Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

STUDY SCHEME 2024 B.TECH (CIVIL ENGINEERING)

Module Name:
1. **Structural Engineering**
2. **Geotechnical and Transportation Engineering**
3. **Environmental Engineering**
4. **Hydraulics and water resources**
5. **Construction Engineering and Management**
6. **Surveying**

Sem	Theory/ Practical	Course Category	Course Code	Course Name	L	T	P	Credits	CA Marks	ESE Marks	Total Marks
3	T	ESC	ESCE101	Solid Mechanics	3	1	0	4	40	60	100
3	T/P	PCC	CCE101	Building Material and Testing	3	0	2	4	90	60	150
3	T/P	PCC	CCE102	Environmental Engineering - I	3	0	2	4	90	60	150
3	T/P	PCC	CCE103	Fluid Mechanics	3	1	2	5	90	60	150
3	T	BSC	BSCE101	Probability and Statistics	4	0	0	4	40	60	100
3	P	PR	SMCE101	Seminar and Technical Report Writing for Engineers	0	0	2	1	50	0	50
3	P	INT	TRCE101	Training-I	-	-	-	1	60	40	100
3	T	HMSC	HSMC103	Business Essentials for Engineers	2	0	0	2	40	60	100
3	T	MNC-AU	MCCE101	Environmental Sciences and Sustainability	2	0	0		50	0	50
3	T	MPD		Mentoring and Professional Development	1	0	0	-	-	-	-
4	T/P	PCC	CCE104	Transportation Engineering	3	0	2	4	90	60	150
4	T/P	PCC	CCE105	Surveying and Geomatics	3	0	2	4	90	60	150
4	T/P	PCC	CCE106	Environmental Engineering - II	3	0	2	4	90	60	150
4	T	PCC	CCE107	Hydraulic Engineering	3	0	0	3	40	60	100
4	T/P	PCC	CCE108	Structural Analysis - I	3	1	2	5	90	60	150
4	T	MPD	MPD102	Mentoring and Professional Development	0	0	1	1	100	0	100
4	T	MNC-AU	MC101	Indian Constitution	2	0	0		50	0	50
4	T	HMSC	HSMC104	Universal Human Values: Understanding Harmony	2	0	0	2	40	60	100
5	T	PCC	CCE110	Structural Design -I	3	1	0	4	40	60	100
5	T/P	PCC	CCE111	Geotechnical Engineering	3	0	2	4	90	60	150

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Sem	Theory/ Practical	Course Category	Course Code	Course Name	L	T	P	Credits	CA Marks	ESE Marks	Total Marks
5	T	PCC	CCE112	Structural Anaylsis-II	3	1	0	4	40	60	100
5	T	PCC	CCE113	Hydrology & Water Resources Engineering	3	1	0	4	40	60	100
5	T	PEC	ECE10x	Elective - I	4	0	0	4	40	60	100
5	P	INT	TRCE102	Training-II	-	-	-	1	60	40	100
5	T	PCC	CCE109	Construction Engineering & Project Management	3	0	0	3	40	60	100
5	T	MNC-AU	MC102	Essence of Indian Knowledge Tradition	2	0	0		50	0	50
5	P	ESC	ESCE102	Design Thinking	0	0	2	1	50	0	50
5	T	MPD		Mentoring and Professional Development	1	0	0	-	-	-	-
6	T/P	PCC	CCE114	Structural Design -II	3	1	2	5	90	60	150
6	T/P	PCC	CCE115	Foundation Engineering	3	1	2	5	90	60	150
6	T	PCC	CCE116	Estimation & Costing	3	0	0	3	40	60	100
6	T	PEC	ECE10x	Elective - II	4	0	0	4	40	60	100
6	T	PEC	ECE10x	Elective - III	4	0	0	4	40	60	100
6	P	PR	PRCE101	Minor Project	0	0	2	1	60	40	100
6	T	PR	FSCE101	Course on Employability, Prospects of Higher Education	2	0	0	2	40	60	100
6	T	ESC	ESC106	Entrepreneurship and Startups	3	0	0	3	40	60	100
6	T	MNC	MOC101/102	Mandatory Open Elective (Organizational Behaviour/ Sustainable Goals)	2	0	0		50	0	50
6	T	MPD	MPD103	Mentoring and Professional Development	1	0	0	1	100	0	100
7	T	PEC	ECE10x	Elective-IV (Through MOOCs)	3	0	0	3	40	60	100
7	T	MOPEC	OCE401	Open Elective - I	3	0	0	3	40	60	100
7	T	MOPEC	OCE402	Open Elective - II	3	0	0	3	40	60	100
7	T	MOPEC	OCE403	Open Elective - III	3	0	0	3	40	60	100
7	P	PR	PRCE102	Major Project	0	0	6	3	120	80	200

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Sem	Theory/ Practical	Course Category	Course Code	Course Name	L	T	P	Credits	CA Marks	ESE Marks	Total Marks
8	P	INT	TRCE4103	Industrial Training	0	0	24	12	450	150	600
8	T	MPD	MPD104	Mentoring and Professional Development	1	0	0	1	100	0	100

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Course Code: ESCE101
Course Title: Solid Mechanics

Programme: B.Tech.	**L:** 3, **T:**1, **P:** 0	**Credits:** 4
Semester: 3	**Theory/Practical:** Theory	**Teaching Hours:** 45(L)+15(T)+0(P)= 60 Hours
Total Max. Marks: 100	**Continuous Assessment (CA) Marks:** 40	**End Semester Examination (ESE) Marks:** 60
Minimum Percentage of Numerical/Design problems in ESE: 80%		
Duration of End Semester Examination (ESE): 3 Hours		
Course Type: Core Course		

Prerequisites (if any): NIL

Additional Material Allowed in ESE: Non-programmable Scientific Calculator

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Identify and apply material properties of solids in calculations and analysis
2	Summarize the different types of deformations and how they relate to stress and strain
3	Calculate stresses and strains in various structural elements under different loading scenarios
4	Draw shear force and bending moment diagrams
5	Apply different failure theories to predict failure
6	Interpret analysis results to draw meaningful conclusions specific to response of solids

CONTENT

Part A
Unit 1: 7(L) hrs
Rigid and deformable solids – physical and strength properties; Concept of force – response of solids, stress-strain diagram of ductile and brittle materials; Principles of statics and equilibrium to analyze forces acting on solid bodies – reactions, shear force and bending moment, use of free body diagrams; Concept of strength and stiffness

Unit 2: 15(L) hrs
Internal forces and deformations in solids – stress and strain; Constitutive relations – Hooke's law; Method of section for evaluating internal forces; Stress – normal and shear stress; Strain – normal and shear strains; Transformation of plane stress and strain, principal stresses and strains; Combined stress – use of Mohr's circle; Principle of superposition and its limitations; Failure under different stress states; Failure criteria to predict safe loads – Mohr-coulomb theory, maximum principal stress theory, Maximum shear tress theory.

Part B
Unit 3: 15(L) hrs
Bending equation and applications; centroid and section modulus of various cross-sectional shapes including rectangular, circular, I/T shapes, channel, angle, flitched beam section; Bending and shear stress in different beams sections – computation and plotting

Unit 4: 8(L) hrs
Understanding the phenomenon of buckling in columns, including Euler's formula; Analyzing stresses in thin-walled pressure vessels like cylinders and spheres; Torsion equation, applications to circular shafts – solid and hollow

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Books

- Statics and Mechanics of Materials by R.C. Hibbeler
- Strength of Materials by S.P. Timoshenko
- Strength of Materials by R.K. Rajput
- Fundamentals of Solid Mechanics by M L Gambhir
- Strength of Materials by R. Subramanian
- Engineering Mechanics of Solids by E. P. Popov

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Course Code: CCE101
Course Title: Building Material and Testing

Programme: B.Tech.	L: 3 T: 0 P: 2	Credits: 4
Semester: 3	Theory/Practical: Theory	Teaching Hours: 45(L) + 0(T) + 30(P)= 75 Hours
Total Max. Marks: 150	Continuous Assessment (CA) Marks: 90	End Semester Examination (ESE) Marks: 60
Minimum Percentage of Numerical/Design problems in ESE: 10%		
Duration of End Semester Examination (ESE):3 Hours		
Course Type: Core Course		

Prerequisites: NIL

Additional Material Allowed in ESE: Non-programmable Scientific Calculator

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Demonstrate the role of materials in building construction
2	Identify appropriate building material for construction
3	Select and apply suitable material testing procedures/techniques
4	Write technical Laboratory report
5	Interpret the test reports for selection of suitable material and compliance
6	Utilize the relevant information from the standards and guidelines

Contents

Part A

Unit 1: (8L) hrs

Material – definition, classifications (engineering, non-engineering and structural, non-structural), types (brittle, ductile, composites and cementitious materials, etc.); Desirable properties and specifications for building materials; Selection of appropriate materials during engineering design & construction.

Unit 2: (14L) hrs

Concrete, bricks, steel, stones, timber – Composition/ constituent materials, production, and applications; Material microstructure, load-deformation response, effect on the strength and other material properties like toughness, water absorption, permeability; Characteristics strength, determination and its reporting

Part B

Unit 3: (10L) hrs

Other materials – Paint, Varnish, Bitumen and asphaltic materials; Water-proofing materials; Geo-textiles; Carbon composites; types and uses; Selection of suitable material in building construction; Methods of application.

Unit 4: (5L) hrs

Quality control - Sampling, Acceptance criterion, Code of practice and guidelines for different building materials such as Cements; Aggregates; Admixtures; Concrete, Bricks, Steel, Timbers.

Unit 5: (8L) hrs

Different equipment, devices, and instruments to characterize the material response/ behavior; Current testing technology (displacement-controlled and load controlled) and its selection for capturing the response of the material; Documenting the experimental program, including the test procedures, collected data, method of interpretation and final results; Use of test data/ testing reports in the material selection for various civil engineering projects /construction

Part C

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

(To be conducted in laboratory as per the relevant BIS codes)

Tests on cement– Fineness, Consistency, Setting time, Soundness, Specific gravity, Compression strength
Tests on aggregates (fine and coarse) – Specific gravity, Bulk Density, Fineness Modulus, Moisture content, Water Absorption, Bulking of sand
Tests on concrete– Slump, Compressive strength (Cube and Cylinder), Split Tensile strength, Flexural strength, Abrasion resistance, and tests for self-compacting concrete
Tests on steel – Elongation, Yield strength, Ultimate strength, Impact strength, Weight
Test on timber – Flexural strength, Unit weight
Test on Bricks – Dimensions, Water absorption, Efflorescence, Crushing strength

Books
- Building Construction Handbook by Chudley & Greeno (2006), (6th ed.), R. Butterworth Heinemann
- Highway Materials and Pavement Testing by Khanna & Justo, Nem Chand & Bros
- Structural Materials by Singh H., Springer
- Mechanical Testing of Engineering Materials by Kyriakos Komvopoulos
- Mechanical Behavior of Materials by E.N. Dowling, Prentice Hall International Edition
- Concrete: Microstructure, Properties and Materials by Mehta, P K and Monteiro P J M, Tata McGraw Hill
- Properties of Concrete by A. M. Neville, Prentice Hall
- Concrete Technology by M. S. Shetty, S. Chand & Co.
- Concrete Technology by M. L. Gambhir, Tata McGraw Hill Publishers, New Delhi
- Concrete Technology by A. R. Santha Kumar, Oxford University Press, New Delhi
- Applicable BIS and IRC code of practice/ guidelines specific to the listed materials

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Course Code: CCE102
Course Title: Environmental Engineering-I

Programme: B.Tech.	**L:** 3 **T:** 0 **P:** 2	**Credits:** 4
Semester: 3	**Theory/Practical:** Theory	**Teaching Hours:** 45(L) + 0(T) + 30(P) = 75 Hours
Total Max. Marks: 150	**Continuous Assessment (CA) Marks:** 90	**End Semester Examination (ESE) Marks:** 60
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 40%		
Duration of End Semester Examination: 3 Hours		
Course Type: Core Course		

Prerequisites (if any): NIL

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Explain the significance of environmental engineering and the fundamentals of water quality, sources, and standards as per BIS and WHO.
2	Estimate and project future population and corresponding water demand using standard engineering forecasting methods.
3	Design the working of conveyance systems suitable for different water sources and terrain conditions.
4	Design various physico-chemical treatment processes involved in making water potable and components of a water distribution network.
5	Analyze water distribution networks using modern software and computational tools like EPANET and watergems.
6	Conduct experiments adopting standard procedures and characterize various water samples.

Contents

Part-A

Unit-1: Introduction to Environmental Engineering and Water Supply   **(8L) hrs**
Importance of Environmental Engineering in Civil Engineering, Role of clean water in public health and sustainable development, Sources of water: Surface water and Groundwater, Water quality parameters and their significance (physical, chemical, biological), Water quality standards: BIS and WHO.

Unit-2: Water Demand and Population Forecasting   **(6L) hrs**
Types of water demand: Domestic, Industrial, Commercial, Firefighting, etc., Factors affecting water demand, Methods of population forecasting, Per capita demand and design period.

Unit-3: Collection and Conveyance Systems   **(9L) hrs**
Types of intake structures: River, canal, reservoir etc., Water conveyance: Gravity and pumping systems, Design of rising mains and transmission pipelines, Pipe materials and joints.

Part-B

Unit-4: Water Treatment Processes (9L) hrs

Objectives of water treatment, Treatment flowcharts for surface and groundwater, Design of treatment units: Screening, Aeration, Water softening, Sedimentation, Sedimentation aided with coagulation, Filtration (slow sand, rapid sand, mixed media filters), Disinfection, miscellaneous treatments.

Unit-5: Distribution Systems and Appurtenances (7L) hrs

Types of distribution systems: Gravity, Pumping, Combined, Distribution reservoirs, Methods of distribution: Layout, design, suitability, Appurtenances in distribution systems, Detection and prevention of water wastage in distribution system.

Unit-6: Design of Water Supply Systems using Modern Tools (6L) hrs

Introduction to design software: EPANET, WaterGEMS etc., Application of software in modeling and simulation of water distribution networks, Case studies using software (basic overview and demonstration-based learning), Role of GIS and remote sensing in water supply systems planning.

Laboratory Work

Experiment No.	Experiment Title
1	Determination of pH value of a water sample.
2	Determination of Turbidity of a water sample
3	Determination of Hardness - total, calcium and magnesium hardness of a water sample.
4	Determination of solids - total, dissolved and suspended solids of a water sample.
5	Determination of alkalinity of a water sample.
6	Determination of chlorides content of a water sample.
7	Determination of sulphates content of a water sample.
8	Determination of bacteriological quality of a water sample
9	Design/Analysis of water distribution networks using EPANET, Water Gems etc.

Text Books
1. S.K. Garg, "Environmental Engineering – Vol. I: Water Supply Engineering", Khanna Publishers.
2. B.C. Punmia, Ashok Jain, Arun Jain, "Water Supply Engineering", Laxmi Publications
3. Howard S. Peavy, Donald R. Rowe & George Tchobanoglous, "Environmental Engg.", McGraw Hill.
4. P. Aarne Vesilind, Susan M. Morgan, "Introduction to Environmental Engineering", Cengage Learning.
5. Mackenzie L. Davis, "Water and Wastewater Engineering- Design Principles and Practice"-McGraw-Hill Education.
6. Viessman Jr, Hammer J. M, Perez, E.M, and Chadik, P. A, Water Supply and Pollution Control, PHI Learning.

Reference Books
1. Hammer, M.J. and Hammer, M.J. Jr., "Water and Wastewater Technology", PHI Learning
2. "Manual on Water Supply and Treatment -1999", Central Public Health and Environmental Engineering Organisation, Govt. of India.
3. American Water Works Association (AWWA), Principles and Practices of Water Supply Operations Series," AWWA.
4. James Edzwald, "Water Quality and Treatment- A Handbook on Drinking Water", American Water Works Association.
5. Bentley Systems, Thomas M Walski, "Advanced Water Distribution Modeling and Management," Bentley Institute Press.
6. Standard Methods for the Examination of Water and Waste Water, American Public Health Association, American Water Works Association, Water Environment Federation, 2023.

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Online Learning Materials

1. https://www.epa.gov/water-research/epanet accessed on 14/05/2025
2. https://education.bentley.com/LearningPaths/guided-learningpaths-310579 accessed on 14/05/2025
3. https://www.udemy.com/course/water-supply-system-design/ accessed on 14/05/2025
4. https://www.udemy.com/course/the-complete-course-in-water-and-wastewater-treatment/ accessed on 14/05/2025
5. https://www.edx.org/xseries/delft-university-of-technology-water-management accessed on 14/05/2025
6. https://www.youtube.com/playlist?list=PLlQdh3107nrtDcqv25wkUPcHITh8_kLGm accessed on 14/05/2025

Supplementary SWAYAM Course

Sr. No.	Course Name	Instructor	Host Institute	URL
1	Water Supply Engineering	Prof. Manoj Kumar Tiwari	IIT Kharagpur	https://nptel.ac.in/courses/105105201 accessed on 14/05/2025
2	Introduction to Environmental Engineering and Science - Fundamental and Sustainability Concepts	Prof. Brajesh Kumar Dubey	IIT Kharagpur	https://onlinecourses.nptel.ac.in/noc25_ge17/preview? accessed on 14/05/2025
3	Water and Wastewater Engineering	Dr. P Bose	IIT Kanpur	https://nptel.ac.in/courses/105104102 accessed on 14/05/2025
4	Water Quality Management Practices	Prof. Gourav Dhar Bhowmick	IIT Kharagpur	https://onlinecourses.nptel.ac.in/noc25_ag12/preview accessed on 14/05/2025
5	Water and waste water treatment	Prof. Bhanu Prakash Vellanki	IIT Roorkee	https://onlinecourses.nptel.ac.in/noc25_ce63/preview accessed on 14/05/2025
6	Rural Water Resources Management	Prof. Pennan Chinnasamy	IIT Bombay	https://onlinecourses.nptel.ac.in/noc25_ge31/preview accessed on 14/05/2025
7	Water and Waste Water Engineering	Prof. C. Venkobachar, Prof. Ligy Philip, Prof. B.S. Murty	IIT Madras	https://nptel.ac.in/courses/105106119 accessed on 14/05/2025

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Course Code: CCE103
Course Title: Fluid Mechanics

Programme: B.Tech.	L: 3 T:1 P:2	Credits: 5
Semester: 3	Theory/Practical: Theory	Teaching Hours: 45(L)+15(T)+30(P) = 90 Hours
Total Max. Marks: 150	Continuous Assessment (CA) Marks: 90	End Semester Examination (ESE) Marks: 60
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 70%		
Duration of End Semester Examination (ESE): 3 Hours		
Course Type: Core Course		

Prerequisites (if any): NIL

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Define fundamental fluid properties, behavior, and terminology.
2	Calculate pressure in pipes, hydrostatic forces on various surfaces, and the stability of floating bodies.
3	Analyze various types of fluid flow and their characteristics.
4	Design pipe networks to meet specified hydraulic and operational requirements.
5	Apply dimensional analysis to derive relationships among fluid parameters.
6	Demonstrate the validity of fluid mechanics theorems and determine performance constants of hydraulic devices through experimentation.

Contents

Part-A

Unit-1 Basic concept and Definitions   5(L) hrs
Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

Unit-2 Fluid statics   10(L) hrs
Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

Unit-3 Fluid kinematics   6(L) hrs
Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one-, two- and three-dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates

Part-B

Unit-4 Fluid dynamics   12(L) hrs
Surface and body forces; Equations of motion - Euler's equation, Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation, venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced.

Unit -5-Dimensional Analysis and hydraulic similitude   **6(L) hrs**

Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem, Or Dimensional homogeneity, Rayleigh method, Buckingham's Pi method and other methods. Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problem.

Unit-6 Flow through pipes   **6(L) hrs**

Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon.

Part-C

Laboratory Work: To be conducted in fluid mechanics lab

Experiment No.	Experiment Title
1	To study of pressure measuring devices as piezometer, U-tube manometer, and pressure gauges.
2	To verify Bernoulli's Theorem.
3	To determine the meta centric height of a Floating Body under different condition.
4	To determine the coefficient of discharge of Venturimeter.
5	To determine the coefficient of discharge of Orifice Meter
6	To determine the coefficient of friction for different diameter pipes.
7	To estimate velocity of fluid in pipe using pitot tube.
8	To estimate the minor losses as energy loss in pipe bend.
9	To estimate the minor losses as energy loss in sudden contraction and sudden enlargement in pipe
10	To determine the coefficient of discharge on rectangular notches.
11	To determine the coefficient of discharge on V-notches
12	To verify Storke's law in laboratory.

Text Books

1. C.S.P. Ojha, R. Berndtsson and P. N. Chadramouli "Fluid Mechanics and Machinery", Oxford University Press, 2010
2. P M Modi and S M Seth, "Hydraulics and Fluid Mechanics", Standard Book House, 22nd edition, 2019.
3. K. Subramanya, "Theory and Applications of Fluid Mechanics", Tata McGraw Hill,3rd edition, 2013.
4. R.L. Daugherty, J.B. Franzini and E.J. Finnemore, "Fluid Mechanics with Engineering Applications" International Student Edition, Mc Graw Hill, 10th edition ,2001

Reference Books

Here are some popular textbooks for Fluid Mechanics in Civil Engineering:

1. Frank M. White "Fluid Mechanics": Tata McGraw-Hill, 9th edition, 2021
2. R. K. Bansal "Fluid Mechanics and Hydraulics", Laxmi Publications,11th edition, 2023.
3. Cengel and Cimbala "Fluid Mechanics", McGraw-Hill Education, 5th edition, 2024.
4. P. N. Modi, "Hydraulics and Fluid Mechanics", Standard Book House, 23rd edition, 2022.
5. N. S. Govinda Rao "Fluid Mechanics for Civil Engineers" BS Publishers & Distributors Pvt Ltd,12th edition, 2021.

Online Learning Materials

1. https://www.youtube.com/watch?v=JYPITI0t_wM
2. https://www.youtube.com/watch?v=oZMEWpR9Vbw
3. https://www.youtube.com/watch?v=QApXrTUwQ14
4. https://www.youtube.com/watch?v=KnZIGa1PmCg

5. https://www.youtube.com/watch?v=Ww6P-XSRNkE
6. https://www.youtube.com/watch?v=vOgDfS50w2s
7. https://www.youtube.com/watch?v=4oEdRWMWYug

Supplementary SWAYAM Course

Sr. No.	Course Name	Instructor	Host Institute	URL
1	Fluid Mechanics	Dr TI Eldeho	IIT Bombay	https://nptel.ac.in/courses/105101082
2	Fluid Mechanics	Dr N Sahoo and Dr Subhashisa Dutta	IIT Guwahati	https://nptel.ac.in/courses/105103095
3	Fluid Mechanics	Dr Subashisa Dutta	IIT Guwahati	https://nptel.ac.in/courses/105103192
4	Environmental fluid mechanics	Prof. Chunendra K Sahu	IIT Kanpur	https://nptel.ac.in/courses/105104565

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Course Code: BSCE101
Course Title: Probability and Statistics

Programme: B.Tech.	L: 4 T:0 P: 0	Credits:4	
Semester: 3	Theory/Practical: Theory	Teaching Hours: 60 Hours	
Total Max. Marks: 100	Continuous Assessment (CA) Marks: 40	End Semester Examination (ESE) Marks: 60	
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 95%			
Duration of End Semester Examination (ESE): 3 Hours			
Course Type: Core Course			

Prerequisites (if any): NIL

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Summarize the fundamental concepts of probability, evaluate conditional probabilities and apply Bayes' Theorem in solving real-world problems.
2	Identify and classify discrete and continuous random variables, and compute their respective probability distributions.
3	Apply linearity of expectation and properties of variance in solving theoretical problems.
4	Evaluate different sampling techniques for testing small samples and making reliable inferences about a population
5	Apply the chi-square test to assess the goodness-of-fit and analyze the independence of attributes in categorical data.
6	Apply appropriate large sample tests to analyze statistical data.

Contents

Part-A

Unit-1 Probability Theory   9 (L) hrs
Probability spaces, theorems of Probability: addition theorem, multiplication theorem on probability, conditional probability and independence of events, Law of total probability, Baye's theorem.

Unit-2 Random Variables   9 (L) hrs
Random Variable: Discrete and continuous random variables, probability mass function, probability density function, distribution functions, exponential densities, Bivariate random variables: discrete and continuous. Joint and Marginal density functions, conditional distributions.

Unit-3 Expectation   5 (L) hrs
Expectation of discrete and continuous random variables, properties of expectation, mean and variance using expectation.

Part-B

Unit-4 Test of Significance   12 (L) hrs
Sampling theory: Null hypothesis and alternate hypothesis, critical value, critical region, region of acceptance, level of significance, Type I and type II errors. Small sample tests: t-test for single mean and for difference of means, F-test (Variance Ratio-test), Chi square test for Goodness of fit and independence of attributes.

Unit-5 Test of Significance for Large Samples   10 (L) hrs
Large sample test for simple proportion, difference of proportion, simple mean, difference of means, simple

standard deviation and difference of standard deviation.

Text Books

1. B.S. Grewal, "Higher Engineering Mathematics", 36th Edition, Khanna Publishers, 2010.
2. R.K. Narula," Engineering Mathematics-III", First Edition, 2019, Sharma Publications.
3. S.C. Gupta, V.K. Kapoor, "Fundamentals of Mathematical Statistics (A Modern Approach)", Sultan Chand & Sons, 23, Darya Ganj, New Delhi-11 0002.

Reference Books

1. E. Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
2. R.K. Jain and S.R.K Iyenger, "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 2008.
3. B.V. Ramana, "Higher Engineering Mathematics", 11th Reprint, Tata McGraw Hill, New Delhi, 2010.

Online Learning Materials

1) https://www.khanacademy.org/math/statistics-probability/analyzing-categorical-data
2) https://ndl.iitkgp.ac.in/ndl_he

Supplementary NPTEL Course

Sr. No.	Course Name	Instructor	Host Institute	URL
1	Introduction to probability and Statistics	Prof. G. Srinivasan	IIT Madras	https://nptel.ac.in/courses/111106112
2	Probability and Statistics	Prof. Somesh Kumar	IIT Kharagpur	https://archive.nptel.ac.in/courses/111/105/1111 05090/

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Course Code: SMCE101
Course Title: Seminar and Technical Report Writing for Engineers

Programme: B.Tech.	L: 0T:0 P:2	Credits:1
Semester: 3	Theory/Practical: Theory	Teaching Hours: 30 Hours
Total Max. Marks: 50	Continuous Assessment (CA) Marks: 50	End Semester Examination (ESE) Marks: 0
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 0%		
Duration of End Semester Examination (ESE): 0		
Course Type: Core Course		

Prerequisites (if any): NIL

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Articulate the key concepts of the seminar topic
2	Conduct necessary literature survey relevant to identified topic
3	Engage in thoughtful discussion and debate related to the seminar topic
4	Analyze arguments and perspectives coming during the seminar
5	Identify and utilize appropriate sources for research and further learning
6	Utilize the relevant information from the standards and guidelines

Contents
Part-A

This is an open-ended structured course in which the students will work on a problem/ topic to be given by faculty and will work under their supervision. The focus area of the seminar can be any topic from the civil engineering discipline. Each student will submit a structured report covering the introduction to the topic, details of literature survey done, outcome of the study, and references.

Focus area of the seminar report includes importance and relevance of the topic, organization of the content, planning the documentation – selection and use of appropriate diagrams, graphs, tables and equations; citing and referencing; references to diagrams, graphs, tables and equations proof reading; originality and plagiarism

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Course Code: TRCE101
Course Title: Training -I

Programme: B.Tech.	L: 0T: 0 P:0	Credits: 1
Semester: 3	Theory/Practical: Practical	Teaching Hours: 60 Hours
Total Max. Marks: 100	Continuous Assessment (CA) Marks: 60	End Semester Examination (ESE) Marks: 40
Minimum Percentage of Numerical / Design / Programming Problems in ESE: nil		
Duration of End Semester Examination (ESE): NIL		
Course Type:		

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Apply formatting to data using Excel's basic functions, cell references, and formatting tools.
2	Apply formulas and functions to perform calculations and automate data processing.
3	Interpret data using charts and conditional formatting to support decision-making.
4	Draw 2D engineering and architectural designs using fundamental AutoCAD tools and commands.
5	Modify technical drawings to reflect design changes and industry standards using AutoCAD features.
6	Organize drawing elements effectively using layers, blocks, and annotation tools for efficient drafting.

Contents

Part-A

Unit-1
Introduction to spreadsheet interface; data entry and formatting; sorting and filtering techniques; applying conditional formatting for data visualization; using built-in functions for basic analysis; creating and customizing charts; data validation; working with tables; printing.

Unit-2
Introduction to formulas and cell referencing; logical functions (IF, AND, OR); lookup functions (VLOOKUP, HLOOKUP, XLOOKUP); math functions (SUM, AVERAGE, COUNT, SUMIF, COUNTIF); text functions (LEFT, RIGHT, CONCATENATE); date/time functions.

Part-B

Unit-3
Introduction to CAD software: interface; setting units and limits; coordinate systems; drawing tools: line, arc, circle, rectangle, polyline, ellipse; object snaps and grid; modifying tools (erase, move, copy); text annotations: single-line and multi-line text.

Unit-4
Layer creation and management; layer properties and standards; dimensioning tools and styles; associative and aligned dimensions; hatch patterns and editing; block creation, insertion, and editing.

Reference Book:
1. "AutoCAD 2023 for Engineers & Designers" By Prof. Sham Tickoo, CADCIM Technologies (India-based publisher), ISBN: 9789393168536.
2. "Learning AutoCAD 2021 "By Sandeep Dogra, BPB Publications (New Delhi) ISBN: 9789389898307

3. "Engineering Drawing with AutoCAD" By Dhananjay A. Jolhe, Tata McGraw Hill Education (India), ISBN: 9780070149817.
4. "AutoCAD Training Guide" By Linkan Sagar, BPB Publications, ISBN: 9789386551991.
5. "Microsoft Excel 2021 Training Guide" By CA. Passu Gopalakrishnan, BPB Publications (New Delhi), ISBN: 9789391030453
6. "Excel Data Analysis: Your visual blueprint for analyzing data, charts, and PivotTables" By Wiley India, Jinjer Simon, ISBN: 9788126510984
7. "Learn Microsoft Excel 2021" By Ritu Arora, BPB Publications, ISBN: 9789389898604.
8. "Mastering MS Excel", By Harjit Singh, Kalyani Publishers (India),
9. "Microsoft Excel 2019 Bible (Indian Adaptation)", John Walkenbach, Wiley India, ISBN: 9788126577444

Online Learning materials.

1   https://youtu.be/2LumoE9KjoY?feature=shared,accessed on May 14, 2025

2   https://youtu.be/VtLXKU1PpRU?feature=shared, accessed on May 14, 2025

3   https://youtu.be/MrYdZiyfbXU?feature=shared,accessed on May 14, 2025

4   https://youtu.be/wbJcJCkBcMg?feature=shared,accessed on May 14, 2025

5   https://youtu.be/Vl0H-qTclOg?feature=shared,accessed on May 14, 2025

6   https://youtu.be/LgXzzu68j7M?feature=shared,, accessed on May 14, 2025

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Course Code: MCCE101
Course Title: Environmental Sciences and Sustainability

Programme: B. Tech.	L: 2 T: 0 P: 0	Credits: Non-Credit Course
Semester: 3	Theory/Practical: Theory	Teaching Hours: 30
Total Max. Marks: 50	Continuous Assessment (CA) Marks: 50	End Semester Examination (ESE) Marks: Nil
Minimum Percentage of Numerical / Design / Programming Problems in ESE: Nil		
Duration of End Semester Examination (ESE): Nil		
Course Type: Mandatory Non-Credit Course		

Prerequisites (if any): NIL
Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Propose solutions to environmental problems related to resource use and management
2	Infer threats to global biodiversity, their implications and potential solutions.
3	Interpret local, regional and global environmental issues
4	Comprehend the sustainability concepts; understand the role and responsibility of engineers in sustainable development
5	Recognize the challenges posed by technology in achieving sustainable development
6	Apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines

Contents

Part-A

Unit-1: Natural Resources 6(L) hrs
Renewable and non-renewable resources: natural resources and associated problems, use and over-utilization of surface and ground water, floods, drought, dam's benefits and problems, growing energy needs, use of alternate energy sources.

Unit-2: Ecosystem and Biodiversity 4(L) hrs
Concept of an ecosystem, producers, consumers, decomposers, ecological succession, food chains, food webs and ecological pyramids, biodiversity at global, national and local level, India as a mega diversity nation, threats to biodiversity, conservation of biodiversity.

Unit-3: Environmental Pollution and Social Issues 6(L) hrs
Air pollution, water pollution, soil pollution, noise pollution, water conservation, rain water harvesting, solid waste management, E-waste management, environmental ethics: issues and possible solutions, climate change-extreme weather conditions, National Action plan on Climate Change

Part-B

Unit-4: Introduction to Sustainability 3(L) hrs
Need and concept of sustainability, social-environmental and economic sustainability concepts, sustainable development goals.

Unit-5: Technology and Sustainability   **3(L) hrs**

Nexus between technology and sustainable development, challenges for sustainable development, multilateral environmental agreements and protocols - Clean Development Mechanism (CDM)

Unit-6: Sustainable Design   **8(L) hrs**

Basic concepts of sustainable habitat, green buildings, green materials & waste material for construction, material selection for sustainable design, green building certification- GRIHA & IGBC certification for buildings, energy efficient building design- passive solar design technique, thermal storage, cooling strategies, high performance insulation. sustainable cities, sustainable transport.

Text Books
1. G. Tyler Miller, Scott E. Spoolman, "Environmental Science", 17th Edition, Brooks/Cole, 2024.
2. D. D. Mishra, "Fundamental concepts in Environmental Studies", 3rd edition, S Chand & Co Ltd, 2014.
3. A. Kaushik, C. P. Kaushik, "Perspectives in Environmental Studies", 6th edition, New Age International Publishers, 2018.
4. R. Rajagopalan, "Environmental Studies, Crisis to Cure" Oxford University Press, 2023.
5. D. Allen, D. R. Shonnard, "Sustainability Engineering: Concepts, Design and Case Studies", 1st edition, Pearson, 2011
6. B. A. Striebig, A. A. Ogundipe, M. Papadakis, "Engineering applications in sustainable design and development", International edition, CL Engineering, 2015.
7. M. S. Sodha, N. K. Bansal, "Solar Passive Building, Science and Design", 1st edition, Pergamon Press, 1986
8. C. J. Kibert, "Sustainable Construction: Green Building Design and Delivery", 5th edition, Wiley, 2022

Reference Books
1. W. P. Cunningham, M. A. Cunningham, "Principle of Environmental Science", 9th edition, McGraw Hill, 2019.
2. P. Meenakshi, "Elements of Environment Science & Engineering", 2nd edition, Prentice Hall India Learning Private Limited, 2012.
3. K. N. Duggal, "Elements of Environment Engineering", 3rd edition, S. Chand & Co. Ltd, 1996.
4. K. M. Mackenthun, "Basic Concepts in Environmental Management", 1st edition, CRC Press, 1999.
5. Ni bin Chang, "Systems Analysis for Sustainable Engineering: Theory and Applications", Illustrated edition, MacGraw Hill, 2010.
6. J. Twidell, T. Weir, "Renewable Energy Resources", 3rd edition, Routledge, 2015.
7. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications- Rating System, TERI Publications - GRIHA Rating System.

Online Learning Materials
1.   https://www.youtube.com/watch?v=wNjIJaXaTkQ&t=1446s
2.   https://www.youtube.com/watch?v=or-z0Q03pcY
3.   https://www.youtube.com/watch?v=or-z0Q03pcY
4.   https://www.youtube.com/watch?v=SHxAOoxhKTA
5.   https://www.youtube.com/watch?v=B8lTtrjxn2s
6.   https://www.youtube.com/watch?v=CA5gxp6rWfA
7.   https://www.youtube.com/watch?v=nFBvLIfFFqI
8.   https://www.youtube.com/watch?v=MWgyRNtp2Do
9.   https://www.youtube.com/watch?v=80JP9SBKGv4
10.   https://www.youtube.com/watch?v=kqHeD5yKtoM
11.   https://www.youtube.com/watch?v=RoIpCJwX7-M
12.   https://www.youtube.com/watch?v=yy3VK6OYBbU

13.   https://www.youtube.com/watch?v=1b2VDJbvAtA

Supplementary SWAYAM Course

Sr. No	Course Name	Instructor	Host Institute	URL
1	Environmental Science	Prof. Sudha Goel and Prof. Shamik Chowdhary	IIT Kharagpur	https://onlinecourses.nptel.ac.in/ noc24_hs160/preview
2	Environment and Development	Prof. Ngamjho Kipgen	IIT Guwahati	https://onlinecourses.nptel.ac.in/ noc23_hs133/preview
3	Sustainable Engineering and Life Cycle Analysis	Prof. Brajesh Kr. Dubey	IIT Kharagpur	https://onlinecourses-archive.nptel.ac.in/noc18_ce08/ preview
4	Introduction to Environmental Engineering and Science – Fundamental and Sustainability Concept	Prof. Brajesh Kr. Dubey	IIT Kharagpur	https://onlinecourses.nptel.ac.in/ noc25_ge17/preview
5	Water, Society and Sustainability	Prof. Jenia Mukherjee	IIT Kharagpur	https://elearn.nptel.ac.in/shop/np tel/water-society-and-sustainability/?v=c86ee0d9d7ed
6	Basic Environmental Engineering and Pollution Abatement	Prof. P. Mondal	IIT Roorkee	https://onlinecourses.nptel.ac.in/ noc24_ch53/preview
7	Sustainable Materials and Green Buildings	Prof. B. Bhattacharjee	IIT Delhi	https://onlinecourses.nptel.ac.in/ noc19_ce40/preview

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Course Code: CCE104

Course Title: Transportation Engineering

Programme: B.Tech.	L: 3 T:0 P:2	Credits: 4
Semester: 4	Theory/Practical: Theory	Teaching Hours: 45(L)+0(T)+30(P) = 75 Hours
Total Max. Marks: 150	Continuous Assessment (CA) Marks: 90	End Semester Examination (ESE) Marks: 60
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 30%		
Duration of End Semester Examination (ESE): 3 Hours		
Course Type: Core Course		

Prerequisites (if any): NIL

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Design the geometric parameters of highways to ensure smooth and safe traffic flow.
2	Design traffic flow facilities and street furniture based on traffic characteristics.
3	Explain the fundamentals of railways and the classification of track systems.
4	Describe the components of a railway track and their required specifications.
5	Outline the importance and key elements of airport infrastructure.
6	Conduct laboratory and field tests on highway materials in accordance with relevant Indian Standards.

Contents

Part-A

Unit 1: Highway development and planning   10(L) hrs

Classification of roads, road development in India, Current Road projects in India, highway cross section elements, sight distance, design of horizontal alignment.

Unit 2: Traffic engineering & control   8(L) hrs

Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control, parking facilities, highway lighting.

Unit 3: Highway Materials   5(L) hrs

Materials used in Highway Construction- Soil, Stone aggregates, bituminous binders, desirable properties, tests and specifications.

Part-B

Unit 4: Railway Engineering   6(L) hrs

History of Railways, Development of Indian Railway, organization of Indian Railway. Railway Gauges: Definition, Gauges on World Railways, Choice of Gauge, Uniformity of Gauge, Loading Gauge, Construction Gauge.

Unit 5: Railway Track   9(L) hrs

Requirements of a Good Track, Track Specifications, Detailed Cross-Section of Single/Double Track used in Indian Railways. Components of permanent way - Rails, Sleepers, Ballast, Track Fixtures & Fastenings, Coning of Wheels, Tilting of Rails, Adzing of Sleepers, Rail Joints, Creep of Rails.

Unit 6: Airport Engineering: Introduction   **7(L) hrs**
Air Transport Scenario in India, Airport planning - Site selection, runway orientation, etc. Concept of Head Wind, Cross Wind, Wind Rose Diagram, Runway Configuration, Aircraft Parking System, Taxiway.

Part-C

Laboratory Work: To be conducted in Laboratory.

Experiment No.	Experiment Title
1	**Tests on Sub-grade Soil** 1. California Bearing Ratio
2	**Tests on Road Aggregates** 1. Crushing Value Test 2. Los Angles Abrasion Value Test 3. Impact Value Test 4. Shape Test (Flakiness and Elongation Index)
3	**Tests on Bituminous Materials and Mixes** 1. Penetration Test 2. Ductility Test 3. Softening Point Test 4. Flash & Fire Point Test 5. Bitumen Extraction
4	**Field Tests** 1. Study of Roughometer/Bump Indicator 2. Study of Benkelman Beam Method

Text/Reference Books:

1. S.K., Khanna, C.E.G Justo and A Veeraragavan, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017
2. L.R. Kadiyalai, ' Traffic Engineering and Transport Planning', Khanna Publishers, 9th edition 2024
3. C.A.O Flaherty, "Highway Engineering", Volume 2, Edward Arnold, London, 1986.
4. S.K Sharma "Principles, Practice & Design of Highway Engineering", S. Chand & Company Ltd., New Delhi, 1985.
5. C. Jotin Khisty, & B. Kent Lall, "Transportation Engineering: An Introduction", Pearson Education, 4th Edition (2017)
6. S.C. Rangwala, "Railway Engineering", Charotar Publishing House, 28th Edition (2020).
7. Satish Chandra & M.M. Agrawal, "Railway Engineering", Oxford University Press, 2nd Edition (2013).
8. S.K Khanna, M.G Arora, & S.S Jain, "Airport Planning and Design", Nem Chand & Bros., Roorkee, 6th Edition (2018)
9. Robert Horonjeff, & Francis X McKelvey, "Planning and Design of Airports", McGraw-Hill Education, 5th Edition (2010)
10. Partha Chakroborty, & Animesh Das, "Principles of Transportation Engineering", PHI Learning Pvt. Ltd.,2nd Edition (2005).
11. V.N. Vazirani, & M.S Joshi, "Transportation Engineering", Khanna Publishers, Updated reprints till 2020
12. Mannering, "Principles of Highway Engineering & Traffic Analysis", Wiley Publishers, New Delhi, 7th edition 2020.
13. Partha Chakraborty, ' Principles of Transportation Engineering, PHI Learning, 2ndedition, 2021.

Guru Nanak Dev Engineering College, Ludhiana

An Autonomous College under UGC Act 1956

B.Tech. (Civil Engineering)

Course Code: CCE105
Course Title: Surveying and Geomatics

Programme: B.Tech.	L: 3 T: 0 P: 2	Credits: 4
Semester: 4	Theory/Practical: Theory	Teaching Hours: 45(L)+0(T)+30(P) = 75 Hours
Total Max. Marks: 150	Continuous Assessment (CA) Marks: 90	End Semester Examination (ESE) Marks: 60
Minimum Percentage of Numerical /Design problems in ESE: 50%		
Duration of End Semester Examination (ESE): 3 Hours		
Course Type: Core Course		

Prerequisites (if any): NIL

Additional Material Allowed in ESE: Non programmable Scientific Calculator

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Explain the concept, various methods and techniques of surveying.
2	Compute angles, distances and levels for a given area.
3	Apply the concept of tachometry survey in difficult and hilly terrain.
4	Select appropriate instruments for data collection and survey purpose.
5	Interpret the concepts related to GIS and GPS and retrieve the information from remotely sensed data and interpret the data for survey.
6	Implement various methods of surveying by using instruments in field.

Contents

Part-A

Unit-1 Introduction: 4 hrs
Principles, Survey stations, Survey lines- ranging, direct &indirect ranging.

Unit-2 Compass Surveying: 4 hrs
Bearing and its measurement with prismatic compass, calculation of angles from bearings, Local Attraction

Unit-3 Levelling: 4 hrs
Principles of levelling, booking and reducing levels; differential levelling, reciprocal levelling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling.

Unit-4 Contouring: 4 hrs
Characteristics, methods, uses; areas and volumes

Unit-5 Plane Table Surveying: 4 hrs
Setting up the plane table and methods of plane tabling (Radiation and three-point problem only).

Unit-6 Theodolite Traversing: 4 hrs
Instruments, Measurement of horizontal and vertical angle; Balancing of Traverse

Part-B

Unit-7 Tachometry: 4 hrs
Definition, determination of tachometer constants and reduced level from tachometric observations.
Triangulation - network- Signals. Baseline corrections, Trigonometric leveling.

Unit-8 Curves: 3 hrs
Types of curves, Elements of simple and Transition curves

Unit-9 Modern Field Survey Systems: 6 hrs
Principle of Electronic Distance Measurement, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories – Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey, Global Positioning Systems (GPS), Segments of GPS, Errors in GPS, Differential Global Positioning System (DGPS)

Unit-10 Photogrammetry Surveying: 4 hrs
Introduction, Basic concepts, flight planning; Stereoscopy, photographic mapping, mosaics, Ground control point

Unit-11 Remote Sensing: 4 hrs
Introduction – Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors.

Laboratory Work

Experiment No.	Experiment Title
1	Measurement of bearing and angles with compass, adjustment of traverse by graphical method.
2	Different methods of levelling, height of instrument, rise & fall methods.
3	Measurement of horizontal and vertical angle by theodolite.
4	Determination of tachometric constants and determination of reduced levels by tachometric observations.
5	Plane table survey, different methods of plotting, Three point problems.
6	Determination of height of an inaccessible object.
7	Setting out of circular curves in the field using different methods.
8	Plotting of traverse using the Total Station and GPS

Text Books
1. S.K. Duggal, Surveying Vol I & II, Tata McGraw Hill, 2019
2. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain Surveying Vol. I & II, Laxmi Publications, 2016
3. R. A. Agor, Text Book of Advanced Surveying, Khanna Publishers, 1991
4. K.R. Arora, Surveying Volume I,II& III, Standard Book House. 2019
5. J. M. Anderson, E. M. Mikhail, Surveying: Theory and Practice (7th Edition), McGraw-Hill Education, 1998

Reference Books

1. James B. Campbell, Introduction to Geomatics, The Guilford Press, 2021
2. P. A. Longley, M. F. Goodchild, D. J. Maguire, D. W. Rhind, Geographic Information Systems and Science (4th Edition), Wiley, Year, 2015
3. C.L. Kochher, A Text Book of Surveying Vol. I & II, Dhanpat Rai Publishing Co., 2014
4. S. Ramamrutham., Plane and Geodetic Surveying, Dhanpat Rai Publishing Company, 2016
5. A.M Chandra., Plane Surveying, New Age International Publishers, 2015
6. A.M Chandra., Higher Surveying, New Age International Publishers, 2015
7. S.K Soni, Surveying Volume I & II, Katson Books, 2016

Online Learning Materials

1. Fundamentals of Surveying by S.K. Roy,
https://civildatas.com/download/fundamentals-of-surveying-by-roy Accessed on 7-05-2025.

2. Surveying-Problem Solving with Theory and Objective Type Questions by Dr. A.M. Chandra
https://civildatas.com/download/surveying-problem-solving-with-theory-and-objective-type-questions
Accessed on 7-05-2025

Online Courses and Video Lectures:

1. Digital Land Surveying and Mapping by J.K. Ghosh,
https://onlinecourses.nptel.ac.in/noc21_ce08/preview Accessed on 7-05-2025.

2. GPS Surveying by J.K. Ghosh
https://onlinecourses.nptel.ac.in/noc20_ce51/preview Accessed on 7-05-2025

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Course Code: CCE106
Course Title: Environmental Engineering-II

Programme: B.Tech.	L: 3 T: 0 P: 2	Credits: 4
Semester: 4	Theory/Practical: Theory	Teaching Hours: 45 (L) + 30 (P) = 75 Hours
Total Max. Marks: 150	Continuous Assessment (CA) Marks: 90	End Semester Examination (ESE) Marks: 60
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 50%		
Duration of End Semester Examination (ESE): 3 Hours		
Course Type: Core Course		

Prerequisites (if any): CCE102

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course, the student will have the ability to:

CO	Course Outcomes
1	evaluate the waste water characteristics and interpret their importance.
2	design the conveyance elements of wastewater collection systems.
3	plan and design components of wastewater treatment systems.
4	compare the efficacy of wastewater treatment technologies under different conditions.
5	analyze sewer networks using modern software and computational tools like OpenFlows Sewer, SewerGEMS etc.
6	conduct experiments adopting standard procedures and assess the quality of wastewater.

Contents

Part-A
Unit-1: Characteristics of wastewater   7(L) hrs
Composition of domestic wastewater, sampling, physical, chemical and microbiological characteristics, biological decomposition, BOD and BOD kinetics, effluent disposal limits.

Unit-2: Sewerage system   10(L) hrs
Systems of sewerage, estimation of dry weather and wet weather flow, flow variations, types of sewers, hydraulic design of sanitary sewers, materials for sewers, construction & maintenance of sewers, sewer appurtenances, wastewater pumping.

Unit-3: Primary treatment of wastewater   6(L) hrs
Preliminary & Primary treatment: screening, grit chamber, floatation units, sedimentation tanks.

Part-B
Unit-4: Secondary treatment of wastewater   9(L) hrs
Introduction to unit operations and processes, Secondary treatment units; activated sludge process, sequencing batch reactors, trickling filters, anaerobic filters, UASB, septic tank, sludge handling and disposal facilities

Unit-5: Natural and tertiary wastewater treatment systems   7(L) hrs
Stabilization ponds, constructed wetland systems, soil aquifer treatment, soak pits, tertiary wastewater treatment for nutrient removal and disinfection, wastewater reuse.

Unit-6: Modern tools in sewerage system design   6(L) hrs

Introduction to design software: SewerGEMS, OpenFlows Sewer, SewerCad etc., application of software in modeling and simulation of sewer networks.

Laboratory Work

Experiment No.	Experiment Title
1	Determination of pH value of a wastewater sample.
2	Determination of solids - total, dissolved and suspended solids of a wastewater sample.
3	Determination of Dissolved Oxygen DO of a water/wastewater sample
4	Determination of Biochemical Oxygen Demand (BOD) of a wastewater sample.
5	Determination of Chemical Oxygen Demand (COD) of a wastewater sample.
6	Determination of nutrients in wastewater (TKN, TN and TP).
7	Determination of heavy metals in a wastewater sample using Atomic Absorption Spectrometry.
8	Determination of bacteriological quality of a wastewater sample
9	Design/Analysis of sewer networks using SewerGems, OpenFlows Sewer etc.

Text Books:
1. Waste Water Engg. (Environmental Engg.-II), B. C. Punmia, Ashok Jain, Laxmi Publications, 2023, New Delhi
2. Environmental Engg. - A design Approach, Arcadio P. Sincero and Gregoria P. Sincero, Prentice Hall of India, New Delhi.
3. Environmental Engg., Howard S. Peavy, Donald R. Rowe & George Tchobanoglous, McGraw Hill, 2017, Indian Edition.
4. Sewage Disposal and Air Pollution Engg., S.K. Garg, Khanna Publishers, 2024, Delhi.

Reference Books
1. Wastewater Engineering: Treatment and Reuse, Metcalf & Eddy, McGraw Hill Education, 2017, 4th edition
2. Water and Wastewater Engineering: Design Principles and Practice, Mackenzie L. Davis, McGraw Hill Education, 2017,1st Edition
3. Introduction to Environmental Engineering and Science, G.B. Masters, Pearson, 2013, 3rd edition.
4. Wastewater Treatment- Concept and Design Approach, G. L. Karia, R. A. Christian, N. D. Jariwala, PHI Learning, 3rd edition.
5. Wastewater Treatment for Pollution Control and Reuse, Arceivala and Asolekar, Tata McGraw Hill, 2006, 3rd edition
6. Natural Wastewater Treatment Systems, R. W. Crites, E. J. Middlebrooks, R. K. Bastian, S. C. Reed, CRC Press, 2014, 2nd edition
7. Standard methods for the examination of water and wastewater, Washington: APHA AWWA, 2023, 24th edition
8. Manual on sewerage and sewage treatment, CPHEEO, 2013.

Online Learning Materials
1. https://www. studybwwt.online/ Accessed on June 02, 2025
2. https://freeebookpdf.download/docs/Biological%20Wastewater%20Treatment%202nd%20Edition-4953586 Accessed on June 02, 2025
3. https://www.classcentral.com/course/xuetangx-water-and-wastewater-treatment-engineering-physicochemical-technology-375920 Accessed on June 02, 2025

4.   https://www.classcentral.com/course/udemy-the-complete-course-in-water-and   wastewater-treatment-434558   Accessed on June 02, 2025

Supplementary SWAYAM Course

Sr. No	Course Name	Instructor	Host Institute	URL
1	Wastewater Treatment and Recycling	Prof. M. K. Tiwari	IIT Kharagpur	https://archive.nptel.ac.in/courses/105/105/105105178/
2	Wastewater Management	Prof. M.M. Ghangrekar	IIT Kharagpur	https://archive.nptel.ac.in/courses/105/105/105105048/
3	Water and Wastewater Treatment	Prof. Bhanu Prakash	IIT Roorkee	https://archive.nptel.ac.in/courses/105/107/105107207/
4	Water and Wastewater Engineering	Prof. C. Venkobachar	IIT Madras	https://archive.nptel.ac.in/courses/105/106/105106119/
5	Water and Wastewater Engineering	--	IIT Kanpur	https://archive.nptel.ac.in/courses/105/104/105104102/#
6	Biological process design for wastewater treatment	Prof. V.C. Srivastava	IIT Roorkee	https://archive.nptel.ac.in/courses/103/107/103107217/

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Course Code: CCE107
Course Title: Hydraulic Engineering

Programme: B.Tech.	L: 3 T:0 P:0	Credits:3
Semester: 4	Theory/Practical: Theory	Teaching Hours: 45(L)+0(T)+0(P) = 45 Hours
Total Max. Marks: 100	Continuous Assessment (CA) Marks: 40	End Semester Examination (ESE) Marks: 60
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 90%		
Duration of End Semester Examination (ESE): 3 Hours		
Course Type: Core Course		

Prerequisites (if any): CCE-103

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Determine flow parameters of laminar flow under varying boundary conditions, including drag force and fluid viscosity.
2	Estimate resisting forces in turbulent flow for both rough and smooth pipes.
3	Examine boundary layer friction and **its** solutions to minimize flow resistance and forces on moving bodies.
4	Design the most economical cross-section of an open channel based on fundamental concepts and definitions of open channel flow.
5	Analyze flow parameters under non-uniform flow conditions in open channels.
6	Analyze the elements and behavior of hydraulic jumps and surges.

Contents

Part-A
Unit-1 Laminar flow   2(L) hrs
Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity.

Unit-2 Turbulent Flow   13(L) hrs
Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes,

Unit-3 Boundary layer analysis   5(L) hrs
Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.

Part-B
Unit-4 Introduction to open channel   5(L) hrs
Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. Continuity Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient "n". Most economical section of channel. Computation of Uniform flow, Normal depth.

Unit-5 Non uniform flow 15(L) hrs

Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Measurement of Discharge and Velocity –Broad Crested Weir. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile Direct Step method.

Unit-6 Hydraulic Jump 5(L) hrs

Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges.

Text Books
1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House
2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
3. Open channel Flow, K. Subramanya, Tata McGraw Hill.
4. Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill.

Reference Books

1. "Open Channel Flow" by F. M. Henderson, McGraw-Hill Education
2. "Open Channel Hydraulics" by R. H. French, John Wiley & Sons
3. "Fluid Mechanics and Open Channel Flow" by R. K. Bansal, Laxmi Publications
4. "Open Channel Flow: A Practical Approach" by J. R. French, CRC Press
5. "Hydraulics of Open Channel Flow" by P. N. Modi, Standard Book House

Online Learning Materials

1. "Fluid Mechanics-II" by Stanford University on Coursera:
   http://www.coursera.org/specializations/fluid-mechanics
2. "Fluid Mechanics-II" by MIT on edX:
   http://www.edx.org/course/fluid-mechanics
3. "Fluid Mechanics for Civil Engineers" by UC Berkeley on Coursera:
   http://www.coursera.org/specializations/fluid-mechanics-civil-engineering
    Fluid Mechanics Tutorial by Tutorials Point:
   http://www.tutorialspoint.com/fluid_mechanics/index.html
4. **5. Fluid Mechanics Guide by Engineering Toolbox**:
   http://www.engineeringtoolbox.com/fluid-mechanics-d_13.html

Supplementary SWAYAM Course

Sr. No.	Course Name	Instructor	Host Institute	URL
1	Fluid Mechanics	Dr TI Eldeho	IIT Bombay	https://nptel.ac.in/courses/105101082
2	Fluid Mechanics	Dr N Sahoo and Dr Subhashisa Dutta	IIT Guwahati	https://nptel.ac.in/courses/105103095
3	Fluid Mechanics	Dr Subashisa Dutta	IIT Guwahati	https://nptel.ac.in/courses/105103192
4	Environmental fluid mechanics	Prof. Chunendra K Sahu	IIT Kanpur	https://nptel.ac.in/courses/105104565

Guru Nanak Dev Engineering College, Ludhiana
An Autonomous College under UGC Act 1956
B.Tech. (Civil Engineering)

Course Code: CCE108
Course Title: Structural Analysis -I

Programme: B.Tech.	L: 3 T:1 P:2	Credits:5
Semester: 4	Theory/Practical: Theory	Teaching Hours: 45(L)+15(T)+30(P) = 90 Hours
Total Max. Marks: 150	Continuous Assessment (CA) Marks: 90	End Semester Examination (ESE) Marks: 60
Minimum Percentage of Numerical / Design / Programming Problems in ESE: 80%		
Duration of End Semester Examination (ESE): 3 Hours		
Course Type: Core Course		

Prerequisites: ESCE101

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Apply the concept of equilibrium in structural analysis.
2	Compute displacements of structures under loads using various methods and principles
3	Calculate internal forces within different structural forms, like trusses, beams, and frames
4	Plot bending moment and shear force diagram
5	Apply concept of influence lines to determine the maximum effect of moving loads
6	Interpret results to draw meaningful conclusions specific to engineering design

Contents

Part A
Unit 1:   **3(L) hrs**
Load – types and their assessment; Type of supports, Concept and types of structure – cables, trusses, beams, arches, frames; statical determinacy of a problem, identification of determinate and indeterminate structures based on degree of redundancy (*DoR*)

Unit 2:   **18(L) hrs**
Internal forces in determinate structures – axial force, shear force, bending moment, sign conventions; Shear force and bending moment diagrams for cantilever, simply supported and overhang beams subjected to point loads, uniformly distributed loads, uniformly varying loads, moments or their combination, the point of contra flexure and its significance; Displacements – deflection, rotation; computation using different methods – direct integration method; moment area method, conjugate beam method, energy-based methods

Part B
Unit 3:   **12(L) hrs**
Effect of load on indeterminate structures – displacements and forces, calculation for problems having *DoR* up to two – arches, beams, frames; Analysis by Method of consistent deformation, Three moment theorem

Unit 4:   **12(L) hrs**
Concept of influence line diagram, rolling loads; Bending moment and shear force diagrams due to single and multiple concentrated rolling loads, uniformly distributed moving loads; Equivalent UDL and applications; Muller Breslau principle; Plotting influence lines for beams, bar force in trusses and portal frames; calculation of the maximum and absolute maximum shear force and bending moment; Concept of envelopes.

Part C
(To be conducted in laboratory)

Test on beams – Measurement of rotations and deflections for simple beams and fixed end beams; Determination of the Flexural Rigidity; Verification of Clark-Maxwell's theorem; verification of the Moment-area theorems; Unsymmetrical bending of a cantilever beam; Curved beams

Test on Arches – Verification of Clark-Maxwell's theorem for two and three hinged arches; Calculation of support reactions; Plotting influence line diagrams

Test on Columns – Behavior of columns and struts with different end conditions.

Test on Trusses – Verification of Clark-Maxwell's theorem; Deflection of a statically determinate truss; Computation of forces in redundant truss joint; Plotting influence line diagrams for joint reactions – Simple and continuous beams; Arches

Books

- Elementary Structural Analysis by Norris Wilber
- Basic Structural Analysis by C S Reddy
- Intermediate structural analysis by C K Wang
- Indeterminate structural analysis by J. Sterling Kinney Addison
- Structural Analysis by Devdas Menon
- Analysis of Structures by Vazirani &Ratwani
- Theory of structures by B.C. Punima
- Laboratory Manual on Structural Mechanics by Harvinder Singh
- Structural Analysis Lab by Lakshman Singh