New York City College of Technology – City University of New York
300 Jay Street, Brooklyn, New York 11201

Department of Architectural Technology

ARCH 2330 (2431) BUILDING TECHNOLOGY III

1 cl hrs, 6 lab hrs, 4 credits

Course Description: This course studies the development of building systems as they occur during the design development phase of architecture. Using case study research methods, students analyze factors, such as building assemblies and systems, codes and government regulations, human ergonomics, and sustainability, which affect building construction and use. Solutions to these issues are integrated into final building drawing set. Students create a series of reports and a set of construction drawings using both analog methods (hand sketching and drawing) and digital tools including traditional Computer Aided Design (CAD) software and Building Information Modeling (BIM) techniques.

Course Context: This is the third class in the sequence of four building technology courses. As this course is under development it is subject to changes. Notice of changes will be provided to students as they occur.

Prerequisites: ARCH 1230 (1231): Building Technology II with a grade of C or higher or ARCH 1240 and ARCH1200 with a grade of C or higher.

Pre- or co-requisites: ARCH 2370: Environmental Systems for Architects

Required Texts:

- Class readings on relevant sections will be posted weekly on either Blackboard or the OpenLab website
- Allen, Edward and Joseph Iano. Fundamentals of Building Construction / Materials and Methods. John Wiley and Sons, 2008.
- Ching, Francis. Building Construction Illustrated. John Wiley and Sons, 2008.

Recommended Text:

- Ramsey, Charles George, Harold Reeve Sleeper, and Bruce Bassler. Architectural Graphic Standards: Student Edition (Ramsey/Sleeper Architectural Graphic Standards Series). John Wiley and Sons, 2008.
- James Vandezande, Eddy Krygiel, and Phil Read. Autodesk Revit Architecture 2013 Essentials: Publisher: Sybex; 1 edition (May 1, 2012)

Attendance Policy: No more than 10% absences are permitted during the semester. For the purposes of record, two lateness are considered as one absence. Class lectures and in class work are critical to student success.

Course Structure: Lectures & lab work. Assignments include sketching, a series of research reports, class presentations, quizzes and set of design development construction drawings. Digital tools learned in prior building technology courses are reinforced and enhanced.

Grading:

50%	Individual Computer Based Drawings (Comprehensive Drawing Set)
15%	Team Case Studies, Presentations, Research
15%	Individual Studio Lab Assignments, Research and Assembly Models
15%	Individual Sketching assignments & redlines
5%	Individual Class Participation

Academic Integrity: Students and all others who work with information, ideas, texts, images, music, inventions and other intellectual property owe their audience and sources accuracy and honesty in using, crediting and citing of sources. As a community of intellectual and professional workers, the college recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and is punishable by penalties, including failing grades, suspension and expulsion.

NAAB Student Performance Criteria Objectives

Introduce

B.3 Codes and Regulations: *Ability* to design sites, facilities and systems consistent with the principles of life-safety standards, accessibility standards, and other codes and regulations.

B.6 Environmental Systems: *Understanding* the principles of environmental systems' design, how systems can vary by geographic region, and the tools used for performance *assessment. This* must include active and passive heating and cooling, indoor air quality, solar systems, lighting systems, and acoustics.

B.9 Building Services Systems *Understanding* of the basic principles and appropriate application and performance of building service systems including mechanical, plumbing, electrical, communication, vertical transportation security, and fire protection systems.

B.10 Financial Considerations *Understanding* of the fundamentals of building costs, which must include project financing methods and feasibility, construction cost estimating, construction scheduling, operational costs, and life-cycle costs.

C.1 *Research*: *Understanding* of the theoretical and applied research methodologies and practices used during the design process.

C.3 Integrative Design*: Ability* to make design decisions within a complex architectural project while demonstrating broad integration and consideration of environmental stewardship, technical documentation, accessibility, site conditions, life safety, environmental systems, structural systems, and building envelope systems and assemblies.

Reinforce:

B.4 Technical Documentation: *Ability* to make technically clear drawings, prepare outline specifications, and construct models illustrating and identifying the assembly of materials, systems, and components appropriate for a building design.

B.5 Structural Systems: *Ability to demonstrate* the basic principles of structural systems and their ability to withstand gravity, seismic, and lateral forces, as well as the selection and application of the appropriate structural system."

B.7 Building Envelope Systems and Assemblies: *Understanding* of the basic principles involved in the appropriate selection and application of building envelope systems relative to fundamental performance, aesthetics, moisture transfer, durability, and energy and material resources.

B.8 Building Materials and Assembly: *Understanding* of the basic principles utilized in the appropriate selection of interior and exterior construction materials, finishes, products, components and assemblies based on their inherent performance including environmental impact and reuse.

D.2 Project Management: Understanding of the methods for selecting consultants and assembling teams, identifying work plans, project schedules and time requirements, and recommending project delivery methods.

Learning Objectives (LO)

Upon successful completion of this course, the student will:

1. **Understand** the process and requirements of developing a design from a schematic concept into design development drawings. (Knowledge)
2. **Execute** work through a collaborative process (Gen Ed)
3. **Generate** clear and concise talking points to guide oral presentations of lab assignments. (Gen Ed)
4. **Understand** the advantages and limitations of BIM (building information modeling) as a tool for design development and project delivery. (Skill)
5. **Apply** knowledge of materials and methods of construction, including sustainable principles, to the development of details and assemblies. (Skill)
6. **Sketch** and **draft** details in orthographic and 3-D views in analogue and digital media. (Skill)
7. **Design** and **analyze** exterior wall system based on environmental performance.
8. **Apply** knowledge of professional construction drawing standards for page composition, title blocks, annotation, and schedules. (Skill)
9. **Develop** a professional quality coordinated, edited, and organized set of design development documents for a given building design using BIM and CAD. (Skill)

Assessment

To evaluate the students' achievement of the learning objectives, the professor will do the following:

1. **Review** students' drawing and modeling work where students must exhibit their visual representation skills (2-D and 3-D). (LO: 6, 8, 9)
2. **Assess** the students' use of professional vocabulary during oral presentations.(LO:3)
3. **Review** the effectiveness of student team organization and their management of the project work by frequent meetings. (LO: 2)
4. **Inspect** student submissions for the efficient and effective use of BIM tools. (LO: 4)
5. **Confirm** the proper coordination of the students' submitted drawing sets. (LO: 9)
6. **Review** the quality and accuracy of the students' submitted analogue and digital models of construction assemblies (LO: 6, 7)
7. **Review** the effectiveness of the design and the accuracy of the analysis of the environmental performance of the submitted exterior wall system. (LO: 5, 7)
8. **Compare** the content and quality of final submission of the design development set to a specific professional standard. (LO 1, 8, 9)

Term Project / Weekly Assignments: Each student is responsible for turning in an assignment even if absent the day the assignment is given. Each student should have the email address or telephone number of at least two other students. If absent please reach out to both student teammates and inform he instructor.

Do not miss deadlines! Assignments must be handed in on time to receive full credit. Assignments handed in more than 1 class late will not be accepted and will receive an F. Late assignments will be dropped one grade. For example, an assignment that is A work becomes an A- and an assignment that is a C- becomes a D.

Course Requirements: Students should expect to spend 10 hours or more per week outside of class time preparing assignments. The computer lab is open weekdays and on Saturdays/Sundays during the semester. Hours are posted after the first week of classes. Due to our high enrollment and greater use of computer labs, open lab hours have been greatly reduced. Remember to plan accordingly and *print all assignments as required the day before your class meets*.

Deadline note: Unless otherwise instructed assignments will be due and must be posted on Blackboard or OpenLab in advance of class meetings at least 12 hours prior to the class's official start time. If class begins 8:30 AM then assignment must be posted by 8:30 PM the night before. Posting instructions will be provided for each assignment.

If assignments require printing, you must print before the start of class. You will not be permitted to print during class and any assignment not ready at the start of class will be marked as late. Submission of PDF or original files will not excuse the lateness due to lack of printing. Late assignments are downgraded.

File Naming and Protocols: File names are to include student's name (last then first), date, assignment name and number. All work must be submitted using the same version of Revit or AutoCAD that is installed in the lab.

Individual Assignment Examples:
Last_First_##_AssignmentName_DueDate(MMDDYY).pdf
Smith_John_01_Grid_092312.pdf or Smith_John_01_Grid_092312.rvt

Only files named properly will be accepted. Other formats will be rejected and considered as not submitted.

Group Assignment Examples: (must include names of all team members)

GroupMemberNames(firstLastInitial)_AssignmentName_DueDate (MMDDYY).pdf or
JohnL.PauMl.GeorgeH.RingoS_Presentation_BuildingAnalysis-SiteAnalysis-CaseStudy_022310.ppt (original)
JohnL.PauMl.GeorgeH.RingoS_Presentation_BuildingAnalysis-SiteAnalysis-CaseStudy_022310.pdf

PDF files:
Most assignments will require that you submit the original source file and a PDF file. Do not submit multiple pdf's – they must be compiled into a single PDF.

Rejected Assignments:
Assignments which are not named correctly or are not compiled as a single PDF will be rejected, marked late and downgraded. They must be resubmitted before the next class meets.

Research Archive/Log Openlab/Blog:
Each student is required to keep a chronological archive of all work & research they complete during the semester. This is to include materials that you downloaded or sourced from the internet, weekly scanned sketches from your sketchbook. The research archive is to be stored on an individual OpenLab site and it to be maintained weekly. All sources must be sited or work is considered plagiarized. You may consider keeping a running word document as a backup. Individual OpenLab Sites will be linked to the course OpenLab site.

Class Communication / OpenLab Website:
The primary means of communication from instructor to student during the semester is the course OpenLab website. Students must check the OpenLab site on a daily basis for updates on assignments and deadlines. OpenLab is the main way in which student questions and concerns will be addressed.

Weekly Course Outline (Updated outline may be provided)

#	Lecture	Lab Activity
Week 1 class 1	**Introduction & Team Up & Project Selection** • *Syllabus, Project Statement & Teams* • *Project Development Process DD to CD* • *Review of sample drawings*	• *Class Administration & Procedures.* • *Divide into teams, team interviews, team schedule & join class OpenLab website. (graded in class)* • *Building Selection* Due next week • Team project site visit – before next class • Individual OpenLab Site ○ Preliminary inventory/analysis due next class
Week 1 class 2	**Project & Site Analysis** • *Building Project Analysis* • *Site Inventory & Analysis* • *Identify Case Study*	• *Class Discussion: Analyze structure, mechanical systems, circulation, code compliance, façade, construction materials & detailing.* • *Become familiar with Site inventory & Analysis. Oasisnyc.net* • *Identify Case Study by Building Type* Due next class: • Team case study visit - before next class ○ Case study log and summary due next class ○ Each student: AutoCAD building plan & grid
Week 2 class 3	**Complete Project Analysis & Case Study** • *In class working session* • *Critical Path Planning*	• *In class working session to complete thorough analysis of building and case study notes.* • *Review:case study visit photos, sketches & notes.* • *Prepare for next class presentation.* Due next class: • Presentation posted day before – OLab/BBoard • Individual CAD Plan with Grid and Dimensions
Week 2 class 4	**Team Analysis Presentations:** • *Building Façade Materials Selection (2 materials). Identify Case Studies for materials development. Team members must research different materials.* • *AutoCAD Floor Plan with Grid & Dimensions drawn by each individual is due today*	• ***Final Team Presentations*** *-Building Analysis (structure, floor to floor, mechanical, circulation)* *-Site Analysis* *-Precedent Case Study* *-Program Listing of Spaces and Sizes* • Presentations Graded In Class – Group and Individual Grade • Each Student to begin Materials Research Log
Week 3 class 5	**Zoning and Building Code Introduction** • *Introduction to zoning and building codes Drawing zoning diagrams & isometrics* • *In class Zoning Worksheets to review FAR, envelope, setbacks, Sky exposure*	• *Oasisnyc.net, City planning Department, NYC Building Department, NYC Zoning Text, Use Groups, Districts, FAR, zoning envelope, Setbacks, sky exposure, street wall height, etc.* Individual Work Due next class: • Sheet Z-1 Site Plan, Environs Maps & Zoning Map • Zoning Worksheets submitted night before class
Week 3 class 6	**Zoning Calculations and Envelope** • *In class pinup review of Z-1 sheet* • *22 x 34 sheet plotted 50% on 11 x 17* • *In class worksheet review* • *In class AutoCAD skills development*	• *In class AutoCAD 3d skills development* • *(3d Solids, Boolean Operations, Flatshot)* • *(Zoning envelope plan, elevation, section & isometrics, Setbacks, sky exposure, street wall ht.)* Individual work due next class: • Sheet Z-1 with corrections & FAR calculations • Sheet Z-2 Zoning Envelope - Building Site Plan, Elevations, Sections and Isometrics • Sheet Z-3 Zoning Text

#	Lecture	Lab Activity
Week 4 class 7	**Zoning Review:** **Intro to Egress, Occupancy & Space Layout** • Intro to Egress, Occupancy, Space Layout • Final Zoning Review • *Regardless of your presentation day all presentations are due before class #8 and all individual zoning sets are due before class #9*	• *In class pinup of 11 x 17 sheets, Z-1, Z-2, Z-3* • *Review of egress, occupancy and space layout. Additional analysis of team building for presentation.* • Due for Grading before next class: • Team Presentations-upload before next class
Week 4 class 8	**Team Zoning Presentation – Day 1** • *Team Egress, Occupancy, Space Presentation*	• *Team presentations of Zoning Solutions and Egress, Occupancy and Space Layout Planning.* Due for individual final grading next class: • Complete Zoning Set Z-1, Z-2, Z-3 • Uploaded before next class
Week 5 class 9	**Team Zoning Presentation – Day 2** • *Team Egress, Occupancy, Space Presentation*	• *Team presentations of Zoning Solutions and Egress, Occupancy and Space Layout Planning.* Due for next class: • Install current version of Revit at home • Open & review program prior to class
Week 5 class 10	**Introduction to BIM/Revit – Day 1** • Scavenger Hunt with Annotation Assigned	• *Introduction to Revit and the Scavenger Hunt* • *Review of view creation including sections, elevations, perspectives and details.* • *Formatting views on titleblocks* • *Adding notes, labels, leaders and dimensions.* **Due for next class:** • *Preliminary Plots for Scavenger Hunt*
Week 6 class 11	**Introduction to BIM/Revit – Day 2** • Scavenger Hunt with Annotation PinUp	• *Pinup Review of Scavenger Hunt. Starting a new Revit file through a one day warmup project.* **Due before next class:** • **Final Scavenger Hunt Assignment**
	BIM/Revit Project Drawings Begins **22 x 34 Titleblocks**	**Work begun in each class must be completed prior to the next class or it will be marked late.** **There will be periodic progress set submissions of work formatted on sheets**
Week 6 class 12	**Grids & Levels** • *Structural grids and floor to floor heights*	• *Revit: Begin individual project drawing. Creation of structural grid, levels & building massing.* • *Annotation of Grid Dimensions* • *Layout of Architectural Plans and Elevations* Due before next class: • Grids & Levels with Dimensions • All Floor Plans formatted on Titleblocks
Week 7 class 13	**Foundations & Floors** • *Building foundation and flooring systems*	• *Revit: Creation of foundations, footings and structural walls & floor systems. Creation of basement columns using concrete.* Due before next class: • PDF Set – Building Plans, Elevations, Sections •

Progress Set 1	*PDF set due – Formatted on Titleblocks* *All Floor Plans, Exterior Elevations,* *2 Building Sections*	**Shows Grids, Levels, Foundation & Floors** **Plotted to a single PDF & uploaded to Blackboard**
#	***Lecture***	***Lab Activity***
Week 7 class 14	**Building Structure – Columns Beams and Trusses** • *Upper level structural elements* • *View Templates* • *Layout of structural drawings*	• *Revit: Concrete Columns and Beams and Slab from Basement to First Floor* • *Creation of upper building structure using steel columns, beams and trusses.* Due before next class: • Building Structure • Cumulative Progress Set
Progress Set 2	*PDF set due – Formatted on Titleblocks* *Existing Architectural Drawings plus* *All Structural Floor Plans & 2 Building Sections*	**Shows Structure Only** **Grids, Levels, Foundation & Floors** **Plotted to a single PDF & uploaded to Blackboard**
Week 8 class 15	**Walls & Doors – Fire Rating, Egress & Codes** • *Review of egress and code requirement for walls and doors, ADA requirements.* • *Room & Door Tag*	• *Revit: Floor plan layout skills development* • *Organizing Floor plans with Room Names and Numbers, Door Names and Numbers* Due before next class: • Basement and First Floor layout with Room Tags & Door Tags
Week 8 class 16	**Door Schedules** **Partition and Door Type Detail Development** • *Cover sheet with perspectives and drawings list for Architectural & Structural Drawings* • *Door Schedules* • *Identity & draw partition types*	• *Add cover sheet w/ perspectives & drawings list* • *Teams to develop comprehensive list of required wall types (unrated, 1hr, 2hr, 3hr) and specialty walls (shaft and chase walls).* • *Begin drafting of partition types and details.* • *Generate door schedules* **Due before next class:** • Door Schedules formatted on floor plans • First Partition with annotation on Titleblock • Research presentations: upload before next class
Progress Set 3	*PDF set due – Formatted on Titleblocks* *Update of all architectural & structural drawings with partition sheet* *Existing Architectural Drawings plus* *All Structural Floor Plans & 2 Building Sections*	**Cover Sheet** **Floor Plans** **Building Elevations & Sections** **Partition Types** **Structural Plans & Sections**
Week 9 class 17	**Individual Materials Case Study & Research Presentations (occur in project groups)** • *Case Study & Research presentations* • *Research presentations for materials and building envelop development. Must include sketches of proposed wall sections. Must study 2 conditions -one for curtain wall and the second for the chosen solid material. Can be same or different buildings*	• Due next class: • Graded – Individual Partition Types – 5 required • In class team case study / research presentations.

#	Lecture	Lab Activity
Week 9 class 18	**Vertical Systems: Cores, Stairs & Mechanical** • *Elevator and stair cores, shafts, bathrooms* • *Revit Stair & Elevator Tools* • *Layout of enlarged core sheets*	• *Development of elevator and stair cores, location and design of mechanical shafts and plumbing chase, bathroom layouts. Strategies for horizontal mechanical systems, perimeter heating and cooling.* Due by next class: • Updated Floor Plans • Core plans/stair sections - plotted 22x34
Week 10 class 19	**Roof Plans: Drainage & Details** • Pinup Review of Core Sheets	• *Revit: Creation of roof systems and details.* • *Use of roof tools by footprint, extrusion and face. Developing roof details.* • *Roof drains and drainage systems* Due by next class: • Roof plan formatted on sheet w/drains & slope
Week 10 class 20	**Drawing Coordination:** **Keys, Annotation & Dimensions** • *Exterior Dimension Strings* • *Interior String Dimensions*	• *Adding Annotation & dimensions to drawing set* • *Addition of Annotation, labels, notes, leaders, dimensions.* Due next class: • Roof plan on sheet w/ drains & slopes
Graded Progress Set 4	*PDF set & Plotted 11 x 17 set due - for grading* *All drawings to date* *New to this set are annotation & dimensions, core and stair plans, stair sections, wall tags* *Continue to include room tags, door tags, scheduled etc.*	**Cover Sheet** **Floor Plans** **Roof Plan** **Core plans & Stair Sections** **Building Elevations & Sections** **Partition Types** **Structural Plans & Sections**
Week 11 class 21	**Façade Development : Windows & Curtain Walls** • *Wall sections layout* • Punched window openings in solid materials • Curtain wall systems – grid organization	• Adding doors to curtain walls, modifying panels, changing materials and colors for spandrel glass. • Façade wall section development and detailing. Due next class: (plot 22 x 34 on 11 x 17) • Curtain wall sections & details on Titleblock
Week 11 class 22	**Façade Development: Masonry Walls** • *Sweeps and Reveals, wall sections* • *Creating masonry walls with sweeps and reveals. Creation of custom profiles. Creation of wall section and details and sheet layout.*	• Façade wall section development and detailing. Due next class: (plot 22 x 34 on 11 x 17) • Masonry wall sections & details on Titleblock
Week 12 class 23	**Façade Development: Precast Panel Systems** • *Construction and design of precast facades* • **plotted previously on 11 x 17* • *Methods of creating a precast panel system including the use of reveals, the use of curtain wall tools and other techniques.*	Due next class: (plotted full size 22 x 34) • *Curtain wall sections & details on Titleblock • *Masonry wall sections & details on Titleblock • Solid wall sections & details on Titleblock

Wk 12 class 24	**Preliminary Project Presentation:** **Wall Section Pinup & Red-marks** • Graded Assignment • Student red-marks	• *Pinup of first floor plan & 3 wall section sheets* Due next class: (plot full size 22 x 34) • Solid wall sections & details on Titleblock
Progress Set 5	*Cumulative set with addition of wall section sheets* *Scans of Red-marked Wall Section Sheets*	Upload to blackboard
Week	***Class Lecture***	***Lab Activity***
Week 13 class 25	**Reflected Ceiling Plans:** **Mechanical & Lighting Systems Integration** • Creating a color coded plan by wall type	• *Layout of reflected ceiling plans, integration of lighting and mechanical systems, grids and soffits. Ceiling details and building code.* Due next class: • Reflected ceiling plan of first floor – plot 11 x 17
Week 13 class 26	**Space Layout:** **Enlarged Plans & Interior Elevations** • *Creating a color coded plan by space type*	• *Development of enlarged plans and elevations. Adding furniture and developing room layout.* Due next class: • Color coded floor plan with key
Week 14 class 27	**Details Development: Façade Development** **Sections, Plans, Elevations & Isometric** • Begin to develop assembly model • In class work session	• *Individual Desk Crits* • *Focus on detail development* • *Matching Enlarged plans, elevations, sections and isometrics* • *Construction of assembly model* Due next class: • Color coded floor plan with key
Week 14 class 28	**Details Development: Façade Development** **Sections, Plans, Elevations & Isometric** • Continue to develop assembly model • In class work session	• *Individual desk crits.* • *Focus on detail development* • *Continue on drawing set development* Due next class: • Final Presentations
Week 15 class 29	**Individual Final Presentation:** **Day 1 - Grouped by Teams** • ***Presentations must be posted and plotted the day before – no plotting permitted on the day of presentation – no exceptions!!***	• *Full pinup and juried presentation of team & individual drawings. Includes group zoning & site review, building analysis from earlier in semester, followed by individual presentations of drawings sets and details color coded to clarify assembly.* • Graded Final PowerPoint Process Presentations of individual project drawings and details • Printed set – format 11x17 and 22x34 as required
Week 15 class 30	**Individual Final Presentation:** **Day 2 - Grouped by Teams**	*Same as previous day*
	Final Submissions uploaded to blackboard	**Date will be set at the end of the semester**