

NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Engineering
Name of Programme:	BTech in Civil Engineering
Course Code:	4CL101ME25
Course Title:	Prestressed Concrete
Course Type:	Department Elective-III
Year of Introduction:	2025-26

L	T	Practical Component				C
		LPW	PW	W	S	
3	1	-	-	-	-	4

Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. analyse stresses in prestressed concrete beams (BL4)
2. estimate losses of prestress and deflection of prestressed concrete beam (BL5)
3. examine the transmission of prestress in pre and post tensioned beams (BL4)
4. design and detail pre-tensioned and post-tensioned concrete beams (BL6)

Unit	Contents	Teaching hours (Total 45)
Unit-I	Introduction Basic principle, advantages, types, materials, systems and method of prestressing, Devices, Analysis of prestressed concrete sections, load balancing concept, stresses at transfer and service loads in flexural members.	08
Unit-II	Losses and Deflection Causes, evaluation of losses, factors influencing losses and deflections, short term and long-term deflection.	08
Unit-III	Limit state method of design Types of flexural failure, design of flexure reinforcement, types of shear cracks, ultimate shear resistance of prestressed concrete members, design of shear reinforcement, design of torsional reinforcement	08
Unit-IV	Transmission of Prestress Transmission of prestress in pretensioned members, anchorage zone stresses for post tensioned members and design of anchorage zone reinforcement.	05
Unit-V	Section properties of Prestressed Concrete members Minimum section modulus, minimum prestressing force and eccentricity, limiting zone for the prestressing force, design of prestressed concrete section for flexure.	06

Unit-VI Design of Prestressed Concrete Beam

10

Proportioning of section based on flexure and shear demand, Design of longitudinal, transverse reinforcement, prestressing force and cable profile for pretensioned and post tensioned concrete beams, detailing of longitudinal and transverse reinforcement

Tutorial Work:

This shall consist of at least 04 tutorials based on the above syllabus.

Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

**Suggested Readings/
References:**

- Krishnaraju, N. *Prestressed Concrete*, Tata McGraw Hill
- Rajagopalan, N. *Prestressed Concrete*, Narosa Publication
- Singh, S. B. *Analysis and Design of Prestressed Concrete Structures*, Wiley India Pvt. Ltd.
- Lin, T.Y. and Burns, N.H. *Design of Prestressed Concrete Structures*, Wiley India Pvt. Ltd.
- Nawy, E. *Prestressed Concrete*, Pearson Pvt Ltd.
- Codes: IS:1343

NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Engineering
Name of Programme:	BTech in Civil Engineering
Course Code	4CL202ME25
Course Title	Building Services
Course Type:	Department Elective-III
Year of introduction:	2025-26

L	T	Practical Component				C
		LPW	PW	W	S	
3	1	-	-	-	-	4

Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. categorise different types of pipes and fixtures used in plumbing installations (BL4)
2. recommend suitable electrical and lighting system in buildings (BL5)
3. develop proficiency in designing, sizing, and selecting HVAC equipment (BL3)
4. function of vertical transportation in modern buildings and infrastructure. (BL4)
5. assess appropriate safety and security systems in buildings. (BL5)

Unit	Contents	Teaching hours (Total 45)
Unit-I	Plumbing Systems Water storage and distribution, heating methods, pipe staking, dual plumbing, drainage system, maintenance, pipes and fittings, pipe sizing and selection for water supply and drainage, plumbing codes and standards	08
Unit-II	Electrical Lighting and Illumination Systems Electrical system installations, electrical control and safety devices: fuse, circuit breakers, lightning arresters, Electrical wiring systems: material and specifications; Factors affecting illumination in building, modern theory of light and colour, synthesis of light, Luminous flux, utilization factor, artificial light sources, types of energy efficient lamps.	12
Unit-III	Heating, Ventilation and Air Conditioning (HVAC) Concept, importance, components, planning of HVAC systems. Basics of heat transfer: conduction, convection, radiation, Psychrometric properties and air conditioning processes, applications of Psychrometric charts, design principles of HVAC system, Renewable energy integration: solar heating, geothermal systems; green building standards.	07

Unit-IV	Vertical Transportation Importance, evolution of technology, role in building functionality and accessibility, Elevator: types, components, car design and interior considerations, functioning of escalators and moving walkways, safety regulations and codes for vertical transportation systems	06
Unit-V	Building Automation and Fire Safety System Need, types and concept of smart building automation, Access control systems: biometrics, RFID, smart cards, Intrusion detection systems, and perimeter security, Closed-circuit television (CCTV) and video surveillance, Integration of security systems for comprehensive protection, Causes of fire, fire resistance materials, safety regulations, fire-fighting devices and systems, fire escapes, Types of fire detection sensors: smoke, heat, flame detectors, Fire alarm systems and their components, Fire suppression systems: sprinklers, gas suppression, Design considerations for effective fire safety measures.	12

Tutorial Work:

This shall consist of at least 04 tutorials based on the above syllabus.

Self-Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

- Suggested Readings/References:**
- Greeno R. *Building Services, Technology and Design*, Routledge publication
 - Hassan G., *Building Services*, Macmillan.
 - Hall, F. & Greeno, R. *Building Services Handbook*, Butterworth-Heinmann.
 - Philips D., *Lighting Modern buildings*, Architectural Press
 - Hall, F., *Building services and equipment*, Routledge
 - Rao, S., Jain R.K. & Saluja, S., *Electrical Safety, fire safety Engineering and Safety Management*, Khanna Publishers.



NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Engineering
Name of Programme:	BTech in Civil Engineering
Course Code:	4CL401ME25
Course Title:	Ground Improvement Techniques
Course Type:	Department Elective-III
Year of Introduction:	2025-26

L	T	Practical Component				C
		LPW	PW	W	S	
3	0	2	-	-	-	4

Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. appraise suitable soil stabilization and drainage techniques (BL5)
2. categorise applications of geosynthetics for Civil infrastructure (BL4)
3. interpret the applications of reinforced soil (BL5)
4. evaluate experimental behaviour of reinforced soil. (BL3)

Unit	Contents	Teaching hours (Total 45)
Unit-I	Ground Improvement Introduction, need, classification, potential, land reclamation: material, methods.	05
Unit-II	Soil Stabilization Terminologies, Mechanical: Compaction, Vibration methods, Pre-loading; Chemical: cementitious, bituminous, lime, polymers; Construction Methods. Grouting: introduction, types, material, methods, procedure, applications. Anchoring: ground anchor, rock bolts, and soil nailing.	09
Unit-III	Drainage Techniques Methods, design principles; Precompression: compressibility, preloading and monitoring; Vertical drains: sand drain, prefabricated vertical drain.	06
Unit-IV	Geosynthetics Need, type, functions, introduction to soil-geosynthetics integration, experimental evaluation for engineering properties, applications: pavement engineering, erosion controls, slope stabilisation, case study.	12

Unit-V **Application of Reinforced Soil**

13

Reinforced Soil Wall: Analysis and design of systematically reinforced soil wall; Introduction of randomly reinforced earth.

Foundations on Reinforced soil: Bearing capacity for foundation on reinforced soil, settlement analysis

Transportation Infrastructure: Geosynthetics for separation, drainage and filtration, overlay, design of pavements subgrade, soil improvement for railway tracks

Environmental Geotechnics: Liners for ponds, canal and landfill, mitigation methods for landslide and soil erosion.

Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/
References:

- Shukla, S.K., *Handbook of Geosynthetic Engineering*, ICE Publishing.
- Sivakumar Babu G.L., *An Introduction to Soil Reinforcement and Geosynthetics*, Universities Press.
- Purshotum Raj P., *Ground Improvement Methods*, Laxmi Publications.
- Patra N. R., *Ground Improvement Methods*, Vikas Publishing House Pvt. Ltd.
- Rao G. V., Banerjee P.K., Shahu J.T., Ramana G.V., *Geosynthetics: New Horizons*, Asian Books Pvt Ltd.
- Saran, S., *Reinforced Soil and its Engineering Applications*, I K International Publishing House.
- Mittal, S., *An Introduction to Ground Improvement Engineering*, Medtech.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 06 experiments/exercises to be incorporated.

Suggested List of Experiments:

Sr. No.	Name of Experiments/Exercises	Hours
1.	Apparent opening Size and Percentage opening	04
2.	Cone Drop Test	02
3.	Pull-out strength Test	06
4.	Soil-geosynthetic interface friction Test	08
5.	Puncture Strength Test	02
6.	Strength of Soil-geosynthetic mixture	08

NIRMA UNIVERSITY

Institute:	Institute of Technology, School of Engineering
Name of Programme:	BTech in Civil Engineering
Course Code:	4CL501ME25
Course Title:	Air and Noise Pollution
Course Type:	Department Elective-III
Year of introduction:	2025-26

L	T	Practical Component				C
		LPW	PW	W	S	
3	1	-	-	-	-	4

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. appraise air pollutants and quality monitoring techniques (BL5)
2. examine the suitable air pollution control methods (BL4)
3. identify the effects of noise pollution and select appropriate control method (BL3)
4. analyse air quality index for pathways of climate change (BL4)

Unit	Contents	Teaching hours (Total 45)
Unit-I	Air Pollution concept and sources, atmospheric stability, air pollutants, classification, pollutant dispersion, health effects on humans and environment.	7
Unit-II	Air Quality Monitoring need, air quality standards, air quality index, sampling & analysis of stack gases and ambient air, dispersion models for air pollutants, plume behavior, stack height design.	11
Unit-III	Air Pollution Control preventive measures and techniques, equipments for control of particulate matter, control methods for gaseous pollutants, laws and regulations.	12
Unit-IV	Noise Pollution and Control introduction, sources, classification, effects on human health, physics of noise, vibrations, indoor and outdoor sound measurement methods, permissible limits, control, noise reduction techniques, case studies.	15

Tutorial Work:

This shall consist of at least 04 tutorials based on the above syllabus.

Self-Study:

The self-study components of the syllabus will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Suggested Readings/
References:

- Rao, M. N. & Rao, H.V.N., *Air Pollution*; McGraw Hill Publication.
- Rao C.S., *Environmental Pollution Control Engineering*, New Age International.
- S.K. Garg, *Environmental Engineering: Vol II*, Standard Publication.
- Peavy, H.S., Rowe, D., Tchobanoglous, G., *Environmental Engineering*, McGraw Hill.
- G.K. Nagi, M.K. Dhillon, G.S. Dhaliwal, *Noise Pollution*, Commonwealth Publishers.
- S.M. Khopkar, *Environmental Pollution Analysis*, New Age International Publications.
- Masters, G.M., and Ela, W.P., *Introduction to Environmental Engineering*, Pearson New International Edition, Pearson Education Inc.
- Seinfeld, J. H. and Pandis, S N., *Atmospheric Chemistry and Physics: from Air Pollution to Climate Change*, John Wiley.
- *Manual on Noise and AQI*, Central Pollution Control Board.

