



Gyanmanjari
Innovative University

Syllabus
Gyanmanjari Institute of Technology
Semester-3 (B. Tech.)

Subject: Civil Drafting with 3D CAD Tools– BET2CV13307

Type of Course: Professional Core

Prerequisite: Basic knowledge of 2D CAD Drafting Excellence

Rationale: Digital drafting and 3D CAD tools play a vital role in modern civil engineering practices. This course enables students to develop skills in computer-aided drafting, 3D modeling, and visualization using industry-standard tools such as AutoCAD and SketchUp. It bridges the gap between traditional drawing and digital construction practices, preparing students for real-world applications in building design, infrastructure planning, and project visualization.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
CI	T	P		SEE	CCE	
2	0	2	3	100	50	150

Legends: CI-Classroom Instructions; T-Tutorial; P-Practical; C –Credit; SEE -Semester End Evaluation; CCE-Continuous and Comprehensive Evaluation

Course Content:

Sr. No.	Course Content	Hrs.	% Weightage
1	Introduction to Digital Drafting and CAD Basics <u>Theory Topics:</u> Introduction to Digital Drafting, Importance of Digital Drafting in Civil Engineering, Overview of CAD Tools, AutoCAD Interface and Workspace, Drawing Setup in CAD, Coordinate Systems in CAD, Basic Drawing Commands in AutoCAD, Units and Measurements in CAD Applications, Fundamentals of Computer-Aided Drafting, Role of CAD in Modern Civil Engineering. <u>Practical:</u> 1. Set up a CAD workspace by configuring units, limits, and grid settings for accurate drafting. 2. Create basic 2D geometric drawings using commands such as line, circle, and rectangle. 3. Apply modification commands like move, copy, trim, and extend	10	20 %



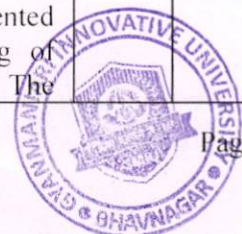
	to edit and refine drawings. - Practice working with different coordinate systems for precise point placement and drawing accuracy. - Create and manage layers, and assign appropriate properties for organized CAD drafting. - Prepare a simple building layout using basic CAD tools and drawing commands. - Perform unit-based drawing exercises to improve accuracy and understanding of measurement systems in CAD. Evaluation Method: <table> <tr> <th>Sr. No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr> <tr> <td>1</td><td> CAD Drawing and Setup Task Students will be assessed through analytical and application-based tasks related to digital drafting and CAD fundamentals. The evaluation will include drawing setup, coordinate systems, basic drawing commands, modification tools, units and measurements, layer management, and preparation of simple engineering drawings. Students may also be required to apply CAD commands for creating and modifying 2D drawings using proper drafting standards and conventions. The assessment will focus on conceptual understanding, accuracy in drafting, command application skills, and structured presentation of drawings. </td><td>20</td><td></td></tr> <tr> <td>2</td><td> Active Learning Activity: CAD Application Activity: Students will perform practical CAD activities involving workspace setup, creation of basic 2D drawings, application of modification commands, coordinate system practice, layer creation, and preparation of simple building layouts. The activities will emphasize precision in drafting, proper use of CAD tools, understanding of units and measurements, and application of digital drawing techniques in civil engineering practice. Students will submit CAD drawings and activity reports in a structured format on the GMIU Portal. </td><td></td><td>10</td></tr> </table>	Sr. No.	Evaluation Methods	SEE	CCE	1	CAD Drawing and Setup Task Students will be assessed through analytical and application-based tasks related to digital drafting and CAD fundamentals. The evaluation will include drawing setup, coordinate systems, basic drawing commands, modification tools, units and measurements, layer management, and preparation of simple engineering drawings. Students may also be required to apply CAD commands for creating and modifying 2D drawings using proper drafting standards and conventions. The assessment will focus on conceptual understanding, accuracy in drafting, command application skills, and structured presentation of drawings.	20		2	Active Learning Activity: CAD Application Activity: Students will perform practical CAD activities involving workspace setup, creation of basic 2D drawings, application of modification commands, coordinate system practice, layer creation, and preparation of simple building layouts. The activities will emphasize precision in drafting, proper use of CAD tools, understanding of units and measurements, and application of digital drawing techniques in civil engineering practice. Students will submit CAD drawings and activity reports in a structured format on the GMIU Portal.		10		
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2	Active Learning Activity: CAD Application Activity: Students will perform practical CAD activities involving workspace setup, creation of basic 2D drawings, application of modification commands, coordinate system practice, layer creation, and preparation of simple building layouts. The activities will emphasize precision in drafting, proper use of CAD tools, understanding of units and measurements, and application of digital drawing techniques in civil engineering practice. Students will submit CAD drawings and activity reports in a structured format on the GMIU Portal.		10												



	Total	10	10
Examination Style:			
CAD Drawing and Setup Task (10 Marks)			
Students will be assessed through practical and application-oriented CAD drafting tasks designed to evaluate their understanding of digital drafting concepts and CAD tools. The examination will require students to create 2D drawings using CAD commands and apply drawing setup procedures, coordinate systems, units, measurements, and object modification techniques. Students may also be required to prepare simple engineering layouts using standard drafting conventions. The assessment shall emphasize drafting accuracy, command application, technical understanding, and proper presentation of drawings.			
CAD Application Activity (10 Marks)			
Students will perform CAD-based practical activities starting with workspace setup, including configuration of units, limits, grid settings, and coordinate systems. They will create basic 2D drawings using fundamental commands such as line, circle, and rectangle, along with modification tools like move, copy, trim, and extend. In the second part, students will prepare a simple building layout using CAD tools with proper layer creation, property assignment, dimensions, and drafting conventions. They will demonstrate organized digital drafting practices and understanding of engineering drawing standards. Evaluation shall be based on command execution, drawing accuracy, graphical presentation, layer management, drafting precision, and report submission.			
3D CAD Modeling			
<u>Theory Topics:</u>			
Introduction to 3D CAD Modeling, Concepts of 3D CAD, AutoCAD 3D Interface, 3D Coordinate Systems, Solid Modeling Techniques (Extrude, Revolve, Sweep), Viewing Tools in 3D CAD, User Coordinate System (UCS), Applications of 3D Modeling in Civil Engineering, Visualization and Rendering Basics in CAD.			
<u>Practical:</u>			
2	8. Create basic 3D primitive objects such as box, cylinder, and sphere using CAD tools. 9. Apply extrude and revolve operations to convert 2D shapes into 3D models. 10. Modify 3D objects using editing tools to refine shape and structure. 11. Develop simple 3D models to understand basic modeling concepts and techniques. 12. Practice navigation tools for rotating, zooming, and viewing 3D models effectively. 13. Compare 2D and 3D models to understand differences in	10	20 %



representation, visualization, and application.			
Evaluation Method:			
Sr. No.	Evaluation Methods	SEE	CCE
1	3D Modeling Task Students will be assessed through analytical and application-based tasks related to 3D CAD concepts and solid modeling techniques. The evaluation will include creation of 3D primitives, use of coordinate systems in 3D space, UCS application, viewing tools, and solid modeling operations such as extrude, revolve, and sweep. Students may also be required to modify and visualize 3D objects using AutoCAD tools and compare 2D and 3D representations. The assessment will focus on conceptual understanding, modeling accuracy, command application skills, and structured presentation of 3D models.	20	
2	Active Learning Activity: 3D Application Activity: Students will perform practical activities involving creation and modification of 3D objects using AutoCAD tools and commands. Students will develop basic 3D models using primitives, apply extrude and revolve operations, use UCS and navigation tools, and demonstrate visualization techniques in 3D space. The activities will emphasize spatial understanding, digital modeling skills, precision in model development, and application of 3D drafting techniques in engineering practice. Students will submit 3D models and activity reports in a structured format on the GMIU Portal.		10
	Total	10	10
Examination Style:			
3D Modeling Task (10 Marks) Students will be assessed through practical and application-oriented 3D modeling tasks designed to evaluate their understanding of AutoCAD 3D concepts and solid modeling techniques. The			



	examination will require students to create and modify 3D models using commands such as extrude, revolve, sweep, and solid primitives. Students may also be required to apply UCS settings, viewing tools, and navigation techniques while developing models in 3D space. The assessment shall emphasize modeling accuracy, command application, spatial understanding, and proper presentation of 3D objects. 3D Application Activity (10 Marks) Activity 1: 3D Modeling and UCS Application Activity (5 Marks): Students will create basic 3D objects using primitives such as box, cylinder, and sphere, and apply operations such as extrude and revolve for model development. Students will also use UCS and view tools to orient and visualize models in 3D space. Evaluation shall be based on command execution, modeling accuracy, participation, and understanding of 3D CAD operations. Activity 2: 3D Object Development and Navigation Activity (5 Marks): Students will develop simple engineering-related 3D models and apply modification and navigation tools for visualization and editing. Students may also compare 2D and 3D representations to understand differences in drafting approaches. Evaluation shall be based on spatial visualization, model presentation, precision in modeling, application of 3D drafting techniques, and report submission.		
3	SketchUp Modeling and Visualization <u>Theory Topics:</u> Introduction to SketchUp Modeling, SketchUp Interface and Tools, Push-Pull Method in 3D Modeling, Groups and Components in SketchUp, Materials and Textures Application, Navigation Tools in SketchUp, Import and Export Functions in SketchUp, Basics of 3D Visualization, Applications of SketchUp in Civil Engineering and Architectural Design. <u>Practical:</u> 14. Explore the SketchUp interface and basic tools to understand navigation and modeling workflow. 15. Create simple 3D models using the push-pull tool for extruding 2D shapes into solids. 16. Use groups and components to organize and manage model elements efficiently. 17. Apply materials and textures to enhance the visual appearance of 3D models. 18. Import CAD drawings into SketchUp and use them as a base for 3D modeling. 19. Develop a simple building model using SketchUp tools and techniques. 20. Export model views and layouts for presentation and	20	25 %



documentation purposes.			
Evaluation Method:			
Sr. No.	Evaluation Methods	SEE	CCE
1	SketchUp Modeling Task: Students will be assessed through analytical and application-based tasks using SketchUp software. The evaluation will include creating 3D models using push-pull tools, applying groups and components, using navigation tools, and managing materials and textures. Students may also be required to import CAD drawings and develop simple 3D models for visualization. The assessment will focus on conceptual understanding, modeling accuracy, tool application skills, and presentation of 3D models.	20	
2	Active Learning Activity: SketchUp Activity: Students will design a basic building plan showing rooms, doors, windows, and circulation, apply planning principles such as orientation and ventilation, and present their layout with proper labeling and structure, compiling their drawings and explanations into a PDF for submission on the GMIU Portal.		10
	Total	10	10
Examination Style:			
SketchUp Modeling Task (10 Marks)			
Students will be assessed through practical and application-oriented SketchUp modeling tasks designed to evaluate their understanding of 3D modeling concepts and tools. The examination will require students to create 3D models using push-pull operations, apply groups and components, manage materials and textures, and navigate the 3D environment efficiently. Students may also import CAD drawings and develop models for visualization. The assessment shall emphasize modeling accuracy, speed, application of SketchUp tools, and quality of visual representation.			
SketchUp Activity: (10 Marks)			
Activity 1: Interface Exploration and Basic Modeling (5 Marks):			
Students will explore the SketchUp interface, navigation tools, and basic modeling commands to create simple 3D objects. Evaluation			

	shall be based on effective use of tools, accuracy in model creation, participation, and understanding of software features. Activity 2: Building Model Development and Visualization (5 Marks): Students will develop a simple building model, apply materials and textures, and export views or layouts for presentation. Evaluation shall be based on model precision, application of visualization techniques, effective use of SketchUp tools, and presentation quality.										
4	Advanced Modeling and Rendering <u>Theory Topics:</u> Advanced 3D Modeling Techniques, Boolean Operations in CAD, Rendering Concepts and Fundamentals, Lighting in 3D Visualization, Material Application in Rendering, Camera Views and Perspectives, Visualization Techniques in Design, Photorealistic Rendering Basics, Applications of Advanced Modeling and Rendering in Civil Engineering and Design. <u>Practical:</u> 21. Perform Boolean operations to create complex shapes by combining or subtracting 3D objects. 22. Create complex 3D models using advanced modeling tools and techniques. 23. Apply materials and textures to enhance realism and surface detailing of models. 24. Set up lighting and camera views to control scene appearance and perspective. 25. Render 3D models to produce realistic visual outputs. 26. Create scene compositions by arranging models, lighting, and camera settings effectively. 27. Compare rendered outputs to evaluate quality, realism, and visual effectiveness. <u>Examination Style:</u> <table border="1"> <thead> <tr> <th>Sr. No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr> </thead> <tbody> <tr> <td>1</td><td> Advanced Modeling and Rendering Task: Students will be assessed through analytical and application-based tasks involving advanced 3D modeling and rendering techniques. The evaluation will include Boolean operations, creation of complex models, application of materials and textures, lighting setup, camera views, rendering concepts, and visualization techniques. Students may also be required to compare rendered </td><td>20</td><td></td></tr> </tbody> </table>	Sr. No.	Evaluation Methods	SEE	CCE	1	Advanced Modeling and Rendering Task: Students will be assessed through analytical and application-based tasks involving advanced 3D modeling and rendering techniques. The evaluation will include Boolean operations, creation of complex models, application of materials and textures, lighting setup, camera views, rendering concepts, and visualization techniques. Students may also be required to compare rendered	20		10	20 %
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		outputs and analyze visual quality and realism. The assessment will focus on conceptual understanding, modeling accuracy, rendering quality, visualization skills, and structured presentation of rendered models.				
	2	3D Visualization and Rendering Activity: Students will perform practical activities involving creation of complex 3D models, application of Boolean operations, materials and textures, lighting setup, camera positioning, scene composition, and rendering of models using visualization techniques. Students will develop rendered views and compare output quality to understand realism and presentation standards in digital visualization. The activity will emphasize creative modeling, rendering precision, effective use of visualization tools, and professional presentation skills.		10		
		Total	10	10		
	Advanced Modeling and Rendering Task: (10 Marks) Students will be assessed through practical and application-oriented rendering tasks designed to evaluate their understanding of advanced modeling, lighting, materials, and visualization techniques. The examination will require students to perform Boolean operations, create complex 3D models, apply materials and textures, set lighting and camera views, prepare scene compositions, and render models for realistic visualization. The assessment shall emphasize modeling accuracy, rendering quality, realism, visual composition, and structured presentation of rendered model. 3D Visualization and Rendering Activity (10 Marks) Students will perform practical activities involving advanced modeling, rendering, and visualization techniques using digital tools. The activities may include creation of complex 3D models, application of materials and textures, setup of lighting and camera views, rendering of scenes, and presentation of visual outputs. Students are expected to demonstrate understanding of visualization principles, rendering quality, realism, and effective digital presentation methods. Evaluation shall be based on modeling precision, rendering accuracy, creative visualization, application of software tools, and presentation quality.					
5	Integrated Building Modeling and BIM Applications Theory Topics:				10	15 %



	3D Building Modeling Concepts, Structural Elements in Digital Modeling, Basics of Building Information Modeling (BIM), Site Layout Modeling Techniques, Integration of AutoCAD and SketchUp, Interoperability Between CAD and BIM Tools, Real-World Applications of BIM in Civil Engineering, Digital Construction Workflow, Collaborative. <u>Practical:</u> 28. Convert a 2D plan into a 3D model using appropriate modeling tools and techniques. 29. Import AutoCAD drawings into SketchUp and use them as a reference for 3D modeling. 30. Develop a complete building model with accurate architectural detailing. 31. Model structural components such as beams, columns, slabs, and foundations. 32. Prepare a site layout showing building placement, access, and surrounding features. 33. Render the final model to produce a realistic visual presentation. 34. Prepare a project report and presentation documenting the modeling process and outcomes. Evaluation Method: <table border="1"> <thead> <tr> <th>Sr. No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr> </thead> <tbody> <tr> <td>1</td><td> 3D Civil Modeling Project Task: Students will be assessed through a comprehensive application-based project involving 3D building modeling, structural component modeling, BIM basics, and site layout preparation using AutoCAD and SketchUp. The evaluation will include conversion of 2D plans into 3D models, integration of CAD drawings with SketchUp, rendering of final models, and application of visualization techniques in real-world civil engineering scenarios. The assessment will focus on modeling accuracy, software integration, application of engineering concepts, visualization quality, and structured presentation of the final project. </td><td>10</td><td></td></tr> <tr> <td>2</td><td> Integrated Building Modeling and Presentation Activity: Students will perform practical activities involving development of complete 3D building models, preparation of site layouts, modeling of structural elements, </td><td></td><td>10</td></tr> </tbody> </table>	Sr. No.	Evaluation Methods	SEE	CCE	1	3D Civil Modeling Project Task: Students will be assessed through a comprehensive application-based project involving 3D building modeling, structural component modeling, BIM basics, and site layout preparation using AutoCAD and SketchUp. The evaluation will include conversion of 2D plans into 3D models, integration of CAD drawings with SketchUp, rendering of final models, and application of visualization techniques in real-world civil engineering scenarios. The assessment will focus on modeling accuracy, software integration, application of engineering concepts, visualization quality, and structured presentation of the final project.	10		2	Integrated Building Modeling and Presentation Activity: Students will perform practical activities involving development of complete 3D building models, preparation of site layouts, modeling of structural elements,		10		
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2	Integrated Building Modeling and Presentation Activity: Students will perform practical activities involving development of complete 3D building models, preparation of site layouts, modeling of structural elements,		10												



	rendering of final outputs, and presentation of project workflow and design approach. Students will integrate AutoCAD and SketchUp tools for digital modeling and visualization of civil engineering projects. The activity will emphasize real-world application, digital modeling competency, rendering quality, project documentation, and professional presentation skills.				
	Total	10	10		
Examination Style: 3D Civil Modeling Project Task (10 Marks) Students will be assessed through conceptual and application-based evaluation demonstrating their understanding of interior and exterior finishing materials used in building construction. The examination will require students to identify materials such as paints, tiles, plaster, flooring, and cladding, explain their properties and uses, and analyze their suitability for different conditions. Students will also evaluate real-life scenarios and select appropriate materials for interior and exterior finishes based on durability, aesthetics, and environmental factors. The assessment will focus on conceptual clarity, practical application, material selection skills, and clear presentation of answers. Integrated Building Modeling and Presentation Activity (10 Marks) Students will perform practical activities involving preparation of complete 3D building models, structural component modeling, site layout development, rendering of final outputs, and project presentation using AutoCAD and SketchUp tools. Students are expected to demonstrate understanding of workflow integration, modeling techniques, rendering concepts, and visualization methods used in civil engineering applications. Evaluation shall be based on accuracy of modeling, effective integration of software tools, rendering quality, project documentation, application-oriented learning, and clarity in presentation.					



Suggested Specification table with Marks (Theory): 100

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	10%	10%	30%	10%	10%	30%

Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand digital drafting tools and CAD interface
CO2	Develop 2D and 3D models using AutoCAD
CO3	Create models using Sketch Up.
CO4	Apply rendering and visualization techniques.
CO5	Develop integrated civil engineering models

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students.

A minimum of 20–30% of the course content shall be suggested to deliver through Flipped Learning, where students study digital learning resources before the classroom session. Classroom time shall be utilized for discussion, problem-solving, practical applications, and higher-order learning activities.

Students shall be encouraged to use AI-powered learning platforms, simulation software, virtual laboratories, digital libraries, research databases, online certification courses, NPTEL, SWAYAM, MOOCs, and other technology-enabled learning resources to strengthen conceptual understanding and practical competence.

Continuous assessment shall be conducted through Active Learning Assignments (ALAs), quizzes, skill demonstrations, presentations, practical exercises, projects, case studies, innovation activities, peer assessment, reflective learning, and industry-oriented tasks instead of relying primarily on conventional written assignments.



Reference Books:

- [1] AutoCAD 2024 for Beginners by CAD Folks, CAD Folks Publication
- [2] Engineering Drawing and AutoCAD by K. Venugopal, New Age International
- [3] AutoCAD 3D Modeling for Engineers by Sham Tickoo, CAD/CIM Technologies
- [4] SketchUp for Dummies by Aidan Chopra, Wiley Publications
- [5] SketchUp Pro 2023 Step by Step by Rajib Mall, BPB Publications
- [6] 3D Modeling and Rendering with SketchUp by Lydia Cline, McGraw Hill

