NIRMA UNIVERSITY
INSTITUTE OF TECHNOLOGY
SCHOOL OF ENGINEERING
Teaching & Examination Scheme
Inter-disciplinary Minor in Sustainable Smart Cities*

w. e. f. Academic Year 2025-26

Course Code	Course Title	Teaching Scheme (hours/week)				Examination Scheme			
		L	T	P	C	Duration Hours	Component Weightage		
						SEE	CE	LPW	SEE
Semester 7 Elective Course-II									
4CL302IE25	Smart Transportation Systems	3	1	0	4	3	0.6	-	0.4
4CL303IE25	Smart City Management, Risk and Control	3	1	0			0.6	-	0.4

L: Lectures, P/T: Practicals / Tutorial, C: Credits
LPW/PW: Laboratory / Project Work

SEE: Semester End Examination
CE: Continuous Evaluation

Note: The department will provide relevant learning material in advance to the students of other departments opting interdisciplinary minor, so that they have prerequisite reading prior to initiation of the minor courses.

*Interdisciplinary Minor will be offered for the students of departments other than Civil Engineering, IT-NU.

w.e.f. for first year students admitted in 2022-23 and Diploma to Degree students admitted in 2023-24 onwards

NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**BTech (All Except Civil Engineering)**
Course Code:	4CL302IE25
Course Title:	**Smart Transportation Systems**
Course Type:	**Inter-disciplinary Minor-Elective II**
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. discover the need for an Intelligent Transportation System (ITS) for smart cities (BL4)
2. illustrate the role of communication systems in ITS for smart cities (BL2)
3. apply ITS for automated highway systems in smart cities. (BL3)
4. utilise ITS for enhancing mobility of smart cities (BL3)

Unit	Contents	Teaching hours (Total 45)
Unit-I	**Introduction to Transportation System** Transportation system and its classification, Roads - planning, survey and reports, Railways – alignment, components of permanent way, Airports – layout of airside and landside, Harbors – classification and layout.	10
Unit-II	**Intelligent Transportation System (ITS)** Definition, objectives, benefits, project management processes, smart data collection techniques: smart detectors, automatic vehicle location, automatic vehicle identification, geographic information systems, IoT-based video data collection.	10
Unit-III	**Telecommunications in ITS for Smart Cities** Importance of telecommunications, information management, smart traffic management, advanced vehicle roadside communication and smart vehicle positioning system.	10
Unit-IV	**Automated Highway Systems in Smart Cities** ITS solutions to enhance transportation efficiency - Advanced Traffic Management Systems (ATMS), Advanced Vehicle Control Systems (AVCS), Advanced Traveler Information Systems (ATIS), electronic payment, emergency management.	08

Unit-V **Use of IoT for Smart Mobility Services** 07

Smart public transportation: need modes, advantages, types of public transport system; interlink between different modes, tagging and smart cards, high-speed transportation services, smart mobility.

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:

- Sussman, J.S., *Perspective on Intelligent Transportation Systems*. Springer.
- Choudhury M A & Sadek A., *Fundamentals of Intelligent Transportation Systems Planning*. Artech House.
- Sarkar, P.K. & Jain, A.K., *Intelligent Transportation Systems*. PHI Learning Pvt. Ltd.
- Chen, K.P. & Miles, J. *Recommendations for World Road Association (PIARC)*. ITS Handbook.
- Turban. E & Aronson. J. E. *Decision Support Systems and Intelligent Systems*. Prentice Hall.

NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**BTech (All Except Civil Engineering)**
Course Code:	4CL303IE25
Course Title:	**Smart City Management, Risk and Control**
Course Type:	**Inter-disciplinary Minor-Elective II**
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. apply project management tools and techniques in smart city planning (BL3)
2. examine strategies for resource allocation, controlling and monitoring in smart city projects (BL4)
3. identify effective risk mitigation strategies for smart cities (BL3)
4. make use of framework, policies and best practices for smart cities management and control (BL3)

Unit	Contents	Teaching hours (Total 45)
Unit-I	**Fundamentals of Project Management** Project Management: philosophy, concepts; Work breakdown structure (WBS): role, phases, stages of project & their approval status, project planning and scheduling, critical path method (CPM), project cost analysis and budgeting, Case studies of successful smart city management projects	10
Unit-II	**Resource Management, Project Monitoring and Control** Importance of resource management in smart city projects, Techniques for resource allocation and optimization, Impact of resource constraints on project scheduling, Significance of project monitoring and control in smart city projects, Key performance indicators (KPIs) for project management	10
Unit-III	**Project Risk Management** Introduction to project risk management in smart city context, risk identification, assessment and prioritization techniques, risk mitigation and contingency planning, risk monitoring and control in smart city projects	07
Unit-IV	**Risks in Infrastructure** Understanding risks in infrastructure, types of risks associated with infrastructure, Identifying and assessing risks, risk analysis and evaluation, risk mitigation strategies, quantitative and qualitative analysis of infrastructure risk	10

Unit V	**Regulatory and Governance Considerations** Regulatory framework for smart cities in India, Governance models and policies for smart city management, privacy and data protection in smart city projects, Ethics and accountability in smart city initiatives, case studies, best practices in smart city management and control	**08**

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:

- James M. Sinopoli, *Smart Buildings Systems for Architects, Owners and Builders.* Butterworth-Heinemann.
- Anil Kumar, *Introduction to Smart Cities*. Pearson Publication.
- Uday Chatterjee, Arindam Biswas, Jenia Mukherjee, Sushobhan Majumdar, *Advances in Urbanism, Smart Cities, and Sustainability,* CRC Press.
- Kumar, Vishal, Vishal Jain, Bharti Sharma, Jyotir Moy Chatterjee, and Rakesh Shrestha, *Smart City Infrastructure: The Blockchain Perspective*. John Wiley & Sons
- James Sinopoli, *Advanced Technology for Smart Buildings*, Artech House.
- UN-Habitat; Inclusive and Sustainable Urban Planning: *a Guide for municipalities; Volume 3: Urban Development Planning*; United Nations Human Settlements Programme.

NIRMA UNIVERSITY
INSTITUTE OF TECHNOLOGY
SCHOOL OF ENGINEERING
Teaching & Examination Scheme
Inter-disciplinary Minor in Geoinformatics*

w. e. f. Academic Year 2025-26

Course Code	Course Title	Teaching Scheme (hours/week)				Examination Scheme			
		L	T	P	C	Duration Hours	Component Weightage		
						SEE	CE	LPW	SEE
Semester 7 Elective Course-II									
4CL701IE25	Geoinformatics in Climate Change and Disaster Management	3	1	0	4	3	0.6	-	0.4
4CL702IE25	Advanced Remote Sensing Techniques & Applications	3	1	0			0.6	-	0.4

L: Lectures, P/T: Practicals / Tutorial, C: Credits
LPW/PW: Laboratory / Project Work

SEE: Semester End Examination
CE: Continuous Evaluation

Note: The department will provide relevant learning material in advance to the students of other departments opting interdisciplinary minor, so that they have prerequisite reading prior to initiation of the minor courses.

*Interdisciplinary Minor will be offered for the students of departments other than Civil Engineering, IT-NU.

w.e.f. for first year students admitted in 2022-23 and Diploma to Degree students admitted in 2023-24 onwards

NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**BTech (All Except Civil Engineering)**
Course Code:	4CL701IE25
Course Title:	**Geoinformatics in Climate Change and Disaster Management**
Course Type:	**Inter-disciplinary Minor-Elective II**
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. demonstrate the phenomenon of climate change (BL2)
2. discover the risk of disaster and associated damages (BL4)
3. identify the need of geoinformatics for climate change (BL3)
4. apply geoinformatics for disaster management (BL3)

Unit	Contents	Teaching hours (Total 45)
Unit-I	**Fundamentals of Climate change** Meteorology and climatology, hydrometeorology, importance of study of hydrometeorology, hydrometeorological extreme events, characteristics of extreme events, climate change impacts on hydrometeorology.	10
Unit-II	**Introduction to Disaster Management** Fundamental concept of disaster management, natural and manmade disasters, historical perspective of disasters in India. Existing organizational structure for managing disasters in India, disaster legislation and policy, risk assessment process, hazard profile, capacity building, utilisation of resource, training and public awareness in disaster management.	10
Unit-III	**Geoinformatics for Climate Change** Geospatial data for climate change; Geoinformatics tools for climate measurement, modelling and visualization; climate change case studies, effects of climate change, land use and land use planning, decision making and application to climate science, comprehensive climate information system.	10
Unit-IV	**Geoinformatics for Disaster Risk Assessment, Monitoring, and Management** Disaster, Role of remote sensing (RS) and geographical information system (GIS) in risk assessment, monitoring and	15

response; applications of Global Navigation Satellite Systems (GNSS) in disaster recovery and coordination; geospatial tools and systems for monitoring and management; geoinformatics tools for preparation of hazard maps: Disaster and development through case studies on natural and human induced disaster such as earthquake, tsunami, floods, landslides, drought, glacial lake outburst floods, cyclone, etc.

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 contents.

Suggested Readings/ References:

- Brian, R., *Geographical Information Systems (GIS) for Disaster Management*, CRC Press.
- Joshi, P.K. & Singh T.P., *Geoinformatics for Climate Change Studies*, The Energy and Resources Institute, TERI.
- Rao, V., *Geoinformatics for Disaster Management*, Manglam Publications.
- Modh, S., *Introduction to Disaster Management*, Macmillan.
- Sinha, P.C., *Disaster Relief: Rehabilitation and Emergency Humanitarian Assistance*, SBS Publishers.
- Singh R.B. (Ed.), *Natural Hazards and Disaster Management Vulnerability Mitigation*, Rawat Publications.
- Robert B., & Edwards K., *Natural Hazards: Earth's processes as hazards disasters and catastrophe*, Pearson Prentice Hall.

NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**BTech (All Except Civil Engineering)**
Course Code:	4CL702IE25
Course Title:	**Advanced Remote Sensing Techniques & Applications**
Course Type:	**Inter-disciplinary Minor-Elective II**
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 the principles of multispectral, thermal and hyperspectral remote sensing (BL4)
2. outline the concept of principles of microwave and Lidar sensing (BL3)
3. apply the digital image processing techniques for a satellite data (BL3)
4. illustrate visual interpretation of images and its applications (BL2)

Unit	Contents	Teaching hours (Total 45)
Unit-I	**Multispectral, Thermal and Hyperspectral sensing** Across-track and along-track scanning: operating principles and examples, thermal radiation principles, interpreting thermal scanner imagery, geometric characteristics of across-track and along-track scanner imagery, radiometric calibration of thermal scanners, temperature mapping with thermal scanner data.	**13**
Unit-II	**Microwave and Lidar Sensing** Radar development, side-looking radar system operation, synthetic aperture radar, geometric characteristics of side-looking radar imagery, radar image interpretation, shuttle imaging radar, shuttle radar topography mission, passive microwave sensing, Lidar.	**12**
Unit-III	**Visual Image Interpretation** Landuse/landcover mapping, geologic and soil mapping, application in agriculture, forestry, water resources, and urban and regional planning, archeological applications and environmental assessment.	**10**
Unit-IV	**Digital Image Processing** Image rectification and restoration, image enhancement, image manipulation, supervised and unsupervised image classification, classification accuracy assessment, hyperspectral image analysis.	**10**

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 contents.

Suggested Readings/ References:

- Lillesand, T. M., and Kiefer, R. W., *Remote Sensing and Image Interpretation*, John Wiley & Sons.
- Shan, J. and Toth, C., *Topographic Laser Ranging and Scanning, Principles and Processing*, Taylor & Francis.
- Fletcher, R., *The Limits of Settlement Growth: A Theoretical Outline* (New Studies in Archaeology), Cambridge University Press.
- Kanevski M. , Timonin V. , Pozdnukhov A., *Machine Learning for Spatial Environmental Data: Theory, Applications, and Software*, Taylor and Fransis.
- Goodfellow, I., Bengio Y., Courville, A., *Deep Learning*, MIT Press.
- Haykin S., *Neural Networks and Learning Machines*, McMaster University.

NIRMA UNIVERSITY
INSTITUTE OF TECHNOLOGY
SCHOOL OF ENGINEERING
Teaching & Examination Scheme
Disciplinary Minor in Construction Technology and Management*

w. e. f. Academic Year 2025-26

Course Code	Course Title	Teaching Scheme (hours/week)				Examination Scheme			
		L	T	P	C	Duration Hours	Component Weightage		
						SEE	CE	LPW	SEE
Semester 7 Elective Course-II									
4CL204DE25	Computer Applications in Construction Management	2	1	2	4	3	0.3	0.3	0.4
4CL205DE25	Quantitative Techniques in Construction Management	3	1	0			0.6	-	0.4

L: Lectures, P/T: Practical / Tutorial, C: Credits
LPW/PW: Laboratory / Project Work

SEE: Semester End Examination
CE: Continuous Evaluation

*Disciplinary Minor will be offered for the students of Civil Engineering Department, IT-NU.

Students who have opted for Minor in Construction Technology and Management will not be permitted to select department electives i.e. Advances in Construction Management and Advanced Construction Technologies.

w.e.f. for the first-year students admitted in 2022-23 and Diploma to Degree students admitted in 2023-24 onwards

NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**BTech (All Except Civil Engineering)**
Course Code:	4CL204DE25
Course Title:	**Computer Applications in Construction Management**
Course Type:	**Disciplinary Minor-Elective II**
Year of Introduction:	**2025-26**

L	T	Practical Component				C
		LPW	PW	W	S	
2	1	2	-	-	-	4

Course Learning Outcomes (CLO):

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

1. choose different software tools used in construction (BL5)
2. make use of software for project planning, and management (BL3)
3. justify use of computer software for estimation and costing (BL5)
4. discover applications of artificial intelligence in construction (BL4)

Unit	Contents	Teaching hours (Total 30)
Unit-I	**Introduction** Importance, trends and emerging technologies, classification of construction software, comparison of software types, selection criteria	05
Unit-II	**Project Management Software** Use of software for planning and scheduling, Gantt charts and precedence networks, activity relationships, resource allocation and levelling, project updating and tracking, risk allocation and assessment, document management and collaboration, reports and analytics	12
Unit-III	**Estimation and Quantity Survey Software** Cost estimation basics, cost analysis and budgeting, Microsoft Excel for quantity surveying and costing, representation of data	08
Unit-IV	**Artificial Intelligence in Construction** Introduction, machine learning, deep learning, natural language processing, image processing, applications of AI in: planning, execution, safety, quality, contract management, decision management.	05

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:

- Calin M. Popescu, Chotchai Charoenngam, *Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications*, Wiley.
- Chitkara, K.K. *Construction Project Management: Planning, Scheduling and Control*, McGraw-Hill Publishing Company.
- Wayne L. Winston, *Microsoft Excel Data Analysis and Business Modelling*, Microsoft Press.
- Paul E. Harris, *Project Planning and Control using Primavera P6*, Eastwood Harris Pvt. Ltd.
- Ondrej Crejcar, *Artificial Intelligence in Civil Engineering*, Springer.
- Mohammad Amin Fotouhi, Maged Malek, and Vishal Singh, *AI in Construction and Building: A Survey of Innovations in the Construction Industry*, CRC Press.

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.	Planning and scheduling using various activity relationships in software	12
2.	Resource allocation, levelling and analysis	04
3.	Risk allocation and analysis, preparation of various reports	04
4.	Quantity survey using excel	06
5.	Preparation of excel program for rate analysis of various items in constriction	02
6.	Presentation on application of AI in any one domain of construction technology and management	02

NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**BTech (All Except Civil Engineering)**
Course Code:	4CL205DE25
Course Title:	**Quantitative Techniques in Construction Management**
Course Type:	**Disciplinary Minor-Elective II**
Year of introduction:	**2025-26**

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

Course Learning Outcomes (CLO):

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

1. analyse probability distribution and hypothesis testing (BL4)
2. make use of linear regression to forecast real-life problems (BL3)
3. identify transportation and transhipment problems (BL3)
4. justify use of optimization techniques for decision-making under uncertainty (BL5)
5. apply decision theory in uncertainty and risk (BL3)

Unit	Contents	Teaching hours (Total 45)
Unit-I	**Introduction to probability and statistics** measures of central tendency and dispersion, frequency distributions, data sampling methods, confidence intervals and margin of error, probability theory, discrete and continuous probability distributions, hypothesis formulation and types of errors, one-sample and two-sample hypothesis tests, chi-squared tests and analysis of variance (ANOVA)	08
Unit-II	**Linear regression and correlation analysis** simple linear regression model, multiple regression analysis, the method of least square, inferences based on the least square estimators, curvilinear regression, checking the adequacy of the model, correlation analysis and coefficient interpretation	08
Unit-III	**Linear programming** Basic of linear programming, simplex method, duality and sensitivity analysis, transportation and transshipment problems, traveling salesman problems, integer programming.	09
Unit-IV	**Optimization techniques** introduction to evolutionary algorithm, introduction to multi-objective optimization, genetic algorithms, differential evolution algorithm, particle swarm optimization,	10

Unit-V	**Decision theory** Introduction to decision theory, decision rules, decision making under conditions of certainty, risk and uncertainty, decision trees utility theory, decision making techniques. break-even analysis, game theory and its applications	10

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:

- Freund, J. E. and Miller., *Probability and Statistics for Engineers*, Pearson.
- Taha, H. A., *Operations research: An introduction*, Pearson Education India.
- Render, B., & Stair Jr, R. M., *Quantitative Analysis for Management*, Pearson Education India.
- Vora, N. D., *Quantitative Techniques in Management*, McGraw Hill Education.
- Rao, S. S., *Engineering Optimization: Theory and Practice*, John Wiley & Sons.

NIRMA UNIVERSITY
INSTITUTE OF TECHNOLOGY
SCHOOL OF ENGINEERING
Teaching & Examination Scheme
Disciplinary Minor in Structural Engineering*

w. e. f. Academic Year 2025-26

Course Code	Course Title	Teaching Scheme (hours/week)				Examination Scheme			
		L	T	P	C	Duration Hours	Component Weightage		
						SEE	CE	LPW	SEE
Semester 7 Elective Course-II									
4CL103DE25	Design of Bridge Structures	3	0	2	4	3	0.3	0.3	0.4
4CL104DE25	Design of Steel-Concrete Composite Structures								
4CL105DE25	Design of Chimney and Silos								

L: Lectures, P/T: Practical / Tutorial, C: Credits
LPW/PW: Laboratory / Project Work

SEE: Semester End Examination
CE: Continuous Evaluation

*Disciplinary Minor will be offered for the students of Civil Engineering Department, IT-NU.

w.e.f. for the first-year students admitted in 2022-23 and Diploma to Degree students admitted in 2023-24 onwards

NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**BTech (All Except Civil Engineering)**
Course Code:	4CL103DE25
Course Title:	**Design of Bridge Structures**
Course Type:	**Disciplinary Minor-Elective II**
Year of Introduction:	**2025-26**

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

Course Learning Outcomes (CLOs):

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

1. determine different types of loads on substructures and superstructure of the bridge (BL5)
2. design superstructure of bridge (BL6)
3. analyse and design substructure of bridge (BL4)
4. evaluate design requirement for the bridge foundation. (BL4)

Unit	Contents	Teaching hours (Total 45)
Unit-I	**Introduction and Fundamentals of Bridge Structures Design** Bridge components and its function, Classification of bridges, reconnaissance study, planning and layout of bridges, Essential design data and their acquisition, IRC specifications for bridges, various types of loads, General design requirements	10
Unit-II	**Analysis and Design of Superstructure** Codes and Design Criteria for Superstructures: Analysis, design and detailing of reinforced concrete slab culverts; analysis, design and detailing of prestressed concrete tee beam and slab bridges; analysis, design and detailing of continuous bridges; analysis, design and detailing of box girder bridges.	15
Unit-III	**Design of Substructure** Forces acting on substructure; Design of abutment, wing wall and expansion joints, Design of pier and pier cap, Types & functions of bearings, Introduction to Bridge bearings Design, Hinges and Expansion joints	12
Unit-IV	**Design of Foundation** Types and classification of foundation, their choice and methods of construction, well foundation, pile foundation, Design and detailing of bridge foundation.	08

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:	• Bakht, B. & Jaegar, L. G. *Bridge Analysis Simplified*, McGraw-Hill. • Raina, V. K. *Concrete Bridge Practice: Analysis, Design and Economics*, Shroff Publishers. • Krishnaraju, N. *Design of Bridges*, Oxford & IBH. • Victor, D. J. *Essentials of Bridge Engineering*, Oxford & IBH. • Saran, S. *Analysis and Design of Substructures*, Oxford and IBH Publishing. • Codes: IRC:5, IRC:6, IRC:112, IRC:78, IS:456. (bearing code)
Laboratory Work:	Laboratory work will be based on above syllabus with minimum 05 experiments/exercises to be incorporated.

Suggested List of Experiments/Exercises:

Sr. No.	Name of Experiments/Exercises	Hours
1.	Assessment of loads acting on the Bridge Structures as per IRC standard	04
2.	Analysis and Design of Box Culvert	06
3.	Analysis and Design of Bridge superstructure	08
4.	Analysis and Design of Bridge Substructure	07
5.	Analysis and Design of Bridge Foundation	05

NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**BTech (All Except Civil Engineering)**
Course Code:	4CL104DE25
Course Title:	**Design of Steel-Concrete Composite Structures**
Course Type:	**Disciplinary Minor-Elective II**
Year of Introduction:	**2025-26**

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

Course Learning Outcomes (CLOs):

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

1. apply codal provisions for design of composite structural members (BL3)
2. design various types of connections of composite structural members (BL6)
3. analyse and design the composite beams and slabs (BL4)
4. evaluate the performance and design criteria for composite columns. (BL5)

Unit	Contents	Teaching hours (Total 45)
Unit-I	**Introduction** Historical overview, Introduction to steel-concrete composite constructions, benefits of composite constructions, material for composite constructions, composite action, fire protection, Design philosophies and codes.	08
Unit-II	**Shear Connection** Shear transfer mechanisms, types and properties of shear connectors, design and detailing of partial and full shear connections. Overview to design of composite member connections: bolted and welded.	10
Unit-III	**Design of Composite Beam and Slab members** *Composite Beam:* classification of cross-section, elastic and plastic analysis of cross-section, effective cross section, simply supported and continuous composite beam: resistance to bending and shear, basic design considerations and design of composite beams, serviceability criteria. *Composite Slab:* steel deck, composite slab, resistance to bending, longitudinal shear, vertical shear, punching shear and point load, serviceability criteria.	15

Unit-IV **Design of Composite columns** **12**

Types of composite columns and advantages, failure mechanism, elastic and plastic behavior of column section, properties of cross-section, slenderness, design of axial, uniaxial and biaxial loaded composite column, shear effects, confinement effect, P-M interaction curves.

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:

- Johnson, R. P. *Composite Structures of Steel and Concrete*, Blackwell Publishing.
- Cosenza, E. and Zandonini, R. *Composite Construction,* CRC Press.
- Narayanan R. *Steel Concrete Composite Structures,* Spon Press, Taylor & Francis Group.
- Taranath, B. S. *Steel Concrete and Composite Design of Tall Buildings*, McGraw-Hill.
- Codes: IS:11384, EC-4 Other: INSDAG Guidelines

Laboratory Work: Laboratory work will be based on above syllabus with minimum 05 experiments/exercises to be incorporated.

Suggested List of Experiments/Exercises:

Sr. No.	Name of Experiments/Exercises	Hours
1.	Assessment of loads acting on the composite structures	03
2.	Analysis and Design of Shear Connection	05
3.	Analysis and Design of Composite Beam	07
4.	Analysis and Design of Composite Slab	08
5.	Analysis and Design of Composite Column	07

NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**BTech (All Except Civil Engineering)**
Course Code:	4CL105DE25
Course Title:	**Design of Chimney and Silos**
Course Type:	**Disciplinary Minor-Elective II**
Year of Introduction:	**2025-26**

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

Course Learning Outcomes (CLOs):

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

1. evaluate chimney structures for stability and safety. (BL5)
2. design of chimney structures. (BL6)
3. analyse and design RCC storage structures (BL4)
4. appraise design requirement of steel storage structures (BL4)

Unit	Contents	Teaching hours (Total 45)
Unit-I	**Chimney Structures- Fundamentals** Dimensioning of chimney, Loads, Design factors, Stresses due to temperature, Components, Platform and safety ladders, Statutory requirements.	08
Unit-II	**Analysis and Design of Chimney Structures** Steel stacks, Refractory linings, Stability consideration, Openings, Access ladder, Design and detailing of RCC chimney structures, Caps and foundation, Introduction to Steel Chimney.	12
Unit-III	**RCC Storage Structures** Introduction, Requirements, Shape, Dimension and Layout, Circular and square bunkers, Jansen's and Airy's theories, Design philosophies; Design and detailing of walls, hopper, staging and foundation.	15
Unit-IV	**Steel Storage Structures** Introduction of design of square bunker, Codal Provisions; Design of side plates, Stiffeners, Hooper, Longitudinal beams; Introduction of design of cylindrical silo, Side plates, Ring girder, stiffeners.	10

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:	• Manohar, S. N. *Tall Chimneys: Design & Construction*, Tata McGraw-Hill. • Krishna, R. N. *Advanced Reinforced Concrete Design*, CBS Publishers. • Krishna, J. & Jain, O. P. *Plain & Reinforced Concrete Volume – II*, Nemchand & Bros. • Rajagopalan, K. R. *Storage Structures*, Routledge. • Codes: IS:802, IS:4091, IS:4998, IS:4995, IS:6533.
Laboratory Work:	Laboratory work will be based on above syllabus with minimum 05 experiments/exercises to be incorporated.

Suggested List of Experiments/Exercises:

Sr. No.	Name of Experiments/Exercises	Hours
1.	Assessment of loads acting on the Chimney and Storage Structures	04
2.	Analysis and Design of Chimney (superstructure)	06
3.	Analysis and Design of Chimney (substructure)	06
4.	Analysis and Design of RCC Storage Structures	07
5.	Analysis and Design of Steel Storage Structures	07