Naan Mudhalvan – Polytechnic – Even Semester 2024-25
4th Semester – Course Curriculum

ABOUT THE COURSE

COURSE NAME:	DIGITAL CONSTRUCTION
TOTAL DURATION:	60 HRS
MODE OF DELIVERY	PHYSICAL CLASSROOM TRAINING AT RESPECTIVE COLLEGES
TRAINER TO STUDENT RATIO:	1:60
TOTAL MARKS:	70 (External) + 30 (Internal) **(Final Assessment shall be done by TNSDC)**

Table 1	
OVERALL COURSE OBJECTIVE:	Harness advanced digital technologies working with cutting-edge tools, innovative processes driving efficiency and productivity.
LEARNING OUTCOME:	1. Apply foundational and advanced digital tools and techniques in civil engineering. 2. Apply SKETCHUP, GIS, AR/VR and other innovative technologies to solve real-world construction challenges. 3. Leverage data analytics and project management tools to enhance efficiency in construction projects. 4. Design and implement sustainable and ethical solutions in modern construction practices.

TABLE 2: MODULE WISE COURSE CONTENT AND OUTCOME				
Sl. No	**Module Name**	**Module Content**	**Module Learning Outcome**	**Duration (Hrs)**
1	Introduction to Digital Construction	Introduction to Digital Construction- Definition and scope of Digital construction- Role of Technology in Modern Construction- Introduction to Softwares	Develop a solid foundation in digital construction, empowering them to adopt innovative practices in	9

		and Basic Modeling - Construction Industry 4.0 -Virtual and Augmented Reality- Applications of VR/AR in Construction.	Construction industry.	
2	Sketchup 3D Modelling	Introduction to SketchUp - SketchUp tools like Push/Pull, Offset, Scale and Organize models with groups and components. Basic shape modelling (rectangle, circle, polygon)- Materials, textures, and basic landscaping using the Sandbox tool for terrain modelling. Basic 3D model of a residential building, including walls, windows, doors, and roof	Create detailed 3D models, apply textures, and develop layouts for Architectural and design projects.	15
3	Advanced Applications of Sketchup	Advanced plugins like Joint Push/Pull, JHS Power bar, 1001 Bit tools, Fredo lib etc. along with rendering techniques using V-Ray and Enscape. 3D Rendered civil project, such as a small park or building, using V-Ray or Enscape.	Integrate extensions, enhance rendering quality, and create parametric designs for advanced architectural and design projects.	15
4	Geographic Information Systems (GIS)	Foundations of GIS: Basics of geospatial concepts, coordinate systems, and spatial data types- Data Analysis and Visualization: Data collection, spatial analysis, and mapping using QGIS software-	Analyze, Interpret and visualize spatial data through thematic maps and other geospatial outputs, Equip their skills to effectively apply GIS in various domains.	12

		Applications and Case Studies: Urban planning, environmental management, and disaster response.		
5	Automation, Robotics and Smart Construction	Automation in Construction -Automation technologies like 3D printing (UltiMaker Cura), site automation, and robotic machinery– Robotics for Site Operations -Use of Robotics for material handling, inspection, and construction tasks- Smart Buildings, IoT- and its applications.	Evaluate and predict the future impact of emerging technologies, such as AI, machine learning, robotics, and automation, on the construction sector.	9

TABLE 3: OVERALL COURSE LEARNING OUTCOME ASSESSMENT CRITERIA AND USECASES

Learning Outcome	Assessment Criteria	Performance Criteria	Use Cases
Develop a solid foundation in digital construction, empowering them to adopt innovative practices in Construction industry	-Practical Assessment demonstrating proficiency in tools like Revit and ArchiCAD, VR/AR basics. - Midterm and final exams.	- Demonstrates proficiency in creating accurate 3D models, layouts, and visualizations using Revit and ArchiCAD.	-Creating 3D models of Residential building components.
Learn to create detailed 3D models, apply textures, and develop layouts for Architectural	- Assessment focus on design accuracy, use of tools, creativity, and presentation quality.	- Model's efficiency in file size, rendering times, and overall system performance.	-Architectural design to create detailed 3D models of buildings and interiors.

and design projects.			
Emphasizes to integrate extensions, enhance rendering quality, and create parametric designs for advanced architectural and design projects.	- High-quality renderings, animations, and walkthroughs, utilizing lighting, textures, and shadows to create realistic and compelling presentations.	- Model's efficiency, including optimized geometry and reduced complexity to ensure smooth navigation and fast rendering.	-Interior design, construction planning, 3D printing, and film animation for prototyping and visual storytelling.
Analyze, Interpret and visualize spatial data through thematic maps and other geospatial outputs, Equip their skills to effectively apply GIS in various domains	-Project-based Assessment creating a Land use Plan for Urban/Rural Area - Case studies and presentations on industry use cases.	-Analyze the spatial growth of an Urban/Rural area over a decade using QGIS technologies.	- Identify and manage zones for residential, commercial, industrial, and agricultural use by analyzing land characteristics and existing infrastructure.
Evaluate and predict the future impact of emerging technologies, such as AI, machine learning, robotics, and automation, on the construction sector.	-Assignment on their understanding of the principles and applications of automation and robotics in construction Applications	-Demonstrate their ability to apply robotics and automation to real-world construction challenges and integrate these technologies with digital tools like Revit and IoT	Improving productivity, safety, and quality while reducing costs and labor dependency.

TABLE 4: LIST OF INDUSTRY USE CASES (20 PROJECTS THAT COMPREHENSIVELY COVER ALL THE LEARNING OUTCOMES)	
S.NO	**Final Projects**
1	Design a Food Court using Sketch-up software.
2	Design a small residential building (e.g., a single-family home, duplex, or apartment unit) using sketch-up
3	Design a commercial space using Sketch-up software.
4	Design a garden or landscape for a residential property.
5	Design a public space like a park, square, or plaza, applying spatial planning principles.
6	Create a sustainable building design or urban space plan that focuses on environmental impact.
7	Design an Interior Room Design using Sketch-up software.
8	Design a larger-scale urban design or neighborhood model.
9	Digital a 3D Residential Villa using Advanced Sketch-Up Plug in
10	Prepare the spatial data required for the mapping and analysis.
11	Create Land Use Map
12	Conduct a Site Analysis for Urban Growth using QGIS
13	Create a Land use Plan for Urban/Rural Area
14	Design and analyze the spatial growth of an Urban area over a decade
15	Perform a spatial analysis to examine the zoning regulations in relation to land use

16	Virtual and Augmented Reality for Construction Training
17	Construction Robotics and Automation
18	Digital Construction for Infrastructure Projects
19	Sustainable Urban Development
20	Digital Construction for Disaster Response and Recovery

TABLE 5: COURSE ASSESSMENT RUBRICS (TOTAL MARKS: 70)				
ASSESSMENT CRITERIA	**FAIR (50%-64%)**	**GOOD (65%-79%)**	**EXCELLENT (80%-100%)**	**WEIGHTAGE (MARKS)**
Practical Skills Proficiency	Demonstrates basic ability to process Sketch-Up & GIS data.	Processes data with few errors and minor guidance.	Processes data independently and achieves high accuracy.	20
Technical Knowledge	Applies theoretical concepts with occasional gaps.	Applies concepts with minimal errors.	Demonstrates flawless application of theoretical knowledge.	10
Project Execution	Completes projects with basic functionality.	Completes detailed projects meeting requirements.	Delivers innovative projects with industry relevance.	30
Communication and Reporting	Presents findings with limited clarity.	Communicates findings effectively.	Delivers professional reports with clear insights.	10