

NAAN MUDHALVAN SYLLABUS

Building Information Modelling

COURSE OBJECTIVE:

1. Learning the concept of Building Information Modelling.
2. Understand the Structural Modelling of buildings from conceptual stage to design stage as per the industrial workflow.
3. Develop the Quantity takeoff Schedule for the project.
4. Learning techniques for extracting 2D Drawing sheets from the 3D model.

COURSE OUTCOME:

1. Comprehensive understanding of Building Information Modelling (BIM) principles, processes, and applications in construction projects.
2. Develop comprehensive Architectural and structural models for buildings based on project requirements and specifications.
3. Design customized quantity take-off schedules and placing of schedules in sheets.
4. Extracting 2D drawing sheets from 3D models.

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)

MODULE WISE COURSE CONTENT AND OUTCOME

MODULE 1	INTRODUCTION TO BIM AND REVIT USER INTERFACE	
CONTENT	Evolution of Engineering drawing – Revit User Interface – Creation of Levels and Grids	(12)
OUTCOME	<ul style="list-style-type: none"> • Analyse the transition of engineering drawings from 2D drawings to BIM • Analyse the Revit interface and its components • Develop levels and grids suiting the project need in Revit 	
MODULE 2	BIM STRUCTURAL MODELLING	
CONTENT	Creation of structural columns and foundations - Creation of Walls and Beams - Creation of Floors and Roofs	(12)

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OUTCOME	<ul style="list-style-type: none"> • Create Structural columns, Create Isolated foundation, wall foundation and stepped Foundation • Develop exterior and interior walls, core walls, wall openings • Create structural beams between Structural columns • Sketch the shape of floors and roofs, adding slopes as needed. • Generate openings within floors and roofs 	
MODULE 3	UTILIZING REVIT FAMILIES	
CONTENT	Placing of doors and windows: Creation of stairs and ramps - Revit annotations.	(12)
OUTCOME	<ul style="list-style-type: none"> • Modify both type and instance properties of doors and windows, Loading and placing of doors and windows in the project. • Create stairs by options by component, sketching, spiral runs. Creation of ramps and its finishes. Placing of railings. • Tagging of annotations and elements in Revit. 	
MODULE 4	REVIT DRAWING EXTRACTION	
CONTENT	Sheet Creation – Creation of Views – Placing of Views in sheets	(12)
OUTCOME	<ul style="list-style-type: none"> • Load Sheet family, and Modify title Block • Create Elevation, Section and Plan views • Analyse Revit Views in customized drawing sheet 	
MODULE 5	REVIT REPORTS	
CONTENT	Schedule Creation – Placing of schedules in Sheets – Room and Area Reports – ARVR Concept - DEMO	(12)
OUTCOME	<ul style="list-style-type: none"> • Create, Sort, format and group Revit Schedule content • Place schedules and material take offs in Sheets • Orient and locate the rooms in the Areas and its schedule, Placing them on sheets • Analyse the basic concepts of ARVR 	

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LIST OF FINAL PROJECTS

1. Creation of Structural BIM model for 2BHK Residential Building
2. Creation of Structural BIM model for Old Age Home
3. Creation of Structural BIM model for Office Space
4. Creation of Structural BIM model for Boys Hostel
5. Creation of Structural BIM model for Hotel Building
6. Creation of Structural BIM model for Restaurant
7. Creation of Structural BIM model for Girls Hostel
8. Creation of Structural BIM model for Duplex House
9. Creation of Structural BIM model for 3BHK Residential Building
10. Creation of Structural BIM model for Commercial Building

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TABLE 1	
OVERALL COURSE OBJECTIVE:	<ol style="list-style-type: none"> 1. Learn the concept of Building Information modelling. 2. Understand the Structural modelling of buildings from conceptual stage to design stage as per the industrial workflow. 3. Develop the Quantity take off Schedule for the project. 4. Learn techniques for extracting 2D Drawing sheets from the 3D model.
LEARNING OUTCOME:	<ol style="list-style-type: none"> 1. Comprehensive understanding of Building Information modelling (BIM) principles, processes, and applications in construction projects. 2. Develop comprehensive Architectural and structural models for buildings based on project requirements and specifications. 3. Design customized quantity take-off schedules and placing of Schedules in sheets 4. Extracting 2D drawing sheets from 3D models

TABLE 2: MODULE WISE COURSE CONTENT AND OUTCOME				
SL.NO	MODULE NAME	MODULE CONTENT	MODULE LEARNING OUTCOME	DURATION (HRS)
1.	Introduction to BIM and Revit User Interface	Evolution of Engineering drawings	Understanding the transition of engineering drawings from 2D drawings to BIM	12
		Revit User Interface	Get familiar with Revit interface and its components	
		Creation of Levels and Grids	Develop levels and grids suiting the project need in Revit	
2.	BIM Structural Modelling	Creation of structural columns and foundations	Create Structural columns, Create Isolated foundation, wall foundation and stepped foundation	12

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		Creation of Walls and Beams	Develop exterior and interior walls, core walls, wall openings, Creation of structural beams between structural columns	
		Creation of Floors and Roofs	Sketch the shape of floors and roofs, adding slopes as needed. Additionally, generate openings within floors and roofs	
3.	Utilizing Revit Families	Placing of doors and windows	Modifying both type and instance properties of Doors and windows, Loading and placing of doors and windows in the project	12
		Creation of Stairs and Ramps	Creation of Stairs by options by component, sketching, spiral runs. Creation of Ramps and its finishes. Placing of Railings	
		Revit Annotations	Basics of annotations in Revit, Tagging of elements in Revit	
4.	Revit Drawing Extraction	Sheet Creation	Loading Sheet family, and Modifying title Block	12
		Creation of Views	Create Elevation, Section and Plan views	

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		Placing of Views in sheets	Basics of placing Revit Views in customized drawing sheet	
5.	Revit Reports	Schedule Creation	Creation of Revit Schedules and Sorting, formatting, grouping of the Revit Schedule content	12
		Placing of schedules in Sheets	Placing schedules and material take offs in Sheets	
		Room and Area Reports	Creation of Rooms and Areas and its schedule, Placing them on sheets.	

TABLE 3: OVERALL COURSE LEARNING OUTCOME ASSESSMENT CRITERIA AND USECASES		
LEARNING OUTCOME	ASSESSMENT CRITERIA	USECASES
Understanding the transition of engineering drawings from 2D drawings to BIM	<ul style="list-style-type: none"> • Demonstrates understanding of traditional 2D engineering drawings and their components. • Shows comprehension of Building Information Modeling (BIM) principles and its significance in the construction industry • Recognizes advantages and limitations of both 2D drawings and BIM in the context of engineering and construction projects 	<p>Use Case: Scenario: A training session is happening for a CAD team for transitioning to BIM and its an introduction class. Task: Provide students with 2D engineering drawings of a building or infrastructure project and ask them to research and analyze different techniques for converting these drawings into BIM models.</p>
Get familiar with Revit interface and its components	<ul style="list-style-type: none"> • Ability to navigate through the Revit interface, including accessing different views, panels, and commands. • Demonstrates familiarity with the various components of the Revit interface, including the ribbon, project browser, 	<p>Use Case: Scenario: Designing a residential community necessitates efficient use of Revit's tools. Task:</p> <ul style="list-style-type: none"> • Navigate through the various tabs and panels of the Revit Ribbon to locate specific

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	<p>properties palette, and status bar.</p> <ul style="list-style-type: none"> • Demonstrates understanding of command locations within the interface and the workflow for accessing and executing commands efficiently 	<p>commands.</p> <ul style="list-style-type: none"> • Demonstrate how to create and modify views (plan, section, elevation) in Revit. • Explore the different types of families (component, system, annotation) available in Revit and their respective uses
<p>Develop levels and grids suiting the project need in Revit</p>	<ul style="list-style-type: none"> • Understanding of the role of levels and grids in establishing the framework for a building project. • Proficiency in creating and manipulating levels and grids in Revit, including adjusting elevation and alignment. • Ability to coordinate levels and grids with other project elements such as walls, floors, and structural components. 	<p>Use Case: Scenario: A BIM modeler wants to Design a multi-story commercial office building with complex floor layouts using Revit by incorporating structural grids into a building model to facilitate structural analysis and coordination. Task:</p> <ul style="list-style-type: none"> • Set up a basic building structure in Revit including levels and grids based on provided architectural drawings. • Adjust the elevation and spacing of levels and grids to match specific project requirements.
<p>Create Structural columns, Create Isolated foundation, wall foundation and stepped foundation</p>	<ul style="list-style-type: none"> • Proficiency in using Revit software to accurately model and place columns. • Ability to coordinate column placement with architectural and engineering plans. • Proficiency in creating various types of foundations, such as isolated footings, strip footings, or mat foundations, using Revit's foundation tools. 	<p>Use Case: Scenario: The BIM designer uses Revit to Model structural columns in Revit to support multiple floors of an office tower. Columns are strategically placed to accommodate floor layouts and transfer loads efficiently Task: The students will use Revit to create structural columns based on provided architectural and structural plans. Coordinate column placement with architectural features and structural grid lines and adjust</p>

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		column sizes
Develop exterior and interior walls, core walls, wall openings, Creation of structural beams between structural columns	<ul style="list-style-type: none"> • Accuracy in modelling exterior and interior walls according to architectural drawings. • Proficiency in creating different types of walls (e.g., masonry, concrete, drywall) with appropriate thickness and materials. • Ability to coordinate beams with other structural elements such as columns and floor slabs. • Ability to create wall openings accurately, ensuring proper alignment and dimensions. 	<p>Use Case:</p> <p>Scenario: Modeling exterior curtain walls and interior partitions in a Commercial building and Designing structural beams.</p> <p>Task: The students use revit software to Model exterior and interior walls in Revit based on architectural floor plans and elevations. Then Incorporate wall openings such as doors, windows, and vents using Revit's opening tools. Create structural beams between designated columns in Revit based on structural engineering drawings.</p>
Sketch the shape of floors and roofs, adding slopes as needed. Additionally, generate openings within floors and roofs	<ul style="list-style-type: none"> • Accuracy in sketching floor and roof shapes according to architectural and structural drawings. • Understanding of floor and roof properties and parameters, including thickness and slope. • Proficiency in creating openings within floors and roofs using Revit's modeling tools. 	<p>Use Case:</p> <p>Scenario: The designer wants to Sketch the floor and roof shapes in Revit for a contemporary villa design with a sloped green roof.</p> <p>Task:</p> <ul style="list-style-type: none"> • Sketch floor and roof shapes in Revit based on architectural plans and elevations. • Apply slope adjustments to roof shapes to accommodate drainage requirements or architectural aesthetics. • Ensure proper alignment and coordination of floor and roof shapes with other building elements. • Generate openings within floors and roofs in Revit based on architectural and structural plans.

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<p>Modifying both type and instance properties of Doors and windows, Loading and placing of doors and windows in the project</p>	<ul style="list-style-type: none"> • Proficiency in modifying type properties of doors and windows, including dimensions, materials, and hardware. • Ability to customize instance properties such as swing direction, sill height, and trim detail for individual doors and windows. • Capability to coordinate door and window placement with architectural and structural elements to ensure proper alignment and functionality. 	<p>Use Case: Scenario: Loading and placing door and window families in Revit for a mixed-use building with retail spaces on the ground floor and residential units above. Ensuring proper placement and functionality to accommodate diverse occupancy types</p> <p>Task: The students will use revit software to Modify type properties of doors and windows in Revit to match project specifications and building standards, Select appropriate door and window types based on architectural drawings and specifications.</p>
<p>Creation of Stairs by options by component, sketching, spiral runs. Creation of Ramps and its finishes. Placing of Railings</p>	<ul style="list-style-type: none"> • Proficiency in creating stairs using different methods, including component-based modeling, sketching, and spiral runs. • Accuracy in adjusting stair parameters such as width, height, tread depth, and riser height to meet design specifications. • Capability to incorporate design features such as handrails, landings, and transitions to enhance usability and safety. 	<p>Use Case: Scenario: Creating stairs in Revit for a Healthcare clinic building using component-based modeling. then, Designing ramps in Revit that prioritizes accessibility for people of all abilities.</p> <p>Task: The students use Revit to Create stairs by selecting predefined stair types and adjusting parameters. Apply finishes to ramps in Revit using appropriate materials and textures to match project specifications and aesthetic preferences.</p>

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<p>Basics of annotations in Revit, Tagging of elements in Revit</p>	<ul style="list-style-type: none"> • Proficiency in creating annotations such as dimensions, text, and symbols in Revit. • Ability to customize annotation properties and settings to meet project standards and documentation requirements. • Ability to customize tag styles and settings to match project standards 	<p>Use Case: Scenario: The model has to be tagged and annotated like Adding dimensions to floor plans and elevations to indicate building element sizes and clearances. Incorporating text annotations to label rooms, doors, and windows with relevant information. Task: The students will use dimension annotations in Revit to indicate the size and location of building elements such as walls, doors, and windows and provide additional information, such as room names, door numbers, and material specifications, on construction drawings.</p>
<p>Loading Sheet family and Modifying title Block</p>	<ul style="list-style-type: none"> • Understanding of title block parameters and settings for customizing sheet layouts to meet project standards. • Ability to coordinate title block modifications with other project stakeholders to ensure alignment with project requirements. 	<p>Use Case: Scenario: The construction manager wants to create sheet in Revit for a hostel project. Modifying the title block to include project-specific information and Coordinating title block modifications Task: The students use Revit to Modify the title block to include project-specific information such as project name, address, and drawing numbers. Customize title block parameters such as text styles, fonts, and sizes to match project standards and corporate branding. Coordinate title block modifications with project team members, including architects, engineers, and contractors, to ensure consistency across all drawing sheets.</p>

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<p>Create Elevation, Section and Plan views</p>	<ul style="list-style-type: none"> • Proficiency in creating elevation, section, and plan views in Revit, ensuring they accurately represent building elements and spatial relationships. • Accuracy in defining view extents and cutting planes to capture relevant information and details. 	<p>Use Case: Scenario: The designer needs to generate section views to showcase vertical circulation elements such as stairs and elevators. Producing plan views to illustrate floor layouts for each building component. Task: The students use Revit to create elevation views to show vertical facades and building features from specific vantage points. Produce plan views to depict horizontal floor layouts and spatial arrangements, including furniture layouts and circulation paths.</p>
<p>Basics of placing Revit Views in customized drawing sheet</p>	<ul style="list-style-type: none"> • Accuracy in placing Revit views within viewports on drawing sheets, ensuring proper scale and alignment. • Understanding of sheet properties and settings, such as sheet size, orientation, and numbering. • Ability to organize views logically and efficiently on drawing sheets to facilitate review and communication. 	<p>Use Case: Scenario: Placing Revit views in customized drawing sheets for a old age home project. Creating drawing sheets with title blocks specific to the developer's branding. Organizing views to include site plans, floor plans, and elevations for each housing unit. Task: The students use Revit to Create customized drawing sheets in Revit by selecting appropriate title blocks and borders from the project template and Insert viewports onto drawing sheets and Arrange them logically within drawing sheets.</p>
<p>Creation of Revit Schedules and Sorting, formatting, grouping of the Revit Schedule content</p>	<ul style="list-style-type: none"> • Proficiency in creating schedules in Revit, selecting appropriate categories and parameters to include in the schedule. 	<p>Use Case: Scenario: The BIM coordinator has asked to create schedules for a Restaurant project, including room schedules, door schedules,</p>

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	<ul style="list-style-type: none"> • Ability to group schedule content logically, organizing similar items together to facilitate analysis and interpretation. 	<p>and equipment schedules. they also wants to Sort schedule content and Format schedules.</p> <p>Task: The students use Revit to Create schedules in Revit and Sort schedule content by parameters such as element name, type, size, quantity, or phase, using Revit's sorting options. And Group similar items in schedules using grouping criteria such as type, function, location, or status, to organize data effectively.</p>
<p>Placing schedules and material take offs in Sheets</p>	<ul style="list-style-type: none"> • Proficiency in placing schedules and material takeoffs onto drawing sheets in Revit, ensuring they are accurately positioned and scaled. • Accuracy in selecting appropriate views and parameters for each schedule and material takeoff, reflecting project requirements. 	<p>Use Case</p> <p>Scenario: Placing schedules and material takeoffs onto drawing sheets for a Girls hostel project, including door schedules, window schedules, and finish material takeoffs.</p> <p>Task: The students use Revit to Identify the appropriate drawing sheets in Revit for placing schedules and material takeoffs based on project organization and standards. Insert views containing schedules and material takeoffs onto drawing sheets, adjusting scale and orientation as needed to fit the sheet layout.</p>
<p>Creation of Rooms and Areas and its schedule, Placing them on sheets</p>	<ul style="list-style-type: none"> • Accuracy in generating schedules for rooms and areas, including relevant parameters such as name, area, and occupancy. • Ability to place room and area schedules onto drawing sheets, ensuring clear presentation and alignment with other project information. 	<p>Use Case:</p> <p>Scenario: Creating rooms and areas in Revit for an office building project, including office spaces, conference rooms, break areas, and circulation zones.</p> <p>Task: The students use Revit to generate room and area schedules in Revit, specifying parameters such as room name, number, area, occupancy, and</p>

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		finish materials. Place room and area schedules onto drawing sheets, arranging them logically and coordinating with other drawing elements such as floor plans and elevations.
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TABLE 4: LIST OF FINAL PROJECTS (10 PROJECTS THAT COMPREHENSIVELY COVER ALL THE LEARNING OUTCOME)	
SL.NO	FINAL PROJECT
1.	Creation of Structural BIM model for 2 BHK Residential Building
2.	Creation of Structural BIM model for Old Age Home
3.	Creation of Structural BIM model for Office Space
4.	Creation of Structural BIM model for Boys Hostel
5.	Creation of Structural BIM model for Hotel Building
6.	Creation of Structural BIM model for Restaurant
7.	Creation of Structural BIM model for Girls Hostel
8.	Creation of Structural BIM model for Duplex House
9.	Creation of Structural BIM model for 3BHK Residential Building
10.	Creation of Structural BIM model for Commercial Building

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Student Assessment Plan:

Each of the above-mentioned test projects will be divided into tasks by the training partner for each specific institution. Such tasks will be jointly evaluated by the faculty and the training partner and the following weightage is to be followed.

- 70% weightage to the external practical assessment.
- 30% weightage to the internal assessment.

Final Test Project/External Assessment Plan:

The Final Test Project will be chosen from the list given above, jointly by the college faculty and the Training Partner. The Final Test Project will be assessed on the following tasks, for 70 marks:

Task	Description	Marks
Task 1	Create a 3D Structural model of the building Part – 1 (Grids & Levels, Foundation)	10 marks
Task 2	Create a 3D Structural model of the building Part – 2 (Columns, Beams, Slabs, Walls)	20 marks
Task 3	Create Revit Family elements	20 marks
Task 4	Generate 2D Drawings	10 marks
Task 5	Material Quantity take-off reports	10 marks