. Upon completion, students should be able to analyze structures by flexibility matrix method and stiffness matrix method and use STAAD – PRO software package for analyzing indeterminate structures.

Text Books

1. Pundit G.S., & Gupta S.P., (2008), Structural Analysis (A matrix approach), Tata McGraw Hill Publishing Ltd.
2. Amin Ghali, Adam M Neville and Tom G Brown, “Structural Analysis: A Unified Classical and Matrix Approach”. Sixth Edition, 2007, Chapman & Hall.

Reference Books

1. DevdasMenon, "Advanced Structural Analysis"(2009), Narosa Publishing House
2. DevdasMenon, "Structural Analysis"(2008), Narosa Publishing House, 2008
3. A.S.Meghre & S.K.Deshmukh, “Matrix Methods of Structural Analysis” (2010) Charotar Publishing House Pvt. Ltd.
4. Kanchi M. B., “Matrix Methods of Structural Analysis” (2002), Wiley Eastern Limited, New Delhi,
5. Ganju T. N., “Matrix Structural Analysis using Spreadsheets” (2002),TMH Publishing Co. Ltd. New Delhi.

Course Content

Unit I: Introduction to Flexibility Matrices and Stiffness Matrices **9 lecture hours**
Flexibility and stiffness matrices- relationship between flexibility and stiffness matrices - properties of stiffness and flexibility matrices - concept of co-ordinates - solution of simple problems.

Unit II: Analysis of Beams by Flexibility Matrix Method **9 lecture hours**
Flexibility matrices for beams - solution of statically indeterminate beams – shear force diagram and bending moment diagram.

Unit III: Analysis of Beams by Stiffness Matrix Method **9 lecture hours**
Stiffness matrices for beams - solution of kinematically indeterminate beams – shear force diagram and bending moment diagram.

Unit IV: Analysis of Plane Truss by Stiffness Matrix Method **9 lecture hours**
Stiffness matrices for plane truss - solution of simple problems.

Unit V: Analysis of Plane Frame by Stiffness Matrix Method **9 lecture hours**
Stiffness matrices for plane truss - solution of simple problems.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Know the concept of static and kinematic indeterminacy.	**1**
2	Understand the concept of flexibility matrix method and stiffness matrix method.	**2**
3	Analyze plane trusses & plane frames.	**3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3018	Applications of Matrix Methods in Structural Analysis	1	2	1									

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3019	Expansive Soil and Ground Improvement Techniques	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3003				
Co-requisites	--				

Course Objectives

1. To understand problems related to expansive soils.
2. To identify preventive measures for mitigating effect of soil expansion on structures founded on expansive soil.
3. To find out proper methods of ground improvement.
4. To understand various soil engineering problems.
5. To use geo-textiles and stabilizers for soil improvement.

Course Outcomes

On completion of this course, the students will be able to

1. Know the physical & mineralogical properties of expansive soil.
2. Conduct tests for identification of swelling soil.
3. Design suitable method for improving properties of expansive soil.
4. Choose correct method for ground improvement.
5. Design grouting process for various soil engineering problems.

Catalog Description

Expansive soils are soils that expand when water is added, and shrink when they dry out. This continuous change in soil volume causes homes built on this soil to move unevenly and crack. Each year in the United States, expansive soils cause $2.3 billion in damage to houses, other buildings, roads, pipelines, and other structures. This is more than twice the damage from floods, hurricanes, tornadoes, and earthquakes combined.

Ground improvement techniques are one of the important aspects for soil stabilization. It can be done by adding materials, stone column, sand drains etc. Compaction is required for the Ground improvement techniques and its type vary with the type of soils. Sometime grouting and geo-textiles materials are also used for Ground improvement.

Text Books

1. Swami Saran (2008), Analysis and Design of sub structures 2nd edition, Limit State Design, Oxford & IBH Publishing Co. Pvt Ltd., 66, Janpath, New Delhi. ISBN: 978-81-204-1700-7.
2. F.H.Chen (1995), Foundations in Expansive Soils, Elseivier Publications. ISBN: 978-04-444-3036-6.
3. Nihar Ranjan Patra (2012), Ground improvement techniques, 1st Edition, Vikas Publishing House. ISBN: 978-93-259-6001-5.

4. Nelson, John D. Nelson, Ron Miller (1997), Expansive Soils: Problems and Practice in Foundation and Pavement Engineering New edition, Wiley-Interscience. ISBN: 978-04-711-8114-9.

Reference Books

1. R.E.Peck, W.E.Hansen&T.H.Thornburn (2004), Foundation Engineering, John Wiley. ISBN: 978-04-716-7585-3.
2. Varghese P.C (2009), Foundation Engineering 1st Edition, Prentice-Hall of India Private Limited. ISBN: 978-81-203-2652-1.
3. P. Purushothama Raj (1999), Ground Improvement Techniques 1st Edition, Laxmi Publications. ISBN: 978-81-318-0594-7.
4. Rao (1990), Engineering with Geo-synthetics, Mcgraw-hill Education. ISBN: 978-00-746-0323-9.

Course Content

Unit I: Origin, Occurrence and Identification of Expansive Soils **9 lecture hours**
Occurrence and distribution in India - Moisture equilibrium - Soil, structure, environmental interaction - Distress symptoms case histories - Soil Structure - Clay mineralogy Swell potential - Field exploration - laboratory tests for identification.

Unit II: Chemical stabilization and Special Foundation **9 lecture hours**
Mechanical alteration – Sand cushion technique - CNS concept – Chemical stabilization with lime, flyash and cement – Special foundations – Under-reamed piles – Straight-shafted drilled piers - Belled piers – Granular pile-anchors.

Unit III: Introduction to Ground Improvement Techniques **9 lecture hours**
Need and objectives of ground improvement, classification of ground modification techniques, suitability and feasibility, emerging trends in ground improvement, methods of de-watering, sumps and interceptor ditches, single, multi stage well points, vacuum well points, Horizontal wells, foundation drains, blanket drains, criteria for selection of fill material around drains, Electro-osmosis.

Unit IV: Stabilization **9 lecture hours**
Soil improvement by adding materials, lime, flyash, cement and other chemicals and bitumen, sand column, stone column, sand drains, prefabricated drains, lime column, soil-lime column, stabilization of soft clay or silt with lime, bearing capacity and settlement of treated soils, improvement in slope stability, control methods.

Unit V: Grouting **9 lecture hours**

Introduction, suspension grout, solution grout, grouting equipments and methods, grouting, design and layout granular piles – ultimate bearing capacity and settlement, method of construction, load test.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Know the physical & mineralogical properties of expansive soil.	**1**
2	Conduct tests for identification of swelling soil.	**4**
3	Design suitable method for improving properties of expansive soil.	**3, 4**
4	Choose correct method for ground improvement.	**1, 2**
5	Design grouting process for various soil engineering problems.	**3, 4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3019	Expansive Soil and Ground Improvement Techniques	1	1	2	1								

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3020	Advanced Geotechnical Engineering	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3003				
Co-requisites	--				

Course Objectives

1. To understand the design aspects of foundation.
2. To evaluate the stress developed in the soil medium.
3. To understand the framework of soil investigation.

Course Outcomes

On completion of this course, the students will be able to

1. Comprehend and utilize the geotechnical literature to establish the framework for foundation design.
2. Plan and implement a site investigation program including subsurface exploration to evaluate soil/structure behavior and to obtain the necessary design parameters.
3. Carry out slope stability analysis for various fills and slopes.
4. Determine allowable bearing pressures and load carrying capabilities of different foundation systems.
5. Understand theories of earth pressures and designing of retaining walls.

Catalogue Description

Geotechnical engineering is essential to understand the bearing capacity of soil and failure of soil in terms of settlements. First it requires soil exploration and type of soil decide the foundation for the structures e.g. shallow and deep foundation. Bearing capacity and failure conditions of soil would be analyzed by the Terzaghi's theory. Slope stability shows the failure conditions of soils. Finally earth pressure also has been discussed.

Text Books

1. Varghese P.C (2009), Foundation Engineering 1st Edition, Prentice-Hall of India Private Limited. ISBN: 978-81-203-2652-1.
2. Arun Kr. Jain, B.C. Punmia, Ashok Kr. Jain (2005), Soil Mechanics and Foundations Sixteenth Edition, Laxmi Publications. ISBN: 978-81-700-8791-5.

Reference Books

1. Shashi K. Gulhati & Manoj Datta (2005), Geotechnical Engineering 1st edition, Tata McGraw Hill Ltd. ISBN: 978-00-705-8829-5.
2. Donald P Coduto, William A. Kitch, Man-chu Ronald Yeung (2010), Geotechnical Engineering: Principles and Practices 2nd revised Edition, Pearson Education. ISBN: 978-01-313-5425-8.

3. Joseph E. Bowles (2006), Foundation Analysis and Design 5th edition, McGraw-Hill, New York. ISBN: 978-00-711-8844-9.
4. Braja M. Das (2007), Principles of Foundation Engineering 6th Edition, Nelson Engineering. ISBN: 978-81-315-0202-0.
5. Ramamurthy (2010), Engineering in Rocks for Slopes, Foundations and Tunnels, PHI Learning Private Limited. ISBN: 978-81-203-4168-5.

Course Content

Unit I: Soil Exploration and Types of Foundations **6 lecture hours**

Objective of site investigation - reconnaissance – detailed site investigation - methods of exploration – geophysical methods - seismic refraction survey. Depth of exploration – factors governing location and depth of foundation – types of foundations – selection of foundation – plate load test – standard penetration test.

Unit II: Capacity and Settlements of Shallow Foundations **10 lecture hours**

Terzaghi's theory of bearing capacity – general and local shear failure - effect of water table – design of footings – settlement of footings - immediate and time dependent settlement – permissible limits – differential settlement, introduction to Codal provisions.

Unit III: Deep Foundations **10 lecture hours**

Classification and selection of piles – static and dynamic formulae for single pile capacity – efficiency and capacity of pile groups – design of pile group – settlement of pile groups– load test on piles.

Unit IV: Slope Stability **9 lecture hours**

Failure of infinite and finite slopes – Swedish circle method – Factor of safety - slope stability of earth dams, introduction to Bishop's method – IS codes.

Unit V: Theories of Earth Pressure **10 lecture hours**

Definitions – Earth pressure at rest – Rankine's active and passive earth pressures - Coulomb's earth pressure theories – types of retaining walls and its design. Introduction of tunneling, ground improvement methods – compaction, deep compaction and fiber reinforced plastic and geo-textiles.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Comprehend and utilize the geotechnical literature to establish the framework for foundation design.	**1**
2	Plan and implement a site investigation program including subsurface exploration to evaluate soil/structure behavior and to obtain the necessary design parameters.	**3, 8**
3	Carry out slope stability analysis for various fills and slopes.	**2, 4, 7**
4	Determine allowable bearing pressures and load carrying capabilities of different foundation systems.	**2, 7**
5	Understand theories of earth pressures and designing of retaining walls.	**1, 2, 3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3020	Advanced Geotechnical Engineering	2	2	2	1			2	1				

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3021	Highway Pavement Design	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3010				
Co-requisites	--				

Course Objectives

1. To introduce various analysis and design procedures of different types of pavements.
2. To familiarise with maintenance, evaluation, strengthening and rehabilitation of the pavements.

Course Outcomes

On completion of this course, the students will be able to

1. Learn the basic principles of flexible and rigid pavements.
2. Demonstrate the ability to analyse and design the flexible and rigid pavements by applying various methods and thorough in construction procedures and the functions of pavements.
3. Ability to critically evaluate flexible and rigid pavements by deflection measurement.
4. Demonstrate the ability to apply strengthening techniques and rehabilitation of pavements.

Catalogue Description

Highway pavement design is the most important part of the traffic engineering. In this part principles and design of flexible and rigid pavement pavement will have discussed. Also the idea about pavement evaluation and its maintenance is required for better design.

Text Books

1. ChakroborthyPartha, and Das Animesh, (2003) “Principles of Transportation Engineering”, Eighth Printing, Prentice-Hall of India, ISBN-9788120320840.

Reference Books

1. Yoder.E.J., and Witczak. M. W., Principles of Pavement Design, Second Edition, John Wiley & Sons, ISBN-9780471977803.
2. Garber. Nicholas J., and Hoel. Lester A., (2009), Traffic & Highway Engineering, Fourth Edition, Cengage Learning, ISBN-9780495082507.
3. S.K. Sharma (1998), Principles, Practice and Design of Highway Engineering, S. Chand & Co Ltd, New Delhi.
4. Bruce.A.G. and Clarkeson.J., (1952), Highway Design and Construction, Third Edition, International Textbook Co.

Course Content

Unit I: General Principles of Pavement Design **10 lecture hours**

Components of a road and functions – factors affecting pavements stability – equivalent single wheel load – vehicle and traffic factors – moisture factors – climate factors – soil factors – stress distribution in different conditions – modulus of elasticity of various layers.

Unit II: Flexible Pavement Design **6 lecture hours**

Empirical method using soil classification tests – estimation of CBR value method of designing pavement – plate bearing test method Ashpalt Institute method – AASSO method – Burmister design method.

Unit III: Rigid Pavement Design **9 lecture hours**

Stresses in concrete pavement – IRC method – design of steel reinforcements – design of different joints in concrete pavements and their functions – construction of concrete pavements and their functions.

Unit IV: Pavement Evaluation **10 lecture hours**

Distresses in flexible pavements – distress in rigid pavements – service ability index – structural evaluation of flexible and rigid pave-ments – evaluation by deflection measurement – strengthening of pavements – flexible overlays – rigid overlays.

Unit V: Highway Maintenance **10 lecture hours**

Maintenance of Bituminous surface concrete roads and low cost roads – maintenance shoulders and drainage system – maintenance of bridges and road structures.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Learn the basic principles of flexible and rigid pavements.	**1**
2	Demonstrate the ability to analyse and design the flexible and rigid pavements by applying various methods and thorough in construction procedures and the functions of pavements.	**3**
3	Ability to critically evaluate flexible and rigid pavements by deflection measurement.	**2**
4	Demonstrate the ability to apply strengthening techniques and rehabilitation of pavements.	**2, 4, 7**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3021	Highway Pavement Design	1	1	2	1			1					

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3022	Traffic Engineering	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3010				
Co-requisites	--				

Course Objectives

1. To teach the concepts of traffic studies, traffic facilities and their regulations and management.
2. To understand the methods for efficient management of traffic in urban roads.

Course Outcomes

On completion of this course, the students will be able to

1. Perform traffic studies.
2. Know importance of traffic management.
3. Identify the specification of traffic facilities.

Catalogue Description

Traffic engineering and its management are the most important now a days. Its necessity followed by the traffic studies and its regulation. The most important is its management. Students will also study about the pavement design principles and pavement design of flexible and rigid pavement.

Text Books

1. Kadiyali.L.R. (2008), Traffic Engineering and Transportation Planning, Khanna Publishers, ISBN-9788174092205.
2. ChakroborthyPartha, and Das Animesh, (2003), Principles of Transportation Engineering, Eighth Printing, Prentice-Hall of India, ISBN-9788120320840.

Reference Books

1. Khisty.C.J., and Lall.B.K., (2003) “Transportation Engineering”, Indian Edition, Prentice-Hall of India , ISBN- 9788120322127.
2. Papacostas.C.S., and Prevedouros.P.D., (2001) “Transportation Engineering and Planning”, Indian Edition, Prentice-Hall of India , ISBN- 9788120321540.
3. Garber. Nicholas J., and Hoel. Lester A., (2009), Traffic & Highway Engineering, Fourth Edition, Cengage Learning, ISBN-9780495082507.

Course Content

Unit I: Traffic Studies **10 lecture hours**

Road user and Vehicle Characteristics - Traffic Studies -Traffic volume and composition - speed, Headway - Concentration and Delay & Flow principles - Capacity and level of service.

Unit II: Traffic Facilities **6 lecture hours**

Signals - Islands - Types and General layout of at-grade and grade separated intersections.

Unit III: Traffic Regulations and Management **9 lecture hours**

Traffic signs and markings - Parking practices - Traffic management measures.

Unit IV: General Principles and Flexible Pavement Design **10 lecture hours**

Factors affecting pavements stability – equivalent single wheel load – vehicle, soil, traffic & Climatic factors - stress distribution in different conditions - CBR method of design - AASSO method & Burmister design method.

Unit V: Rigid Pavement Design **10 lecture hours**

Stresses in concrete pavement – IRC method – design of steel reinforcements – Function of joints, design of joints in concrete pavements - Joint Fillers and sealant.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Perform traffic studies.	**1**
2	Know importance of traffic management.	**11**
3	Identify the specification of traffic facilities.	**6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3022	Traffic Engineering	1					1					2	

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3023	Advanced Transportation Engineering	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3010				
Co-requisites	--				

Course Objectives

1. To teach the students about the different transportation systems.
2. To familiarise with various components involved in their respective modes and their basic design concepts.

Course Outcomes

On completion of this course, the students will be able to

1. Demonstrate the ability to identify the components of railway track, their functions, alignment and the station yards.
2. Recognize and identify the requirement of an airport and the principle involved in it.
3. Learn to classify the harbours and demonstrate the ability to identify the components of a dock.

Catalogue Description

The importance of transportation engineering is very useful in our daily life. So the basics knowledge of transportation modes are important. The basic modes are railways, aircraft etc. So we will go through the introduction, characteristics, design and safety of railway, airport, dock and harbour. The understanding of the geometrical part of the transportation is more important.

Text Books

1. Chandra.S., and Agarwal. M.M., (2007), Railway Engineering, Oxford University Press India, ISBN- 9780195687798.
2. Rangwala.S.C., Rangwala.P.S., (2008), Airport Engineering, Charotar Publishing House Pvt. Limited, ISBN-9788185594972.
3. Oza.H.P., and Oza. G.H., (2011), Dock and Harbour Engineering, Sixth Edition, Charotar Publishing House Pvt., ISBN-9789380358383.

Reference Books

1. Arora.S.P., and Saxena. S.C., (2001), A Textbook of Railway Engineering, Sixth Edition, Dhanpat Rai Publications.
2. Khanna.S.K, and Arora.M.G. (1971), Airport Planning and Design, Nem Chand & Bros.
3. Rangwala.S.C, (1965), Principles of Railway Engineering, Charotar Publishing house.

Course Content

Unit I: Introduction to Railway Engineering **9 lecture hours**

History and administrative setup of Indian Railways; rail gauges, permanent way – functions, requirements, sections in embankment and cutting, stresses in different components of track, Types of joints and fastenings.

Unit II: Track Geometrics and Safety **9 lecture hours**

Requirements of Railway alignment, vertical alignment and horizontal alignment, points and crossings – terminologies, Turnouts – Types and design aspects, Signals classification and their functions, train operation control systems, interlocking of tracks.

Unit III: Introduction to airports and Aircraft Characteristics **9 lecture hours**

Air transport development in India, national and international organizations in air transport, aircraft characteristics and their impact on planning of an airport, selection of site for an airport, airport obstruction, imaginary surfaces, runway orientation clam period and wind coverage.

Unit IV: Geometric Designs and Airport Traffic control Aids **9 lecture hours**

Runway and taxiway geometric designs, exit taxiway, its design and fillet curves, runway configuration, separation clearance, design of apron and their layout. Visual aids, marking and lighting of runway and apron area, wind and landing direction indicator.

Unit V: Docks and Harbour Engineering **9 lecture hours**

Historical development in India , tides, winds & waves, docks, harbours, break waters, jetties, landing stages & wharves, dry docks, transit sheds, cargo handling, , inland water transport. Maintenance.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Demonstrate the ability to identify the components of railway track, their functions, alignment and the station yards.	**2, 3, 12**
2	Recognize and identify the requirement of an airport and the principle involved in it.	**3, 6, 11, 12**
3	Learn to classify the harbours and demonstrate the ability to identify the components of a dock.	**6, 8, 12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3023	Advanced Transportation Engineering		1	2			2		2			1	2

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3024	Ground Water Engineering	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE2009				
Co-requisites	--				

Course Objectives

1. To educate on ground water movement analysis & predictions.
2. To understand the concept to increase ground water potential.
3. To identify the sources of the ground water.

Course Outcomes

On completion of this course, the students will be able to

1. Identify the ground water flow & prediction.
2. Implement the Methods of improving the ground water potential.
3. Manage the ground water sources.

Catalog Description

This course covers fundamentals of subsurface flow and transport, emphasizing the role of groundwater in the hydrologic cycle, the relation of groundwater flow to geologic structure, and the management of contaminated groundwater. Introduction and definitions, groundwater storage and supply, Darcy's Law and its limitation, Dupuit approximation, steady and unsteady flows in confined and unconfined aquifers, radial flow towards wells, storage coefficient and safe yield in a water-table aquifer, design of wells, methods of drilling and construction, development of maintenance of wells.

Text Books

1. David Keith Todd (2005), Groundwater Hydrology, Third Edition, John Wiley & Sons Singapore. ISBN: 9780471059370.

Reference Books

1. Raghunath H.M. (2007), Groundwater, Third Edition, New Age International. ISBN: 9788122419047.
2. Abdel-Aziz ismailkashef (2008), Groundwater Engineering, McGraw-Hill International Editions, Newyork. ISBN: 9780071005333.

Course Content

Unit I: Occurrence and Movement of Groundwater **10 lecture hours**

Introduction to Hydrologic cycle – Origin and Age of groundwater, classification of groundwater, aquifer - water table - Darcy's Law, Coefficient of Transmissibility and storage - Flow rates and equation.

Unit II: Well Hydraulics **9 lecture hours**

Geophysical methods, study of radial flow - well flow, Multiple well system - characteristic well losses, open well, tube well, well depth, well screen - head losses through the screen gravel packing and formation stabilization.

Unit III: Analysis and Evaluation of Pumping Test **9 lecture hours**

Definition of terms - static water level, pumping level, drawdown – residual, drawdown pumping rate -automatic water level re-corder - time drawdown analysis - distance drawdown analysis, Jacob's methods, pumping test methods.

Unit IV: Pollution of Groundwater **8 lecture hours**

Injection methods-monitoring: - Cement lime, Lime - flyash and chemical stabilization, Deep mixing techniques.

Unit V: Groundwater Assessment and Budgeting **9 lecture hours**

Hydrological equilibrium - rain gauge network, runoff procedure for conducting infiltration test – artificial recharge, rainwater harvesting – calculation of groundwater storage capacity and groundwater potential.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and Pos		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Identify the ground water flow & prediction.	**1**
2	Implement the Methods of improving the ground water potential.	**1,2**
3	Manage the ground water sources.	**2, 3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3024	Ground Water Engineering	1	2	1									

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3025	Advanced Hydrology	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE2009				
Co-requisites	--				

Course Objectives

1. To understand the planning and construction of irrigation structures.
2. To have an idea about the construction of highway culverts and bridges.
3.To understand the measures of flood control and economic functioning of hydrologic structures.

Course Outcomes

On completion of this course, the students will be able to

1. Identify the different types & methods of irrigation for better water management.
2. Know the occurrence & distribution of natural waters of the earth.
3. Implement the practices of structural design facilities for water resources project.
4. Implement and study the planning and management for single & multipurpose projects.

Catalog Description

Introduction to Hydrology, Hydrologic Processes, Atmospheric and Subsurface Waterand hydrologic measurements.Unit Hydrograph, Hydrologic Design, Design Storm, Precipitation, streamflow and hydrograph analysis.Hydrologic flood routing.Statistical analysis in water resources.Groundwater hydrology.Engineering applications.

Text Books

1. Subramanya K. (2008), Engineering Hydrology, Tata McGraw Hill Co., Graw Hill Co. ISBN: 9780074624494.

Reference Books

1. Varshney R.S. (2012), Engineering Hydrology, Nem Chand & Brothers Publishers. ISBN: 8185240688.
2. Das (2009), Hydrology & Soil Conservation Engineering, Prentice-Hall of India. ISBN: 9788120335868.

Course Content

Unit I: Hydrograph **9 lecture hours**

Runoff - Factors affecting runoff – measurement – stream gauging – stage discharge relationship – Hydrograph components – Hydrograph separation – Module hydrograph – Derivation of Module Hydrograph – S. Hydrograph – Synthetic hydrograph.

Unit II: Ground Water Hydrology **9 lecture hours**

Ground water-Aquifers, Permeability & transmissibility- steady flow towards a well in confined & water table aquifer - Dupits & Theims equation - measurement of yield of an open well - Tube well & infiltration galleries. Interference among wells-well losses, comparison of well and flow irrigation.

Unit III: Canal Irrigation **9 lecture hours**

Sediment Transport- Importance & Mechanics of transport, bed load & suspended load- Estimation, Design of channels in India- Regime channels- Kennedy and Lacey's theory, Water logging- causes- effects- control measures, canal lining, Land Reclamation.

Unit IV: Dams and Reservoirs **9 lecture hours**

Classification of dams - factors governing their selection – elementary design of gravity dam – earthen dam – arch dam – spillways – energy depositors – spillway gates – important dams in India – Yield of reservoir – storage capacity – strategies and operation – sedimentation process – effects and control measures.

Unit V: Flood Analysis **9 lecture hours**

Empirical methods – statistical methods – flood routing – routing through reservoir routing – through channels (Muskinggum method) – flood forecasting.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and Pos		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Identify the different types & methods of irrigation for better water management.	**1**
2	Know the occurrence & distribution of natural waters of the earth.	**1,2**
3	Implement the practices of structural design facilities for water resources project.	**4**
4	Implement and study the planning and management for single & multipurpose projects.	**11**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3025	Advanced Hydrology	1	2		1							2	

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3026	Pollution Control and Monitoring	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites//Exposure	BTCE3004				
Co-requisites	--				

Course Objectives

1. To understand the factors that must be satisfied for potable water, land and air for the removal and treatment of pollutants.
2. To provide a strong link between the Pollution Damage, Public Authority Control Systems and Technical Control Systems
3. To know the relationship between social, legislative and biological constraints in a modern developed society.

Course Outcomes

On completion of this course, the students will be able to

1. Describe the principles of the biological and chemical treatment processes that are required to ensure adequate quality and quantities of potable water.
2. Implement the principal techniques currently in use for wastewater treatment and to review operational procedures for the plant involved.
3. Use advanced methods for monitoring and modeling spatial and temporal patterns of pollution.

Catalog Description

This course emphasizes pollutions in water, air, land. A brief discussion on water pollution due to industrial, agricultural and municipal wastes.Source of air pollution and effects of pollution on human health, vegetation and climate.Air quality monitoring and air pollution control legislation. Noise Pollution and Control, Solid Waste Management techniques and Environmental Sanitation system included in this course.

Text Books

1. Rao C.S. (2006), Environmental Pollution Control Engineering, New Age International, ISBN: 9788122418354.
2. Arcadio P Sincero, Gregoria A Sincero (2009), Environmental Engineering : A Design Approach, PHI Learning, ISBN: 9788120314740.

Reference Books

1. George Tchobanoglous, Donald R. Rowe, Howard S. Peavy, Environmental Engineering, McGraw-Hill Publishing Co., ISBN: 9780071002318.
2. P. AarneVesilind, Susan M. Morga (2004), Introducing to Environmental Engineering, Nelson Engineering, ISBN: 9780534378127.
3. Gerard Kiley (1996), Environmental Engineering, McGraw-Hill, ISBN: 978-0077091279.

Course Content

Unit I: Water Pollution & Control **9 lecture hours**

Natural process-pollution due to industrial, agricultural and municipal wastes-limitations of disposal by dilution-BOD consideration in streams – Oxygen Sag Curve-Water pollution control legislation.

Unit II: Air Pollution and Control **10 lecture hours**

Pollution and their sources-effects of pollution on human health, vegetation and climate-prevention and control of particulate-industry and air-pollution surveys and sampling-Air quality monitoring- air pollution control legislation.

Unit III: Noise Pollution and Control **8 lecture hours**

Sound and Noise: Sources of noise pollution – environmental and industrial noise; effects of noise pollution; fundamentals of sound generation, propagation etc; sound measurement; sound level meters – types, components, Measures for prevention and control of noise; environmental and industrial noise; noise control legislation.

Unit IV: Solid Waste Management **8 lecture hours**

Source characteristics – quantities – collection methods and disposal techniques – sanitary landfill – incineration – and pyrolysis, composting, aerobic and anaerobic- economics of composting; recycling and reuse.

Unit V: Environmental Sanitation **10 lecture hours**

Relation of food to disease-principles of food sanitation-sanitation of kitchens, restaurants and other catering establishments-quality changes in milk-milk as carrier of infection-pasteurisation of milk-HTST and LTLT processes – cattle shed sanitation. Orientation of buildings with respect to the direction of prevailing winds and solar movement. Air movement inside the buildings for a healthy residential environment.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and Pos		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Describe the principles of the biological and chemical treatment processes that are required to ensure adequate quality and quantities of potable water.	**1**
2	Implement the principal techniques currently in use for wastewater treatment and to review operational procedures for the plant involved.	**2, 3**
3	Use advanced methods for monitoring and modeling spatial and temporal patterns of pollution.	**3, 5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3026	Pollution Control and Monitoring	1		2		1							

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3027	Industrial Waste Treatment and Disposal	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3004				
Co-requisites	--				

Course Objectives

1. Get the adequate knowledge about phenomena of atmospheric environment and treatment, sources, characteristics and treatment processes of various types of industries.
2. Know the various processes of wastewater treatment of different industries and the engineering requirements for treatment facilities.
3. Design the waste treatment system for the different industry.

Course Outcomes

On completion of this course, the students will be able to

1. Provide solutions of physical, chemical and biological treatment and biosensors applied to biological process control
2. Use new techniques for collection, recycling and disposal and treatment of wastewater and solid wastes.
3. Design the wastewater supply and treatment technology.
4. Evaluate and monitor the treatment systems according to the need of different industries.

Catalog Description

Disposal of waste water generated from the industries is the major concern because of the problems and diseases associated with it. Students learn about types of industries, industrial pollution, characteristics of industrial wastes, waste management approach, waste audit, equalization, neutralization, chemical oxidation and physico-chemical treatment. Upon completion, students should be able to know about the characteristics of the different industrial and design the effluent treatment system for the industry.

Text Books

1. Patwardhan A.D. (2008), Industrial Waste Water Treatment, PHI Learning Pvt Ltd. ISBN: 978-81-203-3350-5
2. Nelson, L. Nemerow (2007), Industrial Waste Treatment: contemporary practice and vision for future, Elsevier Butterworth-Heinemann Publication. ISBN: 9780123724939

Reference Books

1. Woodard & Curran Inc. (2006), Industrial Waste Treatment Handbook, Second Edition, Elsevier Butterworth-Heinemann Publication. ISBN: 9780750679633
2. Thomas T. Shen (1999), Industrial Pollution Prevention, Springer publications. ISBN: 3540652086
3. W .W. Eckenfelder Jr. (2000), “Industrial Water Pollution Control”, McGraw-Hill Book Company, New Delhi. ISBN: 9780070393646

Course Content

Unit I: Industrial Pollution **10 lecture hours**

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health – Hazardous Wastes – Environmental legislations related to prevention and control of industrial effluents and hazardous wastes – Pollution Control Boards.

Unit II: Waste Management Approach **8 lecture hours**

Waste management approach – Waste Audit – Volume and strength reduction – material and process modifications – Recycle, reuse and byproduct recovery – Applications.

Unit III: Liquid Waste Treatment Techniques **10 lecture hours**

Equalization – Neutralization – removal of suspended and dissolved organic solids - Chemical oxidation – Removal of dissolved inorganics – Combined treatment of industrial and municipal wastes – Residue management.

Unit IV: Industrial Solid Waste Treatment **8 lecture hours**

Physico-chemical treatment – solidification – incineration – Secured landfills – Legal Provisions.

Unit V: Case Studies of Industrial Pollution Control **9 lecture hours**

Sources & their Characteristics, waste treatment flow sheets for selected industries such as textiles, tanneries, dairy, sugar, paper, distilleries, steel plants, refineries, fertilizer, and thermal power plants.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Provide solutions of physical, chemical and biological treatment and biosensors applied to biological process control	**1**
2	Use new techniques for collection, recycling and disposal and treatment of wastewater and solid wastes.	**3**
3	Design the wastewater supply and treatment technology.	**3**
4	Evaluate and monitor the treatment systems according to the need of different industries.	**4, 9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3027	Industrial Waste Treatment and Disposal	1		2	1					1			

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE3028	Air and Noise Pollution	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	--				
Co-requisites	--				

Course Objectives

1. To understand the aspects of atmospheric pollution and its flow.
2. To know about the issues such as atmospheric composition, monitoring, acidic deposition, urban air quality
3. To understand the use and application of air quality models for the identification of plume flow.

Course Outcomes

On completion of this course, the students will be able to

1. The main chemical components and reactions occur in the atmosphere and examine the factors responsible for perturbing this.
2. The Implementation of the methods for monitoring and modeling spatial and temporal patterns of pollution
3. The air pollution issues at a range spatial scales and how these are relaxed.
4. The environmental impacts of atmospheric pollutants and assess their concentration.

Catalog Description

Increased air and noise pollution is the common impact of industrialization lead to the several dangerous and untreatable impacts on human beings. Students learn about air pollutants, particulates and gaseous pollutants, effects of air pollution on human beings, elements of atmosphere and dispersion of pollutants, meteorological factors, principles and design of air pollution control measures, air quality monitoring, air pollution control measures, sources of noise pollution, environmental and industrial noise and effects of noise pollution.

Text Books

1. M N Rao& H V N Rao (2007), Air Pollution, Tata McGraw-Hill Publishing Company, 26th reprint, New Delhi. ISBN: 0074518718
2. Noel De Nevers (2010), Air Pollution Control Engineering, 2nd Edition, Waveland Press, Inc., Long Grove, Illinois. ISBN: 978-1577666745

Reference Books

1. Singal, S.P. (2000), Noise Pollution and Control, First Edition, Narosa Publishing House, New Delhi.ISBN: 8173193630
2. Rao C.S. (2006) Environmental Pollution Control Engineering, 2nd edition, New Age International,New Delhi. ISBN: 9788122418354
3. William L.Heumann (1997), Industrial Air Pollution Control Systems, McGraw Hill Professional, New York.ISBN: 9780070314306

Course Content

Unit I: Sources and Effects of Air Pollution **9 lecture hours**

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles.

Unit II: Transport of Air Pollution **9 lecture hours**

Elements of atmosphere and dispersion of pollutants – Meteorological factors – Wind roses – Lapse rate - Atmospheric stability and turbulence – Plume rise – Dispersion of pollutions – Gaussian dispersion models – Applications

Unit III: Control of Air Pollution **9 lecture hours**

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment, gaseous pollutant control by adsorption & absorption, condensation, combustion – Pollution control for specific major industries.

Unit IV: Air Quality Management **9 lecture hours**

Air quality standards – Air quality monitoring – Air pollution control efforts – Zoning – Town planning regulation of new indus-tries – Legislation and enforcement – Environmental Impact Assessment – Methods.

Unit V: Noise Pollution & Control **9 lecture hours**

Sound and Noise: Sources of noise pollution – environmental and industrial noise; effects of noise pollution- fundamentals of sound generation - propagation, sound measurement - sound level meters – types, components, Noise prevention & control measures, environmental and industrial noise - noise control legislation

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	The main chemical components and reactions occur in the atmosphere and examine the factors responsible for perturbing this.	**1**
2	The Implementation of the methods for monitoring and modelling spatial and temporal patterns of pollution	**3**
3	The air pollution issues at a range spatial scales and how these are relaxed.	**4**
4	The environmental impacts of atmospheric pollutants and assess their concentration.	**2, 7**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE3028	Air and Noise Pollution	1	1	1	1			2					

1=addressed to small extent

2= addressed significantly

3=major part of course

UNIVERSITY CORES

BTCE1001	Introduction To Civil Engineering	L	T	P	C
Version1.05	Date of Approval:	0	0	2	1
Pre-requisites	--				
Co-requisites	--				

Course Objectives

1. To understand the scope and relevance of Civil Engineering.
2. To know about about different infrastructure developments.
3. To understand about various water resources and irrigation systems.
4. To know about water supply system and waste water treatment.

Course Outcomes

On completion of this course, the students will be able to

1. Know about different materials and their properties.
2. Demonstrate skills in performing measurement of distance, angles, leveling, and curve setting.
3. Know about engineering aspects related to buildings.
4. Know about importance of surveying and the transportation.
5. Get exposed to the rudiments of engineering related to dams, water supply, and sewage disposal.

Catalog Description

Students will learn about the scope and relevance of Civil Engineering. They will know about different civil construction materials and technologies. They will also learn about different infrastructure developments. They will have idea about various water resources and irrigation systems. They will study about water supply system and waste water treatment.

Text Books

1. Dr. B. C. Punmia, Ashok K. Jain &Arun K. Jain (2005), Comprehensive Basic Civil Engineering, Laxmi Publications (P) Ltd.-New Delhi, ISBN: 978-81-700-8403-7.
2. M. S. Palanichami (2010), Basic Civil Engineering, Tata McGraw Hill Education India, ISBN: 978-00-707-0796-2.

Reference Books

1. SateeshGopi (2009), Basics of Civil Engineering, Pearson India, ISBN: 978-81-317-2988-5.
2. Er. Shrikrishna&Er. Shrikrishna A. Dhale (2013), S. Chand Publishing-New Delhi, ISBN: 978-81-219-4288-1.
3. S. S. Bhavikatti (2014), Basics of Civil Engineering, New Age International-New Delhi, ISBN: 978-81-224-3559-7.
4. K. Venugopal, Basic Civil And Mechanical Engineering, Anuradha Agencies Publications-Chennai, ISBN: 978-81-847-2079-2.

Course Content

Unit I: Scope and relevance of Civil Engineering **8 lecture hours**

General introduction to Civil Engineering, Scope of different fields of Civil Engineering, Civil construction materials and technologies. Brief introduction to various building components - slab, beam, lintel, column, foundation, roofs and their functions. Brief introduction to various construction activities like Masonry work, Flooring, Plastering, Painting etc.

Unit II: Civil Engineering in Infrastructure Development **8 lecture hours**

Various types of infrastructure, utilities and services in infrastructure, Surveying – brief description of different surveying techniques and instruments. Transportation – brief introduction to different types of roads – Water bound Macadam road – cement concrete road – Bituminous road Brief introduction to railways – docks – harbours – airports. Bridges – Brief introduction to different types of bridges

Unit III: Water Resources and Environment **8 lecture hours**

Brief introduction to various water resources, Various irrigation systems, Dams – Purpose – brief introduction to different types of dams, Water Supply System – brief description of sources – surface and ground water – water demand – water treatment - Sewage disposal – brief introduction to collection – waste water treatment – septic tank and oxidation pond.

Mode of Evaluation: The subject understanding of students will be evaluated through lab report, lab performance and viva-voce.

Components	**Laboratory**		**Laboratory**
	Internal	**SEE**	
Marks	50	50	
Total Marks	100		

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Know about different materials and their properties.	**1, 6**
2	Demonstrate skills in performing measurement of distance, angles, leveling, and curve setting.	**1**
3	Know about engineering aspects related to buildings	**1, 12**
4	Know about importance of surveying and the transportation.	**1, 6**
5	Get exposed to the rudiments of engineering related to dams, water supply, and sewage disposal.	**7**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE1001	Introduction To Civil Engineering	1					2	2					1

1=addressed to small extent

2= addressed significantly

3=major part of course

HONURS COURSES

BTCE4002	Pre-Stressed Concrete Structures	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3002				
Co-requisites	--				

Course Objectives

1. To analyze sections for flexure and deflection.
2. To analyse the Losses of pre stressed members.
3. To analyse the Transfer of Prestress in Pre tensioned Members and Anchorage Zone Stresses in Post Tensioned Members

Course Outcomes

On completion of this course, the students will be able to

1. Analyze sections for flexure and deflection.
2. Analyze the Losses of pre stressed members.
3. Analyze the Transfer of Prestress in Pre tensioned Members and Anchorage Zone Stresses in Post Tensioned Members.
4. Visualize and work on multi-disciplinary tasks.
5. Use modern engineering tools, software and equipment to analyze and design.

Catalog Description

This course imparts comprehensive knowledge on the Prestressed Concrete. It brings about an understanding of the behaviour of Prestressed Concrete and develops an understanding of the various prestressing systems. This course imparts comprehensive knowledge for analysis of sections for flexure and deflection. It also imparts comprehensive knowledge for Losses of Pre-Stress, Transfer of Prestress in Pre tensioned Members and Anchorage Zone Stresses in Post Tensioned Members.

Text Books

1. Raju, N. K., “Pre-stressed concrete”, Tata McGraw Hill, New Delhi, 1st Edition, 2012.

Reference Books

1. Ramamruthum, S., “Pre-stressed Concrete”, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2003.
2. Lin, T. Y., Burns, N. H., “Design of pre- stressed Concrete Structures”, John Wiley and Sons. New York, 3rd Edition, 1981.

Course Content

Unit I: Basic Principles of Pre-Stressing, Prestressing Systems 9 lecture hours

Basic concepts of prestressing, High strength concrete and steel, Stress-strain characteristics and properties, Various prestressing systems, Pre-tensioning and Post- tensioning systems with anchorages, Advantages and limitations of prestressed concrete.

Unit II: Analysis of Sections for Flexure 9 lecture hours

Basic assumptions, Analysis of stresses in concrete due to pre- stress and loads for different types of cross section, Pressure line or thrust line, Cable profile, Concept of load balancing, Cracking moment.

Unit III: Losses of Pre-Stress & Deflections 9 lecture hours

Nature of losses in pre-stress, Various losses encountered in pre-tensioning and post tensioning methods, Deflection, Factors influencing deflection, Elastic deflection under transfer loads and due to different cable profile. Deflections limits as per IS-1343, Effects of creep on deflection, crack widths.

Unit IV: Flexural and Shear Strength of Prestressed Concrete Sections 9 lecture hours

Types of flexural failure, IS code recommendations for flexure, Ultimate flexural strength of section. Shear and principal stresses, Ultimate shear resistance of prestressed concrete members, Shear reinforcement.

Unit V: Transfer of Prestress in Pre tensioned Members and Anchorage Zone Stresses in Post Tensioned Members 9 lecture hours

Transmission of pre-stress in pre-tensioned members, Transmission length, Bond stresses, Codal provisions for bond and transmission length, Anchorage stress in post- tensioned member. Bearing stress and bursting tensile force, IS code provisions.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Analyze sections for flexure and deflection	**1, 2**
2	Analyze the Losses of pre stressed members.	**1, 2**
3	Analyze the Transfer of Prestress in Pre tensioned Members and Anchorage Zone Stresses in Post Tensioned Members.	**1, 2**
4	Visualize and work on multi-disciplinary tasks.	**2, 9, 10**
5	Use modern engineering tools, software and equipment to analyze and design.	**1, 3, 5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE4002	Pre-Stressed Concrete Structures	2	3	2		1				1	1		

1=addressed to small extent

2= addressed significantly

3=major part of course

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BTCE4003	Dynamics of Structures and Earthquake Engineering	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3001, BTCE3002				
Co-requisites	--				

Course Objectives

1. To analyze structures subjected to dynamic loading.
2. To design structures for seismic loading as per code provisions.
3. To understand about the elements of seismology.

Course Outcomes

On completion of this course, the students will be able to

1. Understand SDOF system and MDOF system.
2. Analyse structures subjected to dynamic loading.
3. Design structures for seismic loading as per code provisions.
4. Understand about the elements of seismology.

Catalog Description

Students understand single degree of freedom system. Students also understand multi-degree of freedom system, response spectra and elements of seismology. Students get ideas for the calculation of seismic forces and design seismic resistant structures.

Text Books

1. Chopra, A.K., "Dynamics of Structures – Theory and Applications to Earthquake Engineering", 4th Edition, Pearson Education, 2011.

2. Agarwal. P and Shrikhande. M., "Earthquake Resistant Design of Structures", Prentice Hall of India Pvt. Ltd. 2007

Reference Books

1. J. Humar, (2012), Dynamics of Structures, Third Edition, CRC Press, *ISBN-13:* 9780415620864.

2. Anil K. Chopra, (2003), Dynamics of Structures - Theory and Applications to Earthquake Engineering, Third Edition, Pearson India,ISBN-13: 9788131713297.

3. Biggs, J.M., "Introduction to Structural Dynamics", McGraw Hill Book Co., New York, 1964

4. Dowrick, D.J., "Earthquake Resistant Design", John Wiley & Sons, London, 2009

5. Paz, M. and Leigh.W. "Structural Dynamics – Theory & Computation", 4th Edition, CBS Publishers & Distributors, Shahdara, Delhi, 2006.

Course Content

Unit I: Theory of Vibrations **9 lecture hours**

Difference between static loading and dynamic loading – Degree of freedom – idealisation of structure as single degree of freedom system – Formulation of Equations of motion of SDOF system – D'Alemberts principles – effect of damping – free and forced vibration of damped and undamped structures – Response to harmonic and periodic forces.

Unit II: Multiple Degree of Freedom System **9 lecture hours**

Two degree of freedom system – modes of vibrations – formulation of equations of motion of multi degree of freedom (MDOF) system – Eigen values and Eigen vectors – Response to free and forced vibrations – damped and undamped MDOF system – Modal superposition methods.

Unit III: Elements of Seismology **9 lecture hours**

Elements of Engineering Seismology – Causes of Earthquake – Plate Tectonic theory – Elastic rebound Theory – Characteristic of earthquake – Estimation of earthquake parameters – Magnitude and intensity of earthquakes – Spectral Acceleration.

Unit IV: Response of Structures to Earthquake **9 lecture hours**

Effect of earthquake on different type of structures – Behaviour of Reinforced Cement Concrete, Steel and Prestressed Concrete Structure under earthquake loading – Pinching effect – Bouchinger Effects – Evaluation of earthquake forces as per IS:1893 – 2002 – Response Spectra – Lessons learnt from past earthquakes.

Unit V: Design Methodology **9 lecture hours**

Causes of damage – Planning considerations / Architectural concepts as per IS:4326 – 1993 – Guidelines for Earthquake resistant design – Earthquake resistant design for masonry and Reinforced Cement Concrete buildings – Later load analysis – Design and detailing as per IS:13920 – 1993.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Understand SDOF system and MDOF system.	**1, 2**
2	Analyse structures subjected to dynamic loading.	**1, 2**
3	Design structures for seismic loading as per code provisions.	**3**
4	Understand about the elements of seismology.	**1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE4003	Dynamics of Structures and Earthquake Engineering	2	3	2									

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE4004	Natural Disaster Mitigation and Management	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	--				
Co-requisites	--				

Course Objectives

1. Know about the types of natural and environmental disasters.
2. Develop skills in various stages of disaster preparedness, mitigation and management.
3. Know the methodology for disaster risk assessment.

Course Outcomes

On completion of this course, the students will be able to

1. The types of natural and environmental disasters and its causes.
2. About organizational and Administrative strategies for managing disasters.
3. About the early warning systems, monitoring of disasters effect and necessity of rehabilitation.
4. About the engineering and non-engineering controls of mitigating various natural disasters.
5. Learn methodologies for disaster risk assessment with the help of latest tools like GPS, GIS, Remote sensing, information technologies, etc.

Catalog Description

With the increases in the numbers of interventions by the human beings with the natural processes and by the implication on load on the environment, natural disasters are common in the today's world. Students learn natural disasters around the world and risk assessment, disaster mitigation, preparedness, response and recovery, earthquake, geological, geo-morphological aspects, landslides, severe weather & tornadoes, cyclones, floods and droughts. Upon completion, students should be able to Map, conduct modeling, risk analysis and loss estimation, natural disaster risk analysis and apply prevention and mitigation measures to reduce the impacts.

Text Books

1. Edward A Keller, Robert H Blodgett (2007), Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes, Pearson Prentice Hall, 2nd Edition. ISBN: 9780132361316
2. Didax (2007), Natural Disasters, Didax Educational Resources: ISBN: 9781583242728

Reference Books

1. Edward Bryant (2005), Natural Hazards, Cambridge University Press, New York. ISBN: 978-0521537438
2. Robert L Kovach Earth's Fury (1995), An Introduction to Natural Hazards and Disasters, Prentice Hall. ISBN: 9780130424334
3. Davi Alexander (1993), Natural Disasters, Routledge. ISBN: 9781857280937

Course Content

Unit I: Natural Disasters – Overview **9 lecture hours**

Introduction- Natural Disasters around the world- Natural Disaster Risk Assessment- Earth and its characteristics – Environmental Change and Degradation - Climate Change - Global warming – Human Dimensions of Global environment Change – Disaster mitigation, preparedness, response and recovery- comprehensive emergency management Early warning systems and Disaster Preparedness– Rehabilitation, Vulnerable Populations - Logistics and Services, Food, Nutrition and Shelter -Role of UN Red cross and NGOs.

Unit II: Plate Tectonics& Earthquakes **9 lecture hours**

Introduction and Review - Natural Disasters -Principles, Elements, and Systems - Geological-Geo-morphological aspects, - Earthquake-Geology, Seismology, Characteristics and dimensions– Landslides- Human impact on the mountainous terrain and its relationship with Rainfall, liquefaction etc- Tsunami - Nature and characteristics.

Unit III: Critical climate system aspects and Processes **9 lecture hours**

Oceanic, Atmospheric and Hydrologic cycles - Severe Weather & Tornadoes , Cyclones, Floods and Droughts - Global Patterns - - Mitigation & Preparation – Drought – Famine- nature & dimensions – Drought Assessment & Monitoring.

Unit IV: Natural hazards Assessment and Communication **9 lecture hours**

Mapping - Modeling, risk analysis and loss estimation – Natural disaster risk analysis - prevention and mitigation - Applications of Space Technology (Satellite Communications, GPS, GIS and Remote Sensing and Information / Communication Technologies (ICT) in Early warning Systems - Disaster Monitoring and Support Centre– Information Dissemination – Mobile Communications etc.

Unit V: Administrative mechanisms **9 lecture hours**

Social organizations – Education and Training – Establishment of capacity building among various stake holders – Government - Educational institutions – Use of Multi-media knowledge products for self-education.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	The types of natural and environmental disasters and its causes.	**1**
2	About organizational and Administrative strategies for managing disasters.	**11**
3	About the early warning systems, monitoring of disasters effect and necessity of rehabilitation.	**3, 7**
4	About the engineering and non-engineering controls of mitigating various natural disasters.	**7**
5	Learn methodologies for disaster risk assessment with the help of latest tools like GPS, GIS, Remote sensing, information technologies, etc.	**5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE4004	Natural Disaster Mitigation and Management	1		1		2		2					

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE4005	Water Resources System Engineering	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	--				
Co-requisites	--				

Course Objectives

1. To provide information about need of water resources engineering in India and teach basic concepts of surface and ground water hydrology and irrigation aspects.
2. To teach various optimization techniques.
3. To provide information about water resources engineering structures.

Course Outcomes

On completion of this course, the students will be able to

1. Understand the components of planning and management in water resources.
2. Use various optimization methods.
3. Use linear and dynamic programming of water resource problems.

Catalog Description

The course introduces the concepts of systems techniques in water resources planning and management, Introduction, System Components, Planning and management, Modeling of water resources systems, Constrained and unconstrained optimization, Linear programming, Dynamic programming with applications to water allocation, capacity expansion, Multi - objective optimization, Review of probability theory, Uncertainty and reliability analysis, Stochastic optimization - Chance constrained LP, Stochastic DP with applications, Surface water quality control; Simulation - Reliability, Resiliency and Vulnerability of water resource systems.

Text Books

1. Jain S.K. and Singh V.P., (2003) 'Water Resources Systems Planning and Management', Elsevier, The Netherlands. ISBN – 9780444514295.
2. Hamdy A. Taha(2006). Operations Research: An Introduction, Prentice Hall, ISBN-9780131889231.

Reference Books

1. Loucks D.P, Stedinger J.R and Haith D.A, (1981) 'Water Resources Systems Planning and Analysis', Prentice Hall, USA, 1981. ISBN – 9780139459238.
2. Mays L.W and Tung Y-K, (2002) 'Hydrosystems Engineering and Management', Water Resources Pubns, 1992. ISBN – 9781887201322.

Course Content

Unit I: Introduction and Basic Concepts **8 lecture hours**

Introduction, System Components, Planning and management, Concept of a system, Advantages and limitations of systems approach, Modeling of Water Resources Systems, Simulation and optimization, Economics in water resources, Challenges in water sector.

Unit II: Introduction to Optimization **8 lecture hours**

Objective function, Maxima, minima and saddle points, convex and concave functions, Constrained and unconstrained optimization using calculus, Lagrange multipliers, Kuhn-Tucker conditions.

Unit III: Linear & Dynamic Programming and Applications **10 lecture hours**

General form of LP, Standard and Canonical forms of LP, Elementary transformations, Graphical method, Feasible and infeasible solutions, Simplex method, Dual and sensitivity analysis, LP problem formulation, Reservoir sizing and Reservoir operation using LP, Introduction, multistage decision problem, Recursive Equations, Principle of optimality, Discrete DP, Curse of Dimensionality, Water allocation problem.

Unit IV: Multi-objective & Stochastic Optimization **9 lecture hours**

Position, Velocity and Acceleration – Rectilinear motion – Curvilinear motion of a particle – Tangential and Normal components – Radial and Transverse components – Rotation of rigid bodies about a fixed axis – General plane motion – Absolute and relative motion method – Instantaneous centre of rotation in plane motion - Linear momentum – Equation of motion – Angular momentum of a particle and rigid body in plane motion – D'Alembert's principle.

Unit V: Simulation **10 lecture hours**

Principle of work and energy for a particle and a rigid body in plane motion – Conservation of energy - Principle of impulse and momentum for a particle and a rigid bodies in plane motion – Conservation of momentum – System of rigid bodies – Impact - direct and central impact – coefficient of restitution.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Understand the components of planning and management in water resources.	**6**
2	Use various optimization methods.	**1**
3	Use linear and dynamic programming of water resource problems.	**1,2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigationsof complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE4005	Water Resources System Engineering	1	2				1						

1=addressed to small extent

2= addressed significantly

3=major part of course

BTCE4006	Transport Planning and Management	L	T	P	C
Version1.05	Date of Approval:	3	0	0	3
Pre-requisites	BTCE3010				
Co-requisites	--				

Course Objectives

1. To teach the transportation planning process, trip generation and distribution methods.
2. To teach various techniques involved in traffic assignments, and introduce evaluation techniques based on economy and performance.

Course Outcomes

On completion of this course, the students will be able to

1. Identify the different planning process involved in transportation and the importance of Zoning.
2. Demonstrate the ability to understand the various distribution methods, trip generation and critically apply the analysis techniques practically.
3. Understand the principles in traffic assignment and apply them suitably as a Successful transportation Engineer.
4. Demonstrate the ability to evaluate a transport projects critically in all aspects and apply transport planning process effectively for medium and small sized towns.

Catalogue Description

The better planning and management gives the better outcome. Here we have to know about the transportation planning process, trip generation and its distribution. Modal split and trip assignment is also important to study. Finally we discussed about the evaluation techniques.

Text Books

1. Kadiyali.L.R. (2008), Traffic Engineering and Transportation Planning, Khanna Publishers, ISBN-9788174092205.
2. Ortuzar.J.D., and Willumsen. Luis G. (2011), Modelling Transport, Fourth Edition, John Wiley & Sons, ISBN-9781119993520.

Reference Books

1. Wright.P.H.,Ashford.N., and Stammer.R., (1998), Transportation Engineering – Planning & Design, Fourth Edition, John Wiley & Sons, New York, ISBN-9780471173960.
2. Dickey.J.W., (1995), Metropolitan Transportation Planning, Tata McGraw-Hill publishing company Ltd, New Delhi.
3. Papacostas.C.S., and Prevedouros.P.D., (2001) “Transportation Engineering and Planning”, Indian Edition, Prentice-Hall of India , ISBN-9788120321540.
4. Garber. Nicholas J., and Hoel. Lester A., (2009), Traffic & Highway Engineering, Fourth Edition, Cengage Learning, ISBN-9780495082507.

Course Content

Unit I: Transport Planning Process **10 lecture hours**

Scope – interdependence of land use and traffic – systems approach to transport planning – survey of existing conditions and forecasting future conditions. Transport survey – definition of study area – zoning survey – types and methods – inventory on transport facilities – inventory of land use and economic activities.

Unit II: Trip Generation **6 lecture hours**

Factors governing trip generation and attraction rates – multiple linear regression analysis – category analysis – critical appraisal of techniques.

Unit III: Trip Distribution Methods **9 lecture hours**

Uniform factor method, average factor methods – gravity model and its calibration – opportunity model.

Unit IV: Modal Split and Trip Assignment **10 lecture hours**

Modal split – factors, advantages and limitations, logit model and its calibration.
Traffic assignment – general principles – assignment techniques – all nothing assignment – multiple root assignment – capacity – restraint assignment – diversion curves

Unit V: Evaluation Techniques **10 lecture hours**

Economic evaluation techniques – performance evaluation – rating and ranking methods – case studies in evaluation – rating and ranking methods – case studies in evaluation of transport projects – land use transport models – transport planning for medium and small sized towns.

Mode of Evaluation: The subject understanding of students will be evaluated through CAT-I & II and Semester End Examination.

Components	**Theory**	
	Internal	**SEE**
Marks	50	50
Total Marks	100	

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between Cos and POs		
Sl. No.	**Course Outcomes (COs)**	**Mapped Programme Outcomes**
1	Identify the different planning process involved in transportation and the importance of Zoning.	**1**
2	Demonstrate the ability to understand the various distribution methods, trip generation and critically apply the analysis techniques practically.	**4**
3	Understand the principles in traffic assignment and apply them suitably as a Successful transportation Engineer.	**1**
4	Demonstrate the ability to evaluate a transport projects critically in all aspects and apply transport planning process effectively for medium and small sized towns.	**11**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning
		1	2	3	4	5	6	7	8	9	10	11	12
BTCE4006	Transport Planning and Management	2			1							2	

1=addressed to small extent

2= addressed significantly

3=major part of course