

# Guru Nanak Dev Engineering College, Ludhiana

An Autonomous College under UGC Act 1956

## B.Tech. (Civil Engineering)

### STUDY SCHEME 2024 B.TECH (CIVIL ENGINEERING)

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	CCE109	Structural Design -I	3	1	0	4	40	60	100
5	T/P	PCC	CCE110	Geotechnical Engineering	3	0	2	4	90	60	150
5	T	PCC	CCE111	Structural Analysis-II	3	1	0	4	40	60	100
5	T	PCC	CCE112	Hydrology & Water Resources Engineering	3	1	0	4	40	60	100
5	T	PEC	ECE10x	Elective - I	4	0	0	4	40	60	100

# 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	P	INT	TRCE102	Training-II	-	-	-	1	60	40	100
5	T	PCC	CCE113	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
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

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

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

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

# Guru Nanak Dev Engineering College, Ludhiana

An Autonomous College under UGC Act 1956

## B.Tech. (Civil Engineering)

### 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. Arne 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=PLIQdh3107nrtDcqV25wkUPcHITh8\\_kLGM](https://www.youtube.com/playlist?list=PLIQdh3107nrtDcqV25wkUPcHITh8_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	<a href="https://nptel.ac.in/courses/105105201">https://nptel.ac.in/courses/105105201</a> accessed on 14/05/2025
2	Introduction to Environmental Engineering and Science - Fundamental and Sustainability Concepts	Prof. Brajesh Kumar Dubey	IIT Kharagpur	<a href="https://onlinecourses.nptel.ac.in/noc25_ge17/preview?">https://onlinecourses.nptel.ac.in/noc25_ge17/preview?</a> accessed on 14/05/2025
3	Water and Wastewater Engineering	Dr. P Bose	IIT Kanpur	<a href="https://nptel.ac.in/courses/105104102">https://nptel.ac.in/courses/105104102</a> accessed on 14/05/2025
4	Water Quality Management Practices	Prof. Gourav Dhar Bhowmick	IIT Kharagpur	<a href="https://onlinecourses.nptel.ac.in/noc25_ag12/preview">https://onlinecourses.nptel.ac.in/noc25_ag12/preview</a> accessed on 14/05/2025
5	Water and waste water treatment	Prof. Bhanu Prakash Vellanki	IIT Roorkee	<a href="https://onlinecourses.nptel.ac.in/noc25_ce63/preview">https://onlinecourses.nptel.ac.in/noc25_ce63/preview</a> accessed on 14/05/2025
6	Rural Water Resources Management	Prof. Pennan Chinnasamy	IIT Bombay	<a href="https://onlinecourses.nptel.ac.in/noc25_ge31/preview">https://onlinecourses.nptel.ac.in/noc25_ge31/preview</a> accessed on 14/05/2025
7	Water and Waste Water Engineering	Prof. C. Venkobachar, Prof. Ligy Philip, Prof. B.S. Murty	IIT Madras	<a href="https://nptel.ac.in/courses/105106119">https://nptel.ac.in/courses/105106119</a> 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

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

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

**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  $\pi$ -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, 10<sup>th</sup> edition, 2001

**Reference Books**

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

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

**Online Learning Materials**

1. [https://www.youtube.com/watch?v=JYPITi0t\\_wM](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>

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

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**

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

# 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

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

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

standard deviation and difference of standard deviation.

**Text Books**

1. B.S. Grewal, “Higher Engineering Mathematics”, 36<sup>th</sup> 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”, 9<sup>th</sup> 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”, 11<sup>th</sup> 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](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	<a href="https://nptel.ac.in/courses/111106112">https://nptel.ac.in/courses/111106112</a>
2	Probability and Statistics	Prof. Somesh Kumar	IIT Kharagpur	<a href="https://archive.nptel.ac.in/courses/111/105/111105090/">https://archive.nptel.ac.in/courses/111/105/111105090/</a>

# 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

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

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, CAD/CIM Technologies (India-based publisher), ISBN: 9789393168536.
2. "Learning AutoCAD 2021" By Sandeep Dogra, BPB Publications (New Delhi) ISBN: 9789389898307

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

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/VI0H-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.

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

**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", 17<sup>th</sup> Edition, Brooks/Cole, 2024.
2. D. D. Mishra, "Fundamental concepts in Environmental Studies", 3<sup>rd</sup> edition, S Chand & Co Ltd, 2014.
3. A. Kaushik, C. P. Kaushik, "Perspectives in Environmental Studies", 6<sup>th</sup> 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", 1<sup>st</sup> 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", 1<sup>st</sup> edition, Pergamon Press, 1986
8. C. J. Kibert, "Sustainable Construction: Green Building Design and Delivery", 5<sup>th</sup> edition, Wiley, 2022

**Reference Books**

1. W. P. Cunningham, M. A. Cunningham, "Principle of Environmental Science", 9<sup>th</sup> edition, McGraw Hill, 2019.
2. P. Meenakshi, "Elements of Environment Science & Engineering", 2<sup>nd</sup> edition, Prentice Hall India Learning Private Limited, 2012.
3. K. N. Duggal, "Elements of Environment Engineering", 3<sup>rd</sup> edition, S. Chand & Co. Ltd, 1996.
4. K. M. Mackenthun, "Basic Concepts in Environmental Management", 1<sup>st</sup> 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", 3<sup>rd</sup> 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=B8ITtrjxn2s>
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>

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

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

**Supplementary SWAYAM Course**

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

# Guru Nanak Dev Engineering College, Ludhiana

An Autonomous College under UGC Act 1956

## B.Tech. (Civil Engineering)

Course Code: CCE104

Course Title: Transportation Engineering

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

# Guru Nanak Dev Engineering College, Ludhiana

An Autonomous College under UGC Act 1956

## B.Tech. (Civil Engineering)

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	<b>Tests on Sub-grade Soil</b> 1. California Bearing Ratio
2	<b>Tests on Road Aggregates</b> 1. Crushing Value Test 2. Los Angles Abrasion Value Test 3. Impact Value Test 4. Shape Test (Flakiness and Elongation Index)
3	<b>Tests on Bituminous Materials and Mixes</b> 1. Penetration Test 2. Ductility Test 3. Softening Point Test 4. Flash & Fire Point Test 5. Bitumen Extraction
4	<b>Field Tests</b> 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 10<sup>th</sup> Edition, Nem Chand & Bros, 2017
2. L.R. Kadiyalai, ' Traffic Engineering and Transport Planning', Khanna Publishers, 9<sup>th</sup> 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 Chakraborty, & 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, 7<sup>th</sup> edition 2020.
13. Partha Chakraborty, ' Principles of Transportation Engineering, PHI Learning, 2<sup>nd</sup>edition, 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

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

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

**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

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

**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](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](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

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

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

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, 4<sup>th</sup> 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://freebookpdf.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

# Guru Nanak Dev Engineering College, Ludhiana

An Autonomous College under UGC Act 1956

## B.Tech. (Civil Engineering)

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	<a href="https://archive.nptel.ac.in/courses/105/105/105105178/">https://archive.nptel.ac.in/courses/105/105/105105178/</a>
2	Wastewater Management	Prof. M.M. Ghangrekar	IIT Kharagpur	<a href="https://archive.nptel.ac.in/courses/105/105/105105048/">https://archive.nptel.ac.in/courses/105/105/105105048/</a>
3	Water and Wastewater Treatment	Prof. Bhanu Prakash	IIT Roorkee	<a href="https://archive.nptel.ac.in/courses/105/107/105107207/">https://archive.nptel.ac.in/courses/105/107/105107207/</a>
4	Water and Wastewater Engineering	Prof. C. Venkobachar	IIT Madras	<a href="https://archive.nptel.ac.in/courses/105/106/105106119/">https://archive.nptel.ac.in/courses/105/106/105106119/</a>
5	Water and Wastewater Engineering	--	IIT Kanpur	<a href="https://archive.nptel.ac.in/courses/105/104/105104102/#">https://archive.nptel.ac.in/courses/105/104/105104102/#</a>
6	Biological process design for wastewater treatment	Prof. V.C. Srivastava	IIT Roorkee	<a href="https://archive.nptel.ac.in/courses/103/107/103107217/">https://archive.nptel.ac.in/courses/103/107/103107217/</a>

# Guru Nanak Dev Engineering College, Ludhiana

An Autonomous College under UGC Act 1956

## B.Tech. (Civil Engineering)

Course Code: CCE107

Course Title: Hydraulic Engineering

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

# Guru Nanak Dev Engineering College, Ludhiana

An Autonomous College under UGC Act 1956

## B.Tech. (Civil Engineering)

### 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](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](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	<a href="https://nptel.ac.in/courses/105101082">https://nptel.ac.in/courses/105101082</a>
2	Fluid Mechanics	Dr N Sahoo and Dr Subhashisa Dutta	IIT Guwahati	<a href="https://nptel.ac.in/courses/105103095">https://nptel.ac.in/courses/105103095</a>
3	Fluid Mechanics	Dr Subashisa Dutta	IIT Guwahati	<a href="https://nptel.ac.in/courses/105103192">https://nptel.ac.in/courses/105103192</a>
4	Environmental fluid mechanics	Prof. Chunendra K Sahu	IIT Kanpur	<a href="https://nptel.ac.in/courses/105104565">https://nptel.ac.in/courses/105104565</a>

**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

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

Beams, frames (determinate cases only) – Internal forces: axial force, shear force, bending moment; sign conventions; Shear force and bending moment diagrams for cantilever, simply supported and overhang beams/frames 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 method, Energy methods

**Part B**

**Unit 3:**

**12(L) hrs**

Cables – General cable theorem, shape, elastic stretch of cable, maximum tension in cable and back-stays, pressure on supporting towers; Trusses (determinate cases only) – computation of forces (using Method of joint, Method of section, Tension coefficient method) and displacements (using Energy method)

**Unit 4:**

**12(L) hrs**

Concept and applications of influence line diagram (determinate cases only); rolling loads – Bending moment and shear force diagrams due to single and multiple concentrated rolling loads, uniformly distributed moving

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

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