GALGOTIAS UNIVERSITY

(Under the Uttar Pradesh Private Universities Act No. 12 of 2019)

COURSE BOOK 2021-2025

Curriculum and syllabus
2021-2025

Department of Civil Engineering
Program :B. Tech in Smart Cities

Vision

To be a Centre of Excellence for imparting high end research and technical education in Civil Engineering with specialization in Construction Technology producing socially aware professionals to provide sustainable solutions to global community.

Mission

M1: To impart quality education and mould technically sound, ethically responsible professionals in the field of Civil Engineering with specialization in Construction Technology.

M2: Collaborate with industry and society to design a curriculum based on the changing needs of stakeholders and provide excellence in delivery and assessment.

M3: Establish state-of-the-art facilities for world class education and research.

M4: To mentor students in pursuit of higher education, entrepreneurship and global professionalism.

POs

PO1: Apply the knowledge of Mathematics, Science, and Engineering fundamentals, and an engineering specialization to solution of complex engineering problems (Engineering Knowledge)

PO2: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (Problem analysis)

PO3: Design of solutions for complex engineering problems and design of system components or processes that meet the specified needs with appropriate considerations of public health and safety, and cultural, societal, and environmental considerations (Design/development of solutions)

PO4: Use research based methods including design of experiments, analysis and interpretation of data and synthesis of information leading to logical conclusions (Conduct investigations of complex problems)

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling complex engineering activities with an understanding of limitations (Modern tool usage)

PO6: Apply reasoning within the contextual knowledge to access societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice (The engineer and society)

PO7: Understand the impact of the professional engineering solutions in the societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable developments (Environment and sustainability)

PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice (Ethics)

PO9: Function effectively as an individual independently and as a member or leader in diverse teams, and in multidisciplinary settings (Individual and team work)

PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large such as being able to comprehend and write effective reports and design documentation, make effective oral presentations, and give and receive clear instructions (Communication)

PO11: Demonstrate knowledge and understanding of engineering management principles and apply those to one's own work as a member and leader of a team to manage projects in multidisciplinary environments (Project management and finance)

PO12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change (Life-long Learning).

PEOs

PEO1: Graduates shall attain state of the art knowledge in the different streams of Civil Engineering specialized in smart city and be trained for playing the role of competent infrastructure engineer.

PEO2: Graduates shall be capable of pursuing productive careers in private and government organizations at the national and international level and to become successful entrepreneurs.

PEO3: Graduates shall display a high sense of social responsibility and ethical thinking and develop smart engineering solutions.

PSOs

PSO1: Develop the ability to implement emerging techniques to utilize technology, information and data for the improvement in core infrastructure elements.

PSO2: Excel in providing the smart solutions for the problems in waste, water, energy and traffic management

Curriculum

Semester 1									
Sl. No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1		Energy Sources and Audit	1	0	0	1	20	30	50
2		Data Analytics (Excel and Tableu)	1	0	0	1	20	30	50
3		AI Fundamentals	2	0	0	2	20	30	50
4		Differential / Vector calculus and Matrices	3	0	0	3	20	30	50
5		Programming for Problem Solving (C)	1	0	4	3	20	30	50
6		Communication Skill (BEC-1)	3	0	0	3	20	30	50
7		Engineering Physics	2	0	0	2	20	30	50
8		Engineering Physics Lab	0	0	2	1	50	-	50
9		Bio Systems in Engineering	2	0	0	2	20	30	50
10		AC DC Circuits	2	0	2	3	20	30	50
		Total credits				**21**			
Semester II									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1		Integral and Multiple Calculus	2	0	0	2	20	30	50
2		Partial Differential Equations	1	0	0	1	20	30	50
3		Embedded Technology and IOT	1	0	2	2	20	30	50
4		Waste Management	0	0	2	1	50	-	50
5		Environmental Science	0	0	1	0.5	50	-	50
6		Liberal and Creative Arts	0	0	1	0.5	50	-	50
7		Creativity, Innovation and Entrepreneurship	1	0	2	2	20	30	50
8		Application of Python Programming	0	0	2	1	50	-	50
9		Introduction to Digital System	2	0	2	3	20	30	50
10		Data Structure Using C	2	0	2	3	20	30	50
11		Digital Fabrication	0	0	2	1	50	-	50
12	BCE01T3201	Engineering Mechanics	3	0	0	3	20	30	50
		Total credits				**20**			
Semester III									
	Course Code	**Name of the Course**					**Assessment Pattern**		

Sl No			L	T	P	C	IA	MTE	ETE
1		Mathematics-III (Functions of Complex Variables and Transforms)	3	0	0	3	20	30	50
2		Aptitude building and Logical Reasoning - I	0	0	2	1	50	-	50
3		Disruptive Technologies	0	0	4	2	50	-	50
4		AI and its Applications	0	0	4	2	50	-	50
5	BCE02T3301	Strength of Materials	2	0	0	2	20	30	50
6	BCE02T3302	Basic Fluid Mechanics	2	0	0	2	20	30	50
7	BCE02T3303	Introduction to Surveying	2	0	0	2	20	30	50
8	BCE02T3304	Basic Transportation Engineering	2	0	0	2	20	30	50
9	BCE02P3302	Basic Fluid Mechanics Lab	0	0	2	1	50	-	50
10	BCE02P3303	Surveying Lab	0	0	2	1	50	-	50
11	BCE01P3304	Engineering Drawing	0	0	4	2	50	-	50
12	BCE02P3301	Strength of Materials Lab	0	0	2	1	50	-	50
13	BCE02P3304	Basic Transportation Engineering Lab	0	0	2	1	50	-	50
		Total credits				**22**			

Semester IV

Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1		Mathematics-IV (Numerical and Computational Methods)	2	0	0	2	20	30	50
2		Numerical and Computational Methods Lab	0	0	2	1	50	-	50
3		Aptitude building and Logical Reasoning - II	0	0	2	1	50	-	50
4		Engineering Clinic - I (IOT)	0	0	2	1	50	-	50
5		Communication Skill (BEC-2) - 3 credit	3	0	0	3	20	30	50
6	BCE01T3402	Construction Engineering	3	0	0	3	20	30	50
7	BCE02T3403	Basic Structural Analysis	2	0	0	2	20	30	50
8	BCE02T3404	Water & Waste Water Treatment Systems	2	0	0	2	20	30	50
9	BCE02T3405	Soil Mechanics	2	0	0	2	20	30	50
10	BCE02T3406	Reinforced Concrete Structures	2	0	0	2	20	30	50
11	BCE02P3404	Water Analysis Lab	0	0	2	1	50	-	50
12	BCE02P3405	Soil Mechanics Lab	0	0	2	1	50	-	50
13	BCE01P3402	Construction Engineering Lab	0	0	2	1	50	-	50
		Total credits				**22**			

Semester V									
Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1		Mathematics-V (Application of Statistical Methods in Construction)	3	0	0	3	20	30	50
2		Engineering Economics and Management	3	0	0	3	20	30	50
3		Engineering Clinic - II (Machine Learning)	0	0	2	1	50	-	50
4		Campus to Corporate	3	0	0	3	20	30	50
5		Aptitude building and Logical Reasoning – III	0	0	2	1	50	-	50
6		Applied Geology	2	0	0	2	20	30	50
7		Program Elective – I	3	0	0	3	20	30	50
8	BCE01P3504	CAD Lab - I (AUTOCAD)	0	0	4	2	50	-	50
9		Planning Techniques	3	0	0	3	20	30	50
10		Social Internship	0	0	2	1	50	-	50
11		Hobby Class	0	0	1	0.5	50	-	50
12	BCE02P3501	Industrial Internship - I	0	0	0	1	50	-	50
13		Smart City map preparation	0	0	0	1	50	-	50
		Total credits				**24.5**			

Semester VI									
Sl No	Course Code	Name of the Course					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1		Excel Training & PPT Training	0	0	1	0.5	50	-	50
2	BCE02T3601	Introduction to Design of Steel Structures	2	0	0	2	20	30	50
3		Foreign Language (German / Japanese / French)	0	0	4	2	20	30	50
4	BCE01P3605	Analysis and Design Lab (STAAD PRO)	0	0	2	1	50	-	50
5		Aptitude building and Logical Reasoning - IV	0	0	2	1	50	-	50
6	BCE01P3606	Design and Innovation	0	0	2	1	50	-	50
7		Open Elective - I	3	0	0	3	20	30	50
8		Program Elective - II	3	0	0	3	20	30	50
9		Program Elective - III	3	0	0	3	20	30	50
10		Energy Efficient Buildings in Smart city	3	0	0	3	20	30	50
11	BCE02T3603	Quantity Surveying and Estimating	3	0	0	3	20	30	50
12	BCE02P3607	Estimation Lab (PRIMAVERA)	0	0	4	2	50	-	50
		Total credits				**24.5**			

Semester VII									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1		Program Elective - IV	3	0	0	3	20	30	50
2		Program Elective - V	3	0	0	3	20	30	50
3		Ethics and Professional Competency	0	0	2	1	50	-	50
4	BCE02P3998	Capstone Phase-1	0	0	4	2	50	-	50
5		Open Elective - II	3	0	0	3	20	30	50
6	BCE02T3701	Project Planning and Scheduling	2	0	0	2	20	30	50
7	BCE02P3701	Project Planning and Scheduling Lab (PRIMAVERA)	0	0	2	1	50	-	50
8	BCE02P3702	Industrial Internship - II	0	0	0	1	50	-	50
		Total credits				**16**			

Semester VIII									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BCE02P3999	Capstone Phase-2	0	0	20	10	50	-	50
		Total credits				**10**			

Total Grand Credits = 160

List of Program Electives

Sl No	**Course Code**	**List of Programme Elective**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1		Metropolitan Planning, Development and Management	3	0	0	3	20	30	50
2		Disaster Risk Mitigation and Management	3	0	0	3	20	30	50
3		Sustainable Transportation	3	0	0	3	20	30	50
4		Demography for Smart City	3	0	0	3	20	30	50
5		Sustainable Construction Materials	3	0	0	3	20	30	50
6		Environment & Energy for Smart City	3	0	0	3	20	30	50
7		Management of Materials	3	0	0	3	20	30	50
8		TQM in Construction of Smart City	3	0	0	3	20	30	50
9	BCE02T5706	Value Engineering and Valuation	3	0	0	3	20	30	50
10	BCE02T5707	Infrastructure Development	3	0	0	3	20	30	50

Detailed Syllabus

Name of The Course	Engineering Mechanics				
Course Code	BCE01T3201				
Prerequisite	-				
Co-requisite	-				
Anti-requisite	-				
		L	T	P	C
		3	0	0	3

Course Objectives

1. To calculate the reactive forces.
2. To analyze structures.
3. To learn the geometric properties of different shapes.

Course Outcomes

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

CO1	Understand fundamental principles of forces and the concept of free body diagram.
CO2	Calculate the centroid, centre of gravity and moment of inertia of various surfaces.
CO3	Determine stresses and strains for one dimensional axially loaded member.
CO4	Analyze plane trusses by different methods
CO5	Understand the concept of BMD and SFD
CO6	Understand latest research paper

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Introduction to Mechanics & Equilibrium of Forces **8 Hours**
Fundamental Principles - Vectorial Representation of Forces - Coplanar forces - Resolution and Composition of forces and equilibrium of particles – introduction of Forces on a particle in space - Equivalent system of forces - Principle of transmissibility - Single equivalent force - Free body diagram - Equilibrium of rigid bodies in two dimensions and three dimensions.
Unit II: Properties of Surfaces **8 Hours**
Centroid – Centre of gravity – Parallel axis theorem - First moment of area – Second moment of area – Product of inertia of plane areas – Polar moment of inertia
Unit III: Stresses & Strains **8 Hours**
Axial Stress and Strain - Solution of simple problems – Tapered Section - One Dimensional axial loading of members of varying cross-section – Stress - Strain Diagram of mild steel.
Unit IV: Analysis of plane truss **8 Hours**
Trusses: Introduction - Simple Truss - Analysis of Simple truss - Method of Joints - Method of Sections – Tension Coefficient Method
Unit V: Introduction to shear force and bending moment 8 **Hours**
Beam: Introduction, Shear force and Bending moment, Shear Force Diagram and Bending Moment Diagram for statically determinate beams.
Unit VI: Discussion on Latest Research Paper **4 Hours**
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class.

Suggested Reading

1. Punamia B. C. (2010), Mechanics of Materials, 15th Edition, Laxmi publications (P) Ltd, ISBN: 9788131806463.

2. Shames I. H. (2006), Engineering Mechanics – Statics and Dynamics, 4th Edition, Prentice-Hall of India Private limited, ISBN- 9780133569247.

Name of The Course	Basic Fluid Mechanics				
Course Code	BCE02T3302				
Prerequisite	-				
Co-requisite	-				
Anti-requisite	-				
		L	T	P	C
		2	0	0	2

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.
4. Students understand Citizens' Role and Civil Society- Social Movements and Non-Governmental Organizations.

Course Outcomes

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

CO1	To find frictional losses in a pipe when there is a flow between two places.
CO2	Calculation of conjugate depth in a flow and to analyse the model and prototype.
CO3	Find the dependent and independent parameters for a model of fluid flow.
CO4	Explain the various methods available for the boundary layer separation.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Fluid Properties and Hydrostatics **7 Hours**
Density – Viscosity – Surface tension – compressibility – capillarity – Hydrostatic forces on plane – inclined and curved surfaces – buoyancy – centre of buoyancy – metacentre.
Unit II: Fluid Dynamics **7 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 **7 Hours**
Dimensional homogeneity – Raleigh and Buckingham π theorems – Non-dimensional numbers – Model laws and distorted models-Module quantities-Specific quantities.
Unit IV: Dimensional Analysis **7 Hours**
Dimensional homogeneity – Raleigh and Buckingham π theorems – Non-dimensional numbers – Model laws and distorted models-Module quantities-Specific quantities.

Suggested Reading

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

Name of The Course	**Basic Fluid Mechanics Lab**			
Course Code	**BCE02P3302**			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

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 student will be able to:

CO1	To find frictional losses in a pipe when there is a flow between two places.
CO2	Calculation of conjugate depth in a flow and to analyse the model and prototype..
CO3	Find the dependent and independent parameters for a model of fluid flow.
CO4	Explain the various methods available for the boundary layer separation.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
50	-	50	100

Course Content:

List of Experiments:

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

Suggested Reading

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.

Name of The Course	**Surveying Lab**			
Course Code	**BCE02P3303**			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

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 student will be able to:

CO1	Learn about basics involved in different types of surveying like tape, compass, leveling, and theodolite (total station).
CO2	Demonstrate skills in performing measurement of distance, angles, leveling, and curve setting.
CO3	Develop skills for estimating distance between given points, area of a given plot and earthwork involved in cuttings and fillings.
CO4	Develop skill to carry out tachometry, geodetic surveying wherever situation demands.
CO5	Develop skills to apply error adjustment to the recorded reading to get an accurate surveying output.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**
50	-	50	100

Course Content:

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

Suggested Reading

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

Name of The Course	Introduction to Surveying			
Course Code	BCE02T3303			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	T	P	C
	2	0	0	2

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 student will be able to:

CO1	Learn about basics involved in different types of surveying like tape, compass, leveling, and theodolite (total station).
CO2	Demonstrate skills in performing measurement of distance, angles, leveling, and curve setting.
CO3	Develop skills for estimating distance between given points, area of a given plot and earthwork involved in cuttings and fillings.
CO4	Develop skill to carry out tachometry, geodetic surveying wherever situation demands.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Plane Surveying and Theodolite **7 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 **7 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 **7 Hours**
Area, volume calculation of earth work – Introduction to Global positioning system – GPS surveying methods.
Unit IV: Curve Surveying **7 Hours**
Definitions, designation of curve, elements of simple curve - Settings of simple circular curve, Compound and reverse curve- Transition curve – Introduction to vertical curves.

Suggested Reading

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

Name of The Course	Engineering Drawing			
Course Code	BCE01P3304			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	T	P	C
	0	0	4	2

Course Objectives

1. To create awareness and emphasize the need for Engineering Drawing in all the branches of engineering.
2. To follow basic drawing standards and conventions.
3. To develop skills in three-dimensional visualization of engineering component.

Course Outcomes

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

CO1	Prepare drawings as per standards (BIS).

CO2	Solve specific geometrical problems in plane geometry involving lines, plane figures and special Curves.
CO3	Produce orthographic projection of engineering components working from pictorial drawings.
CO4	Develop skill Planes under study.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Introduction **7 Hours**
Engineering Drawing: An Overview, its need and objectives. Introduction to Computer Aided Drafting- Introduction to AutoCAD/CATIA; Initial setup commands, Utility commands, drawing aids, entity draw commands, display commands and edit commands.
Unit II: Lettering, Numerals and Dimensioning **7 Hours**
Drawing scale, various types of lines and their uses. Lettering. Dimensioning; Basic types of dimensioning- linear, angular and radial dimensioning. Title block.
Unit III Orthographic Projection – Points and Lines **7 Hours**
Object in four quadrant, 2-D description of quadrants. Projection of points. Projection of lines- Inclined lines, projection of a skew line, line parallel to perpendicular plane.
Unit IV: Orthographic Projection –Planes **7 Hours**
Planes under study, classification of planer surface, projection of planer surface- principal, inclined, oblique planes.

Suggested Reading

1. Bhatt N. D., "Engineering Drawing", Charotar publishing House, 1998.
2. French and Vierk, "Fundamentals of Engineering Drawing", McGraw Hill, 2002.
3. John K.C., "Engineering Graphics for Degree", PHI Learning Private Limited, New Delhi, 2010.

Name of The Course	**Strength of Materials**
Course Code	**BCE02T3301**
Prerequisite	-
Co-requisite	-
Anti-requisite	-

L	T	P	C
2	0	0	2

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 student will be able to:

CO1	Understand the concepts of volumetric strain and torsion.
CO2	Analyse shear force and bending moment for different types of beams.
CO3	Calculate deflections in beams and trusses.
CO4	Study compression member, columns and finding buckling and crushing load.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Volumetric Strains and Torsion. **7 Hours**
Bulk Modulus – Modulus of rigidity – Change in volume – Volumetric Strain - Introduction to torsion - Torsion of shafts of circular section - torque and twist - shear stress due to torque
Unit II: Shear Force and Bending Moment **7 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 **7 Hours**
Introduction - Theory of bending - deflection of beams by Macaulay's method - moment area method and conjugate beam method.
Unit IV: Theory of Columns **7 Hours**

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

Suggested Reading

1. Ramamrutham S. and Narayanan R. (2008), Strength of Materials, 3rd Edition, Dhanpat Rai Publications Company, ISBN: 9788187433545.
2. Bansal R. K. (2010), Strength of Materials, 4th Edition, Laxmi Publications, ISBN: 9788131808146.

Name of The Course	**Construction Engineering**			
Course Code	**BCE01T3402**			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

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 student will be able to:

CO1	Develop ability to choose the modern construction materials appropriate to the climate and functional aspects of the buildings.
CO2	Supervise the construction technique to be followed in brick and stone masonry, concreting, flooring, roofing and plastering etc.
CO3	Understand the properties of cement and its laboratory testing methods.
CO4	Determine quality of fine aggregate and course aggregate
CO5	Learn about the different properties of concrete**.**
CO6	Understand latest research paper

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**
20	30	50	100

Course Content:

Unit I: Properties of Construction Materials **8 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 **8 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 **8 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 **8 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 **8 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.
Unit VI: Discussion on Latest Research Paper **4 Hours**
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class.

Suggested Reading

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.

Name of The Course	Soil Mechanics			
Course Code	BCE02T3405			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	T	P	C
	2	0	0	2

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

CO1	Give an engineering classification of a given soil
CO2	Understand the principle of effective stress, and then calculate stresses that influence soil behavior.
CO3	Determine soil deformation parameters, and calculate settlement magnitude and rate of settlement
CO4	Specify soil compaction requirements.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
50	-	50	100

Course Content:

Unit I: Weight volume relations and Index properties **7 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 **7 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 **7 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 **7 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.

Suggested Reading

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

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

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.

Name of The Course	Strength of Materials Lab			
Course Code	BCE02P3301			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	T	P	C
	0	0	2	1

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 student will be able to:

CO1	Conduct tension and compression tests on the components
CO2	To determine hardness, impact strength, fatigue strength of the specimens.
CO3	Measure strain and load using specific gauges.
CO4	Measure torsion in mild steel.
CO5	Compression and tension test on helical springs.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
50	-	50	100

Course Content:

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

Suggested Reading

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.

Name of The Course	Construction Engineering Lab
Course Code	**BCE01P3402**
Prerequisite	-
Co-requisite	-
Anti-requisite	-

	L	T	P	C
	0	**0**	**2**	**1**

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 student will be able to:

CO1	Identify the suitability of materials for construction work.
CO2	Perform different test conducted on cement, aggregate and concrete as per relevant Codal provision.
CO3	Demonstrate the relevant BIS testing procedure to be carried out to ascertain the quality of building materials.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
50	-	50	100

Course Content:

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.

Suggested Reading

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

Name of The Course	**Soil Mechanics Lab**			
Course Code	**BCE02P3405**			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

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 student will be able to:

CO1	Give an engineering classification of a given soil.
CO2	Understand the principle of effective stress, and then calculate stresses that influence soil behavior.
CO3	Determine soil deformation parameters, and calculate settlement magnitude and rate of settlement.
CO4	Specify soil compaction requirements.
CO5	Conduct laboratory tests, and obtain soil properties and parameters from the test observations and results

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**
50	-	50	100

Course Content:

List of Experiments

1. To determine moisture content of soil
2. To determine the specific gravity of soil fraction passing 4.75 mm 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

Suggested Reading

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

Name of The Course	Basic Structural Analysis			
Course Code	BCE02T3403			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	T	P	C
	2	0	0	2

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 student will be able to:

CO1	Identify the method of analysis for statically indeterminate structures
CO2	Understand the difference between statically determinate structures and statically indeterminate structures
CO3	Use the influence line diagram for analysing beam.
CO4	Understand strain energy method to analyse arches.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Theorem of Three Moments **7 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 **7 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: Analysis of Arches **7 Hours**
Two hinged and three hinged parabolic arches - circular arches - cables - tension forces in towers - influence line for horizontal thrust and bending moment.
Unit IV: Slope deflection method **7 Hours**
Kinematic indeterminacy - Slope deflection method - analysis of continuous beams and portals - bending moment and shear force diagram.

Suggested Reading

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

2. S. Ramamrutham (2004), Theory of Structures, 5th Edition, Dhanpat Rai Publications, ISBN: 978041528091

Name of The Course	Basic Transportation Engineering			
Course Code	BCE02T3304			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	T	P	C
	2	0	0	2

Course Objectives

1. To impart the knowledge in Highway Geometrics, Traffic Engineering, materials, construction and design of pavements

Course Outcomes

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

CO1	Design various geometric elements of highways.
CO2	Understand the procedure to collect the traffic data for design and traffic management.
CO3	Test the highway materials as per IS/IRC guidelines.
CO4	Do structural design of flexible and rigid pavements.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Highway and Traffic Planning **7 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 **7 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 **7 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 **7 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.

Suggested Reading

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

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

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

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

Name of The Course	**Water & Waste Water Treatment Systems**			
Course Code	**BCE02T3404**			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	**T**	**P**	**C**
	2	**0**	**0**	**2**

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 student will be able to:

CO1	The type of unit operations and processes involved in water treatment plants.
CO2	Unit operations and processes required for satisfactory treatment of water.
CO3	Demonstrate an ability to recognize the type of unit operations and processes involved in wastewater treatment plants.
CO4	Demonstrate an ability to choose the appropriate unit operations and processes required for satisfactory treatment of wastewater.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**
20	30	50	100

Course Content:

Unit I: Water Treatments Units **7 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 II: Unit Operations & Processes **7 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 III: Wastewater Treatment **7 Hours**
Physical, chemical and biological principles involved in wastewater treatment and designing of unit-operations and processes. Permissible standards for wastewater disposal.
Unit IV: Pre and Primary Treatment **7 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.

Suggested Reading

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

Name of The Course	**Basic Transportation Engineering Lab**			
Course Code	**BCE02P3304**			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

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 student will be able to:

CO1	Understand about aggregate crushing value test and aggregate impact test.
CO2	Perform Los Angeles Abrasion Test and Shape Test.
CO3	Understand different procedures for testing bitumen.
CO4	Test the highway materials as per IS/IRC guidelines.
CO5	Carry out Spot Test and California Bearing Ratio Test

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**
50	-	50	100

Course Content:

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

Suggested Reading

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.

Name of The Course	**Water Analysis Lab**			
Course Code	BCE02P3404			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

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 student will be able to:

CO1	The type of unit operations and processes involved in water treatment plants.

CO2	Unit operations and processes required for satisfactory treatment of water.
CO3	The design of unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.
CO4	To study unit operations & advanced processes in water treatment its disinfection and aeration and softening.
CO5	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.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
50	-	50	100

Course Content:

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.

Suggested Reading

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

Name of The Course	**CAD Lab-I (AUTOCAD)**				
Course Code	**BCE01P3504**				
Prerequisite	-				
Co-requisite	-				
Anti-requisite	-				
	L	**T**	**P**	**C**	
	0	**0**	**2**	**1**	

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 student will be able to:

CO1	Implement the regulations for layout planning and preparation of drawings
CO2	Prepare building drawings for residential building and hospital buildings by AUTOCAD.
CO3	Design the different projections of the buildings.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
50	-	50	100

Course Content:

List of Experiments

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 of workshop with trussed roof.

Suggested Reading

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.

Name of The Course	**Analysis and Design Lab (STAAD PRO)**			
Course Code	**BCE01P3605**			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

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 structures.
3. To enable the students to design different components of structuresCourse Outcomes

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

CO1	Understand the details of STAAD – PRO software package.
CO2	Know the behavior of RCC structures.
CO3	Know the bending moment diagram drawn in tension face and shear force diagram.
CO4	Design RCC beams and columns.
CO5	Analyze and design RCC portal frames.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**
50	-	50	100

Course Content:

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 doubly reinforced RCC beam.
5. Analysis and design of RCC columns with different end conditions.
6. Analysis and design of RCC portal frames.

Suggested Reading

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

Name of The Course	**Design and Innovation**			
Course Code	**BCE01P3606**			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

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 structures.
3. To enable the students to design different components of structures

Course Outcomes

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

CO1	Understand the details of STAAD – PRO software package.
CO2	Know the behavior of RCC structures.
CO3	Know the bending moment diagram drawn in tension face and shear force diagram.
CO4	Design masonry building.
CO5	Design RCC building.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
50	-	50	100

Course Content:

List of Experiments
1. Design of (G+2) masonry building. 2. Design of staircase. 3. Design of (G+3) RCC building. 4. Design of (G+4) RCC building.

Suggested Reading

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

Name of The Course	Industrial Internship - I			
Course Code	BCE02P3501			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	T	P	C
	-	-	-	1

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 organization and multidisciplinary team.
3. To develop technical, interpersonal and communication skills.

Course Outcomes

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

CO1	Apply engineering knowledge in solving real-life problems.
CO2	Attain new skills and be aware of the state-of-art in engineering disciplines of their own interest.
CO3	Get exposure to real-life-working environment & practices, and to attain the professionalisms.
CO4	Work with multi-tasking professionals and multidisciplinary team.
CO5	Prepare a technical report, to improve presentation and other soft skills.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
50	-	50	100

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 HOD of DOCE. The student at the end of internship will present his report about the internship before a committee constituted by the HOD of the department 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 HOD.

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			

Name of The Course	Reinforced Concrete Structures			
Course Code	BCE02T3406			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	T	P	C
	2	0	0	2

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 student will be able to:

CO1	Understand the behavior of structural members and the concept of design.
CO2	Calculate moment of resistance for different types of RC beam sections.
CO3	Design any type of RC beam.
CO4	Understand the difference between one way slab and two way slab.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Material Properties and Design Concepts **7 Hours**
Material properties: Compressive strength, tensile strength, 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. Design of singly reinforced beams by working stress method.
Unit II: Limit state design of beams **7 Hours**
Design principles and procedures for critical sections for bending moment and shear forces. Flexural and shear design example of singly and doubly reinforced simply supported and cantilever beams using the codal provision. Detailing of longitudinal and shear reinforcement, anchorage of bars, check for development length. Reinforcement requirements, slenderness limits for beams for lateral stability. Flexural and shear design of simply supported T and L beams. Design of rectangular section for torsion.
Unit III: Limit State Design of Slabs **7 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 IV: Limit State Design of Compression Members **7 Lecture Hour**
General design aspects of compression members. Design of short axially loaded columns with reinforcement detailing. Design of columns with uniaxial bending and biaxial bending using SP- 16 charts, design of long column.

Suggested Reading

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.
4. B. C. Punmia (2003), Design of reinforced concrete structures, Lakshmi Publishers.

Name of The Course	Introduction to Design of Steel Structures
Course Code	BCE02T3601

Prerequisite	-				
Co-requisite	-				
Anti-requisite	-				
	L	**T**	**P**	**C**	
	2	**0**	**0**	**2**	

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:

CO1	Understand different types of structural rolled steel sections and their properties and design of connections.
CO2	Design laterally supported and unsupported beams.
CO3	Design built up column sections, lacings, battens, column bases and tension members.
CO4	Design plate girders and understand curtailment of flange plates and stiffeners.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Introduction and Design of Connection. **7 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 **7 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 **7 Hours**
Design of column – built up section – single and double lacing – batten – Column bases – design of tension members.
Unit IV: Roof Trusses. **7 Hours**
Types of roof trusses - Calculation of dead load, live load, wind load – Analysis and design of roof truss – Design of purlins.

Suggested Reading

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.

Name of The Course	**Quantity Surveying and Estimating**				
Course Code	**BCE02T3603**				
Prerequisite	-				
Co-requisite	-				
Anti-requisite	-				
	L	**T**	**P**	**C**	
	3	**0**	**0**	**3**	

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 student will be able to:

CO1	Prepare a detailed estimate for different types of structures.
CO2	Prepare valuation reports and cost quality control.
CO3	Estimates the quantity of items and analyse its rates considering material, labour and machinery cost with the help of software.
CO4	Prepare valuation reports and cost quality control.
CO5	Know specifications of various items of works
CO6	Understand latest research paper..

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Estimation of building **8 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 **8 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 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 **8 Hours**
Valuation- rent fixation, tenders, - contracts –accounting procedure, measurement book, stores, cost & quality control – PWD & CPWD practice - Specifications of various items of works - Schedule of Rates.
Unit V: Detailed specifications and Schedule of Rates **8 Hours**
Specifications of various items of works - Schedule of Rates.
Unit VI: Discussion on Latest Research Paper **4 Hours**
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class..

Suggested Reading

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.

Name of The Course	**Industrial Internship - II**			
Course Code	**BCE02P3702**			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	**T**	**P**	**C**
	-	-	-	**1**

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 organization and multidisciplinary team.
3. To develop technical, interpersonal and communication skills.

Course Outcomes

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

CO1	Apply engineering knowledge in solving real-life problems.
CO2	Attain new skills and be aware of the state-of-art in engineering disciplines of their own interest.
CO3	Get exposure to real-life-working environment & practices, and to attain the professionalisms.
CO4	Work with multi-tasking professionals and multidisciplinary team.
CO5	Prepare a technical report, to improve presentation and other soft skills.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
50	-	50	100

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 HOD of DOCE. The student at the end of internship will present his report about the internship before a committee constituted by the HOD of the department 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 HOD.

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**			

Name of The Course	**Capstone Phase - I**			
Course Code	**BCE02P3998**			
Prerequisite	**-**			
Co-requisite	**-**			
Anti-requisite	**-**			
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

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 student will be able to

CO1	Submit a project synopsis comprising of the application and feasibility of the project.
CO2	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.
CO3	Work and communicate efficiently in multidisciplinary teams..
CO4	Identify, formulate, and solve engineering problems.
CO5	Develop an understanding of professional and ethical responsibility.

Continuous Assessment Pattern

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

Name of The Course	**TQM in Construction of Smart City**			
Course Code				
Prerequisite	**-**			
Co-requisite	**-**			
Anti-requisite	**-**			
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives

1. To familiarize with quality management in construction Industry.

2. To familiarize with clauses for quality management in construction Industry.
3. To understand the leadership in construction Industry.

Course Outcomes

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

CO1	To realize the importance of significance of quality.
CO2	Manage quality improvement teams.
CO3	Identify requirements of quality improvement programs
CO4	To realize the importance of significance of quality.
CO5	Identify requirements of quality management in the construction industry.
CO6	Understand latest research paper.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Quality management **8 Hours**
Quality management in construction industry, new approach to quality management, and road to quality management.
Unit II: Quality assurance **8 Hours**
Formal QA, quality assurance, ISO 9000, clauses of ISO 9000, third party assessment for construction works.
Unit III: Leadership and total quality management **8 Hours**
Leadership and total quality management, tools for total quality management, teamwork for total quality management, stages in team development, and role within a team.
Unit IV: Learning organization **8 Hours**
Learning organization, lean production and management applied to construction industry.
Unit V: Total quality management **8 Hours**
Quality management in the construction industry, research objectives, senior management and total quality management, cultural change in construction.
Unit VI: Discussion on Latest Research Paper **4 Hours**
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class.

Suggested Reading

1. Steven McCabe. (1998). "Quality Improvement Techniques in Construction." LONGMAN.
2. Kwakye, A.A. (1997), "Construction Project Administration", Adisson Wesley Longman, London.

Name of The Course	**Estimation Lab (PRIMAVERA)**			
Course Code	**BCE02P3607**			
Prerequisite	**-**			
Co-requisite	**-**			
Anti-requisite	**-**			
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

Course Objectives

1.To develop the capacity of students in correlating theoretical knowledge into practical systems pertaining to civil engineering domain.
2. To foster collaborative learning skills.
3. To 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 both in oral and written format.

Course Outcomes

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

CO1	Identify, formulate, and solve engineering problems.
CO2	Understand specifications of various items of works and schedule of rates and prepare valuation reports.
CO3	Submit a project report comprising of the application and feasibility of the project.
CO4	Work and communicate efficiently in multidisciplinary teams.
CO5	Develop an understanding of professional and ethical responsibility.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks

50	-	50	100

Course Content:

List of Experiments

1. Determination of volume of excavation of earth.

2. Estimation for concrete and steel in footings.

3. Form work required for footings.

4. Estimation for brick walls and plastering.

5. Form work required for columns including scaffolding and shuttering.

6. Estimation for concrete and steel in columns.

7. Form work required for slabs including scaffolding and shuttering.

8. Estimation for concrete and steel in slabs.

9. Form work required for beams including scaffolding and shuttering.

10. Estimation for concrete and steel in beams.

11. Rate analysis for various items of works.

12. Preparation of bills.

13. Studies of PWD and CPWD practices.

14. Bar bending schedule.

15. Valuation of the building.

Suggested Reading

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.

Name of The Course	**Capstone Phase – 2**
Course Code	**BCE02P3999**

Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	**T**	**P**	**C**
	0	**0**	**20**	**10**

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 student will be able to:

CO1	Submit a project synopsis comprising of the application and feasibility of the project.
CO2	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.
CO3	Work and communicate efficiently in multidisciplinary teams..
CO4	Identify, formulate, and solve engineering problems.
CO5	Develop an understanding of professional and ethical responsibility.

Continuous Assessment Pattern

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

Name of The Course	Sustainable Construction Materials			
Course Code	BCE02T5701			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	T	P	C
	3	0	0	3

Course Objectives

1. This course mainly aims to develop the knowledge about sustainable construction materials and importance of sustainable construction.
2. To make the students to understand sustainable construction materials & process.
3. Students get ideas about different types structure conditions.
4. Students understand repair techniques.

Course Outcomes

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

CO1	Know the sustainable construction materials – meaning, scope, nature, present status of the sustainable construction materials.
CO2	Study and application of various conditions of sustainable construction.
CO3	Get a thorough knowledge of various types of Sustainable Projects.
CO4	Know the different procedures for Disputes Resolving.
CO5	Understand different types of Risk Management in project.
CO6	Understand latest research paper.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Necessity and importance. **8 Hours**
Necessity and importance of sustainable construction materials. Material composition and properties, production, storage, distribution, testing, acceptance criteria, limitations of use, economic consideration, and recent development related to the following materials to be studied.
Unit II: Various construction chemicals/admixtures **8 Hours**
Various construction chemicals/admixtures , Fly ash and its use in concrete ,Silica fume concrete ,Self-compacting concrete, Fiber Reinforced plastics and concrete ,Light weight concrete.
Unit III: Special Materials **8 Hours**
Crumb modified bitumen Rubber, Glenium Concrete, Materials used in nuclear-containment structures. Gas pressure welding of rebar. Precast concrete.
Unit IV: High performance concrete **8 Hours**
High performance concrete, Nano technology in cement concrete, Ferro cement Technology. Mix design As per Is code 10262:2019
Unit V: Maintenance of Structure **8 Hours**
Materials for Repairing - Special concretes and mortar - Concrete chemicals - Special elements for accelerated strength gain - Expansive cement - Polymer concrete – Ferro cement, Fibre reinforced concrete - Fibre reinforced plastics. Risk Management in project.
Unit VI: Discussion on Latest Research Paper **4 Hours**
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class.

Suggested Reading

1. Concrete Technology by Neville.
2. Construction Materials, Methods & Techniques(3e) by William P Spence, Yesdee Publication 2012, Pvt. Ltd,, Chennai, India
3.Concrete Structure properties & Materials by Mehta P.K & Mantreio P.J.M, Prentice hall.
4.Concrete Technology by M.S.Shetty, S.Chand Publ.
5. Civil Engineering and Construction Review magazine.
6. New Building Materials and Construction World magazine.
7. Is code 10262: 2019

Name of The Course	Environment And Energy For Smart City			
Course Code				
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	T	P	C
	3	0	0	3

Course Objectives

1. The objective of this course is to expose the students to the concepts of sustainability in the context of building and conventional engineered building materials, such as Concrete,

Bricks, and achieving the same through lower Carbon cements, Superior brick kilns and Recycled aggregate minimizing consumption of natural resources including water.
2. To make the students to understand VOC and indoor air quality.
3. To make the students to understand Energy codes ECBC requirement.
4. Students understand Role and Civil Society- Social Movements and Non-Governmental / Governmental Organizations.

Course Outcomes

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

CO1	Know about Role of Material in sustainable construction.
CO2	Study and know about operational energy in sustainable construction.
CO3	Get a thorough knowledge of Comparative energy performance emission
CO4	Know &Understand Energy codes ECBC requirement.
CO5	Understand latest research paper.
CO6	Students understand use of renewable energy in buildings.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Introduction **8 Hours**
Embodied energy, Operational energy in Building and Life cycle energy. Ecological foot print, Bio-capacity and calculation of planet equivalent.
Unit II: Role of Material **8 Hours**
Carbon from Cement, alternative cements and cementitious material, Alternative fuel for cements for reduction in carbon emission. Sustainability issues for concrete, Role of quality, minimization of natural resource utilization, High volume fly ash concrete, geo-polymer concrete etc. concrete with alternative material for sustainability.
Unit III: Aggregates and water consumption **8 Hours**
Reduction in water consumption in concrete, Recycled aggregate, Energy for grinding crushing of cement aggregate etc. and reduction. Operational energy in building role of materials and thermal conductivity. Clay Bricks, Types kilns, Comparative energy performance emission performance and financial performance, Indoor air quality.
Unit IV: Sustainability and Health **8 Hours**
Paints, Adhesive and sealants for use in building, Volatile organic content (VOC) emission issues and indoor air quality for Sustainability and Health hazard Operational energy reduction and net zero building, Optimization for design of building for energy efficiency and example of optimization through use of Evolutionary genetic algorithm.
Unit V: Building Integrated Photo Voltaic **8 Hours**
Use of Building Integrated Photo Voltaic (BIPV) and other renewable energy in buildings, basic concepts and efficiency. Radiation budget, Surface water balance, Effects of trees and microclimatic modification through greening.
Unit VI: Discussion on Latest Research Paper **4 Hours**
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class.

Suggested Reading

1.Fereidoon P. Sioshansi (2011) Energy, Sustainability and the Environment, Butterworth-Heinemann. Page; 640pp. ISBN 9780123851376.
2.Ali Sayigh (2013) Sustainability, Energy and Architecture, Academic Press. Pages; 552pp. ISBN 9780123977571.
3.Vivian Tam Khoa Le (2019) Sustainable Construction Technologies, Butterworth-Heinemann. Pages; 490pp. ISBN 9780128117507.

Name of The Course	**Value Engineering and Valuation**			
Course Code	**BCE02T5706**			
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives

1. Define Value engineering and its objectives
2. Estimation of project budget using capitalized income approach
3. Analyze a building using LCC methodology

Course Outcomes

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

CO1	Understand the basics of Value Engineering (VE) to ensure that a standardized method is used for VE applications to projects.
CO2	Learn to perform "function analysis" for buildings and civil projects
CO3	Understand the appropriate time to apply VE for building design projects.
CO4	Understand the value engineering and total project management.
CO5	Understand the function system in project management.
CO6	Understand latest research paper

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Value engineering **8 Hours**
Introduction to value engineering (VE), definition, objectives of value engineering, reasons for unnecessary costs, VE techniques and methodology, interface with the other programs**.**
Unit II: Project budget **8 Hours**
Elements of the project budget, need for cost control, meaning of capitalization, capitalization process, and capitalized income approach to construction project budgeting.
Unit III: Life cycle cost (LCC) and building costs **8 Hours**
Life cycle cost (LCC) and building costs, LCC technology and examples, LCC methodology, LCC formats and analysis and weighted evaluation – application of LCC to buildings.
Unit IV: Value engineering and total project management **8 Hours**
Value engineering and total project management, level of effort, team selection, value engineering job plan, and work plan phases
Unit V: Function system **8 Hours**
Classifying function, defining function, project level function system technique (fast) diagram, creativity and fixation, interpersonal skills, generation of ideas, brainstorming, rules for brainstorming, Delphi technique, application of Delphi technique to civil engineering projects.
Unit VI: Discussion on Latest Research Paper **4 Hours**
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class.

Suggested Reading

1. Jay Mandelbaum Danny L. Reed, Project Leader
2.Tenah, K.A. (1985). "The Construction Management Process", Reston Publishing Company, Inc. Virginia
3. Dell'Isola, Alphonse (1997). "Value Engineering: Practical Applications." R.S. Means Company, Inc: Kingston, MA.
4. Oberiender, G. D. (1993). "Project Management for Engineering and Construction". McGraw-Hill, Inc.: New York

Name of The Course	**Infrastructure Development**				
Course Code	**BCE02T5707**				
Prerequisite	-				
Co-requisite	-				
Anti-requisite	-				
	L	**T**	**P**	**C**	
	3	**0**	**0**	**3**	

Course Objectives

1. Importance of prefabrication in construction
2. Advantages of modular coordination in prefabrication
3. Application of different equipments in construction industry

Course Outcomes

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

CO1	Interpret the basic principles of geo-mechanics and their application in infrastructure development.
CO2	Interpret the design of structural elements.
CO3	Explain the complexities of delivery of infrastructure works and processes used for project development and management.
CO4	Learn to issues related to infrastructure development.
CO5	To study different infrastructure project.
CO6	Understand latest research paper

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Construction Industry **8 Hours**
Nature, characteristics, size and structure. Role of infrastructure development in employment generation and improving of the National economy. Various Agencies associated with infrastructure development in India as regards various sectors.
Unit II: Status of Infrastructure in India **8 Hours**
Resource Planning- Planning for material, Labour, time and cost-Resources Utilization, material, Labour, time and cost - Procurement- inventory control
Unit III: MATERIAL, EQUIPMENT AND LABOUR **8 Hours**
Road sector Port , Railway, communication, water supply and drainage, Power sector, oil and gas industry, Health and educational services. Infrastructure Development, Indian budget and its relation with Infrastructure development projects in India. Various programs related with Infrastructure development in rural and urban sector. Public Private Partnership (PPP) in Infrastructure, Draft Concession Agreement for PPP projects, Escrow Agreement.
Unit IV:Issues related to infrastructure development **8 Hours**
Pre – requisites necessary to ensure success for switching over from public sector management to private sector management, issues in developing, funding and managing infrastructure projects, role, responsibility of project management consultants. FDI in Infrastructure development, Problem areas and solutions.
Unit V: SPV's for Infra projects **8 Hours**
JNNURM - Jawaharlal Nehru National Urban Renewal Mission, PMGSY – Pradhan Mantri Gram Sadak Yojana, RGGVY - Rajiv Gandhi Grameen Vidyutikaran Yojana, Ports Connectivity Projects, Indira Gandhi International Air Port project, Indo – US Nuclear Deal, Nuclear Power Projects in India.
Unit VI: Discussion on Latest Research Paper **4 Hours**
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class.

Suggested Reading

1. Construction Engineering & management of Projects(For Infrastructure & Civil Works) by S. C. Sharma, Khanna Publishers, 2nd Edition, 2011
2. India Infrastructure Report – Rakesh Mohan.
3. Infrastructure Today – Magazine.
4. Document of five year plans, published by Govt. of India.
5. Public Private Partnership in Infrastructure by R. N. Joshi Vision Publications – 2010.
6. Infrastructure Development in India by Rajarshi Majumder Rawat Publications – 2010

Name of The Course	**Sustainable Transportation**				
Course Code					
Prerequisite	-				
Co-requisite	-				
Anti-requisite	-				
	L	**T**	**P**	**C**	
	3	0	0	3	

Course Objectives

1. To understand concept & need of transportation systems in urban areas.
2. The social, economic and environmental implications of various modes of transportation, including the relationship between transportation, urban form and public health;
3. Evaluation of the relative strengths and weaknesses of local transportation plans in terms of sustainability of smart cities.
4. Unsustainable impacts of different transport modes & measures to curb it.
5. Alternative sustainable technologies for environmentally as well as socially sustainable transportation system.

Course Outcomes

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

CO1	Explain the unsustainable impacts of today's transport sector
CO2	Analyse and compare the potentials and challenges of sustainable transportation system.
CO3	Critically judge solutions based on environmental impact assessment
CO4	Urban and regional transport planning
CO5	Being able to understand & find merits of Alternative sustainable technologies
CO6	Discuss on Latest Research Paper.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Introduction to Transportation system **8 Hours**
Introduction to various types of mass transportation systems Need of mass transportation, recent trends in transit, mass transportation characteristics.
Unit II: Urban and regional sustainable transport planning **8 Hours**
Transportation and Urban Sprawl, Its environmental impact on humans, flora and fauna, soil, water, air, climate and landscape . Transportation planning, Trip generation, distribution , Mode choices , **Traffic assignment.** Establishment of baseline conditions w.r.t soil, water and air quality
Unit III: Sustainable Public Transportation Systems **8 Hours**
Introduction to public transit, History - Personal public transit experiences, Opportunities for transit professionals Transportation economics, Sustainability Transit modes and technologies, Transit system performance, Transit capacity, Frequency and headway , Quality of service, Coefficient of rolling friction, modes comparison, system configurations, system performance calculations.
Unit IV: Introduction to Environmental Impact Assessment (EIA) **8 Hours**
Background and history of EIA, Concept of EIA, need of EIA, regulation & policies as per EIA, Assessing environmental change, EIA theory and decision-making, Key issues in EIA, Overview of the stages of the EIA process, Overview of legislation for EIA.
Unit V: Sustainable Transportation Modes Planning **8 Hours**
Pedestrian – Planning Principles, Tools, Designs, Methods to measure success, Cycles- Planning Principles, Cycle Track Network, Crossings and intersections and junctions, Transit Planning, Road Side Infrastructure Planning. Sustainable Parking management. Land-use plans, zoning schemes and provisions
Unit VI: Discussion on Latest Research Paper **2 Hours**
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class.

Suggested Reading

1. Assessment & Decision Making for Sustainable Transport, European Conference of Ministers of Transport, OECD Publishing 2004
2. Paquette, R.J., et al, Transportation Engineering Planning and Design, John Wiley & Sons, New York, 1982.
3. Alan Black, Urban Mass Transportation Planning, McGraw-Hill, 1995
4. Wood, C. and Wood, C., "Environmental Impact Assessment: A Comparative Review", Prentice Hall. 2002.
5. Petts, J., "Handbook of Environmental Impact Assessment", Blackwell Publishing. 1999.

Name of The Course	**Energy Efficient Buildings in Smart city**				
Course Code					
Prerequisite	-				
Co-requisite	-				
Anti-requisite	-				
	L	**T**	**P**	**C**	
	3	**0**	**0**	**3**	

Course Objectives

1. This course aims to highlight importance of Energy-Efficient Buildings within the context of Energy issues in the 21st century.
2. To familiarize students with the concept of Energy efficiency, Renewable sources of energy and their effective adaptation in green buildings for smart city.
3. To give a full understanding of Building Form and Fabric, Infiltration, ventilation, Lighting, cooling and water conservation.
4. To highlight the importance of Environmental Management as well as Environmental impact Assessment methods in Energy efficient buildings.

Course Outcomes

CO1	Understand to make buildings energy efficient.
CO2	Have a fuller grasp on Renewable Energy mechanisms such as Passive Solar heating and collection, Photovoltaic's, and Ground source heat pumps, and their adaption to green building concepts.
CO3	Understand the concepts of Site and Climate, Building Form, Building Fabric, Infiltration and ventilation, Lighting, Heating, Cooling, Energy Management and water conservation.
CO4	Have the necessary skills to undertake an Environmental Impact Assessment study for Energy Efficient Buildings. They shall be equipped with the associated cutting-edge management strategies too.
CO5	Monitor energy consumption.
CO6	Discuss on Latest Research Paper.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks

20	**30**	**50**	**100**

Course Content:

Unit I: Green Buildings, Energy and Environment 8 Hours
Green Buildings within the Indian Context, Types of Energy - Energy Efficiency and Pollution, Better Buildings, Reducing energy consumption, Low energy design
Unit II: Renewable Energy, Site and Climate 8 Hours
Renewable Energy sources that can be used in Green Buildings - Solar energy - Passive Solar Heating - Passive Solar collection - Wind and other renewable - A passive solar strategy - Photovoltaic - Climate and Energy - Macro and Microclimate - Indian Examples.
Unit III: Building Form and Fabric 8 Hours
Building Form - Surface area and Fabric Heat Loss - utilizing natural energy - Internal Planning - Grouping of buildings - Building Fabrics - Windows and doors - Floors - Walls - Masonry - Ecological walling systems - Thermal Properties of Construction Material.
Unit IV:Infiltration, Ventilation, Lighting, Cooling and Water Conservation 8 Hours
Infiltration and ventilation - Natural ventilation in commercial buildings - passive cooling - modeling air flow and ventilation - Concepts of daylight factors and day lighting - daylight assessment - artificial lighting - New light sources - Cooling buildings - passive cooling - mechanical cooling - Water conservation- taps, toilets and urinals, novel systems - collection and utilization of rain water.
Unit V: Energy Awareness 8 Hours
Energy awareness - monitoring energy consumption - Building Environmental Assessment - environmental criteria - assessment methods - assessment tools (e.g. LEED) – Economies - Sustainable architecture and urban design - principles of environmental architecture - Benefits of green buildings - Energy Conservation Building code – NBC.
Unit VI: Discussion on Latest Research Paper 8 Hours
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class.

Suggested Reading

1. William T. Meyer, (2007), Energy Economics and Building Design, McGraw - Hill, ISBN: 9780070417519.
2. Sim Van Der Ryn and Stuart Cowan, "Ecological Design", Annotated Edition, Island Press ISBN-13: 9781597261418.
3.Richard D. Rush, (1991), The Building System Integration Handbook., Butterworth – Heinemann Ltd, ISBN-13: 9780750691987.

Name of The Course	**Smart City map preparation**				
Course Code					
Prerequisite	-				
Co-requisite	-				
Anti-requisite	-				
	L	**T**	**P**	**C**	
	0	**0**	**2**	**1**	

Course Outcomes

CO1	Understand the elements of map
CO2	Knowledge on scale and types of maps
CO3	Understand the concept of theme maps
CO4	Understand the basic concepts of topographic maps according to SOI guidelines
CO5	Generation of Theme Maps from Base map
CO6	Preparation of a base of a city

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
50		**50**	**100**

Course Content:

1. Basic elements of MAPS, components and presentation

2. Scale and type of maps—study of large scale, small scale maps, Land use maps of cities. (tracing of maps and understating of concept of scale)

3. Different theme maps—census map series, geographical maps, components of working drawings of a site, buildings.

4. Topographical maps – sources, SOI specifications, grid formation, data factors, projection systems- Types, basic concepts, SOI guidelines and assumptions for projection systems, Study of SOI grids.

5. Generation of Theme Maps from Base map_ Land Use Types etc. Demonstration of Use of Statistical Data on Maps- Pictographically, Graph etc.

6. Preparation of a base of a city: (i) Copying an existing map and Generating map from other sources (ii) Components of a Base map for a city or part of a city (iii) Map presentation with colours.

Name of The Course	**Statistical Methods in Planning Smart Cities**			
Course Code				
Prerequisite	-			
Co-requisite	-			
Anti-requisite	-			
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives

1. To study the Elements of Physical Infrastructure and its Management.
2. To study the Basic Principles of Urban Transport Planning and Infrastructure

Course Outcomes

CO1	Explain the unsustainable impacts of today's transport sector
CO2	Analyse and compare the potentials and challenges of sustainable transportation system.
CO3	Critically judge solutions based on environmental impact assessment
CO4	Urban and regional transport planning
CO5	Being able to understand & find merits of Alternative sustainable technologies
CO6	Discuss on Latest Research Paper.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**
20	30	50	100

Course Content:

Unit I: Data Collection **7 Hours**
Statistical data and methods; collection of data, record, file, sources of data; questionnaire design, design of sample surveys; simple random sampling, stratified sampling, systematic samples, etc.; data coding, data verification
Unit II: Basic Data Presentation 7 Hours
Statistical tables; types of tables, comparisons, methods of presentation, graphic presentation; types of charts; plotting a curve, rules for drawing curves; bar charts, pictography, pie charts, histograms
Unit III: Statistical Methods **10 Hours**
Raw data, frequency distribution, selecting number of classes, class limits, curves, cumulative frequency distribution and gives, measures of central tendency; arithmetic mean, median, mode, geometric mean and harmonic mean; measures of absolute dispersion, range, quartile deviation, average deviation, standard deviation, skewness and kurtosis. Statistical Programme for Social Sciences (SPSS) genstat and statisticia and its application for statistical methods.
Unit IV: Time Series Analysis **8 Hours**
Variation in time series, trend analysis, cyclical variation, seasonal variation, irregular variation, time series analysis forecasting; Applications in planning.
Unit V: Probability Theory and Probability Distribution **8 Hours**
Introduction, addition rule, conditional probability, multiplication rule, random variables and probability distribution, mathematical expectation; Binomial distribution, Poission distribution; and normal distribution
Unit VI: Discussion on Latest Research Paper **2 Hours**
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class.

Suggested Reading

1. Traffic Engineering and Transport Planning, L. R. Kadiyali, Khanna Publications
2. Infrastructure and Governance, Sameer Kochhar, Deepak B. Phatak & H.Krishnamurthy, Academic Foundation, New Delhi
3. Principles of Urban Transport Systems Planning, B. G. Hutchinson, McGrawHill Inc
4. Introduction to transportation planning, Michael J Bruton, Hutchinson
5. Guidelines on Regulations and Control of Mixed Traffic in Urban Areas by IRC 70-1977

Name of The Course	**Disaster Risk Mitigation and Management**			
Course Code				
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives

1. To understand the Basic Concepts of Disaster Management.
2. To understand Disaster Management Mechanisms; Disaster Risk Mitigation; and Post Disaste Measures.

Course Outcomes

CO1	Understand the fundamental concepts of Disaster management
CO2	Knowledge on the mechanisms of disaster management

CO3	Strategies on industrial, chemical and biological disasters
CO4	Understand various types of disasters, communication and information technology in disaster management.
CO5	Understand the concept of natural resource management for disaster safe habitation
CO6	Discussion on latest research paper

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
50	-	50	100

Course Content:

Unit I: Basic Concepts of Disaster Management 8 Hours
Disaster – definitions, concept and perceptions; different types of disasters; recent initiatives at national and state level; Kyoto Framework of disaster mitigation and management; Disaster management policy – national and states; Disaster Management Act – national and states
Unit II: Disaster Management Mechanisms 8 Hours
Disaster management mechanisms – national, state and district levels; select global practices; disaster and development; physical planning and disaster management plans; various role players in disaster management – NGOs / CBOs and Armed Forces; Community Based Disaster Preparedness (CBDP)
Unit III: Disaster Risk Mitigation 8 Hours
Natural Disasters – physical phenomenon, causes and consequences mitigation and management practices – cyclones, floods, earthquakes, landslides etc.; causes and risk mitigation strategies at the Master Plan for industrial, chemical and biological disasters; land use planning, building bye laws and disaster safe construction practices for different types of disasters
Unit IV: Disaster Preparedness 8 Hours
Forecasting and early warning systems for various types of disasters; communication and information technology in disaster management; disaster education and awareness; documentation and case studies on natural disasters. Urbanization, land requirements, social and affordability issues of land use, Climate change and its implications in disaster mitigation
Unit V: Post Disaster Management and Cross Cutting Issues 8 Hours
Post disaster management; rehabilitation and reconstruction of disaster affected areas; urban disaster mitigation; natural resource management for disaster safe habitation; relationship between disaster and environment; safe hill area development guidelines and coastal zone regulations for safe habitation; human settlement planning for consequence mitigation of global warming and climate change
Unit VI: Discussion on Latest Research Paper 2 Hours
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class

Suggested Reading

1. Damon P Capolla Introduction to International Disaster Management 2007 Butterworth Heinemann publications
2. George D Haddow and Jane A Bullock Introduction to Emergency Management 2006 Elsevier Butterworth Heinemann
3. Dr. Aniruddha Dhairyadhar Joshi, Text Book of Disaster Management 2009 Lotus Publication of Pvt ltd
4. Ministry of Home Affairs Model Amendment in Town and Country Planning Legislations, 2004 MHA

Name of The Course	**Metropolitan Planning, Development and Management**			
Course Code				
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives

1. To understand the Process of Metropolitanization and Evolution of Metropolitan Cities and their respective Regions using Case Studies.
2. To introduce the Techniques of Delineation of Metropolitan Regions and study their Structure, Form and Characteristics with the help of Case Studies.

Course Outcomes

CO1	General trends and distribution of metropolis
CO2	Knowledge on Metropolitan region and delineation techniques
CO3	Understand the Forms and concepts for metropolitan planning and development
CO4	Knowledge on tools and constraints in the implementation of metropolitan development plan
CO5	Development efforts in case of some of the metropolises
CO6	Discussion on latest research paper

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
50	-	50	100

Course Content:

Unit I: Metropolis and Metropolitanisation **8 Hours**
Introduction to metropolis and related concepts, growth and scale; Complexities:social, economic, physical and administrative; Metropolitanisation in India: general trends and distribution; Issues and problems in metropolitan planning and Development
Unit II: Metropolises and its Region **8 Hours**
Area of influence, service area of a metropolis; Metropolis as a primate city; Concept of degree of primacy; Metropolitan region and delineation techniques; Metropolitan regional structures: characteristics, components and spatial patterns
Unit III: Forms **8 Hour** Metropolitan centralization and decentralization processes; Concepts of ring and satellite towns, counter-magnets; Forms and concepts for metropolitan planning and development: Sheet, Galaxy, Core, Star, Ring and Multi-nucleated; Merits and demerits; Efficient functioning of metropolis
Unit IV: Disaster Preparedness **8 Hours**
Metropolitan planning: spatial planning studies and surveys; Concepts and techniques of preparation of metropolitan city plans; Metropolitan planning, development and management strategies at regional and settlement levels; Tools and constraints in the implementation of metropolitan development plan in terms of administration, legal and financial aspects; Role and function of public participation
Unit V: Disaster Preparedness **8 Hours**
Metropolitan planning, development and management in India; Appraisal of planning and development efforts in case of some of the metropolises, viz. Kolkata, Mumbai, Delhi and Chennai, etc
Unit VI: Discussion on Latest Research Paper **2 Hours**
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class

Suggested Reading

1. Ramachandran, R. Urbanization and Urban Systems in India 1998 Oxford University Press, New Delhi
2. ITPI City and Metropolitan Planning and Design ITPI, New Delhi
3. Bawa, V.K. Indian Metropolis: Urbanization, Planning and Management 1987 Inter-India Publications, New Delhi
4.MMRDA Madras 2011: A New Perspective for metropolitan Management 1991 MMRDA, Chennai
5. NCRPB Regional Plan 2021 2005 NCRPB, New Delhi

Name of The Course	**Planning Techniques**			
Course Code				
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives

1. To learn different Database required for Planning and Socio-economic Survey Techniques.
2. To learn the Methods and Contents of Preparation of Base Maps

Course Outcomes

CO1	Knowledge on base map preparations
CO2	Understand the base requirement of smart city planning
CO3	Understand the data requirement for various types of regional plans
CO4	Concept of graphical presentation of Statistical Data
CO5	Concept of graphical presentation of Spatial Data
CO6	Discussion on latest research paper

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Techniques of Preparing Base maps **8 Hours**
Choice of appropriate scale for region and settlement level plans; town development plans, zonal development plans, layout plans; graphical, linear and areal scales; contents of base maps at various scales, notations
Unit II: Data Base for Planning and Socio -Economic Surveys **8 Hours**
Data requirements for urban and regional planning; sources of primary and secondary data; questionnaire design, measurement scale and their application, sampling techniques, types of socio-economic surveys; self-surveys, interviews, mailed questionnaires and observer participation
Unit III: Physical Surveys **8 Hours**

Techniques of conducting surveys for land use, building use, density, structural condition of buildings, heights of building, land utilization and physical features of land; Data requirement for various types of regional plans.
Unit IV: Techniques of Graphic Presentation of Statistical Data 8 Hours
Tabulation of data, graphical presentation of data; pie diagrams, histograms, bar charts, normal, semi-log and double log graphs and their uses; colour, black and white presentation techniques; basis disciplines of illustration and tables.
Unit V: Techniques of Graphic Presentation of Spatial Data 8 Hours
Land use classification, coding and analysis; residential and non-residential density patterns and analysis; colour, black and white presentation techniques; basis disciplines of illustration; Presentation of spatial data, analysis and proposals.
Unit VI: Discussion on Latest Research Paper 2 Hours
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class

Suggested Reading

1. James Ambrose Building Structures, Second (Edition) Wiley
2. R.P. Mishra Regional Planning: Concepts, Techniques Policies 1992 Concept Publishing
3.Richard E. Klasterman Community Analysis and Planning Techniques 1990 Rowman & Littlefied Publisher
4. Shen Zhesujiang Geospatial Techniques in Urban Planning 2011 Sringer

Name of The Course	**Applied Geology**				
Course Code					
Prerequisite					
Co-requisite					
Anti-requisite					
		L	**T**	**P**	**C**
		2	0	0	2

Course Objectives

1.The overall objective of lecture portion of engineering geology is to demonstrate the importance of geology in making engineering decisions.
2.Introduce the fundamentals of engineering properties of earth materials for their use in civil engineering constructions.
3.Develop quantitative skills and frame work for solving basic engineering geology problems related to geological features and geological hazards.

Course Outcomes

CO1	Characterize and classify various minerals and rocks on the basis of their engineering properties.
CO2	Assess geological hazards and develop mitigation frameworks.
CO3	Use seismic and electrical methods to investigate subsurface and develop a native construction plan incorporating all relevant aspects of geology.
CO4	Work in a multidisciplinary team to identify geological features of prospective civil engineering project sites.
CO5	Analyze ground water movements and deal with ground water problems.
CO6	Discussion on latest research paper

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Exam (MTE)	End Term Exam (ETE)	Total Marks
20	30	50	100

Course Content:

Unit I: Minerals and Rocks 8 Hours
Relevance and importance of engineering geology, Mineral properties, composition and their use in the manufacture of construction materials, Physical and engineering properties of igneous, metaphoric and sedimentary rocks.
Unit II: Interior and Structures of earth 8 Hours
Earth's interior based on seismic models, Geological maps – attitude of beds, Plate tectonics and continental drift theory, Study of earth's geological structures – fold, faults and joints, Geological factors affecting civil engineering constructions, geophysical methods – Seismic and electrical methods for subsurface investigations
Unit III: Weathering and Soils 8 Hours
The atmosphere, Weather and climate, Ocean structure and composition, Rock Quality Determination (RQD) & Rock Structure Rating (RSR), Soil origin and formation, classification and its engineering importance, Slope stability, rock and soil slope stability analysis.
Unit IV: Ground water 8 Hours
Characteristic of ground water, occurrence of ground water, Hydro geological cycle, Darcy's Law, laboratory permeability tests, Types of aquifers, Water level fluctuations, ground water investigation, Groundwater contamination, Artificial recharge of groundwater, Seawater intrusion and harvesting of rainwater.
Unit V: Earth Process 8 Hours
Resources – minerals, water & energy, Natural hazards – Brief description on cause and formation of flood, cyclone, volcano,

earthquake, tsunami and landslides, Global warming and the greenhouse effect, Future of the Earth.
Unit VI: Discussion on Latest Research Paper 2 Hours
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class

Suggested Reading

1. P.C. Varghese (2012), Engineering Geology for Civil Engineers, PHI Learning private limited. ISBN: 978-81-203-4495-2.
2. Parbin Singh, (2004), Engineering & General Geology, S.K. Kataria and Sons- Delhi. ISBN: 978-93-501-4267-7.
3. Garg. S.K. (2004), Physical and Engineering Geology, Khanna Publishers – Delhi. ISBN: 978-81-740-9032-4.
4. Jerome V. Degraff Robert B. Johnson (2011), Principles of Engineering Geology, Wiley India Pvt Ltd. ISBN: 978-81-265-3314-5.
5. Dr. D. V. Reddy (2010), Engineering Geology 1st Edition, Vikas Publishing House. ISBN: 978-81-259-1903-2.

Name of The Course	**Demography for Smart City**			
Course Code				
Prerequisite				
Co-requisite				
Anti-requisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives

1. To Study varied Relationships between Demography and Urbanization in India
2. To develop the ability to Critically Analyze Settlement Systems embedded in the Urban and Regional Planning

Course Outcomes

CO1	Understand the concept of population influencing the smart city planning.
CO2	Concept and importance of demography for smart city
CO3	Knowledge on the evolution of urbanizations in India
CO4	Knowledge on the role of urban area for smart city development
CO5	Understand the policies and strategies for Smart city
CO6	Discussion on latest research paper

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Exam (MTE)**	**End Term Exam (ETE)**	**Total Marks**
20	30	50	100

Course Content:

Unit I: Study of Population 8 Hours
Demographic variables: fertility, mortality, migration; evolution of population study, contribution of Malthus; mortality-trends, biological and social factors and mortalitygender, race, social structure, life style, social status, occupation etc; measures of mortality-crude and age-specific death rates; infant mortality, adjusted or standardized death rates; neonatal mortality rate; fertility-fertility trends, fertility and social and biological behavior; differential fertility, ethnic groups, socioeconomical group, methods of measuring volumes of migration; direct and indirect measures; effect of migration of composition of population.
Unit II: Study of Demography 8 Hours
Source of demographic data; Census of India and its role as a data warehouse; population structure and composition -age sex composition, sex ratio, dependency ratio, child-woman ratio; measures of age-sex structure, age-sex pyramid, population composition; marital status, caste, region , literacy level, etc; life table techniques; techniques in preparing life table, abridged life table; population estimation, projection and population forecasting; basic cohorts survival model, inter regional cohorts survival model.
Unit III: Urbanization in India 8 Hours
A brief history of urbanization in India; Mughal and British influences of India cities; post-independence urbanization; urbanization process as influenced by sociocultural, political, economic and administrative factors; definition of urban centers, concepts of rural-urban continuum and dichotomy; census definition of urban places town, cities, town groups, urban agglomeration, standard urban area metropolis, megalopolis, etc; functional classification of urban places.
Unit IV: Settlement Systems and Role of Urban Area 8 Hours
Settlement system, senses classification of settlements, primate city, rank-size rule, central place concept, concepts of complementary area, central goods and services, range, threshold, etc; city-region relationship; structure of city regions, area of influence, dominance; rural-urban fringes; its structure, stages of growth, its role in urban growth; urbanization, industrialization and urban development; push and pull factors; migration trends and impacts on urban and rural development
Unit V: Earth Process 8 Hours

Over view of world urbanization, National Urbanization policy, basic issues in urbanization policy; role of national and state level policies; five year plans, latest attempts at urbanization policy formulation in the country; salient features of the report of the National Commission on Urbanization
Unit VI: Discussion on Latest Research Paper 2 Hours
This unit is based on research papers / Innovations / start-up ideas / white papers / applications. Minimum one latest research paper will be discussed in the class

Suggested Reading

1. Sivaramakrishnan, K.C., Kundu, A., and Singh, B.N. Handbook of Urbanization in India 2005 Oxford University Press, New Delhi.
2. Kundu, A. Trends and Processes of Urbanization in India 2011 IIED and UNFPA, London.
3. Ramachandran, R. Urbanization and Urban Systems in India Oxford University Press, New Delhi.
4. Misra, R.P. Urbanization in India: Challenges and Opportunities 1998 ICSSR, Shillong