

The following information is specific to a ‘Classroom’ space type and is in addition to all previously stated standards listed in Divisions 01 – 33.

General Guidelines

1. For classrooms, seminar rooms, distance learning spaces, and videoconference spaces, CMET (Center for Media & Educational Technology), UO Information Services (which includes Network, Telecom, and Academic Services) must be engaged in the programming and design phases. These entities must review and approve design and installation. Collaborative work with these entities provides for proper integration with existing systems, adherence to standards, and frequently reduces fees. If outside consultation or installers are required to meet project timelines for design and/or installation, CMET, IS Academic Services and Network / Telecom shall help to determine scope of work, assist in the selection process, review submittals, and review and approve final work. These entities are to work directly with the design team, specialized consultants, engineers, contractors, and installers for the purposes of proper project coordination.
2. AV equipment and any network and telecom systems shall be Owner Furnished.
3. Review and approval of the following in design is required:
 - a. Data/Network signal paths including conduit diameters. Signal paths between rooms and floors such as hallway cable trays or conduits between floors such as through network closets.
 - b. Lighting requirements and configurations.
 - c. Control rooms and/or projection room requirements.
 - d. Project Drawings: floor plans; room elevations; reflected ceiling diagrams; AV floor or ceiling plans; AV one line riser diagrams; electrical; mechanical; etc.
 - e. Casework drawings and/or furniture specifications if the project does not use the UO standard podium and lectern.
4. Audio Visual – AV Guidelines:
 - a. AV technology design considerations for classroom, conference room, distance learning, seminar, etc. shall include the following: (The portions following expand upon these technologies and requirements associated with each.)
 - Presentation systems including Data/video projectors, flat screen high definition televisions, AV and Multimedia switching systems, video and audio distribution systems.
 - Signal transcoding and routing over other types of cable such as Cat5 or fiber optic.
 - Audio systems including amplification, speakers, microphones, etc.
 - Video production systems including control spaces and lighting, installed camera placement, and control.
 - User accessible controls, portable equipment connections and alter-abled AV access technologies.
 - b. Design guidelines for AV provisions within public atrium spaces that could be used for gatherings include the following:
 - Portable video production equipment needs power and signal connection to any installed audio and video systems: camera and microphone inputs; network connections; power requirements.
 - Depending on the size of the space, atrium spaces may require floor and/or wall boxes to supply multiple locations for recording systems and microphones. Wall boxes are preferred over floor boxes. If floor boxes are to be used, they should be recessed in to or flush with the floor.
 - Atrium spaces should be designed with signal/power paths to control rooms and/or associated distribution systems.

Space Planning

1. Guidelines for selection of classroom locations:

- a. Locate general classrooms, large-capacity classrooms, and lecture halls as close as possible to main entrances of buildings to limit travel through the buildings.
- b. Classrooms on upper floors of buildings shall be located as close to building stairways and elevators to limit travel through the buildings.
- c. Locate classrooms away from indoor noise-generating equipment and activities; such as restrooms, building systems, etc. If a classroom must adjoin a noise-generating area, provide adequate sound barriers to minimize class disruption.
- d. For distance education classrooms, particular attention is needed in regard to day lighting and noise controls. If the classroom is to be used exclusively for distance education, consider placing in a position without exterior windows.

2. Classroom Configuration Requirements:

- a. The preferred configuration of seminar, small, and large classrooms shall be determined by the needs of the faculty and instructors, the department program and curriculum, and the currently adopted pedagogy in mind. Future pedagogy, instructional technology, and forecasted student and instructor needs should be reviewed with related infrastructure for such should be planned. Rooms are typically rectangular with a length-to-width ratio of no greater than 1 to 1.5 with the headwall on the long side. Use of all walls for instructional purposes should be considered. Instructional pedagogy and User function is paramount for room configuration. Involvement of the UO Committee for Academic Infrastructure (CAI) is required for detailed needs.
- b. The preferred configuration of a lecture hall is fan-shaped with seating, screen, and instructional needs dictating the exact shape. Involvement of the CAI is required for detailed needs.
- c. Ceiling height and ceiling access consideration is important for the placement of projection and screens.
- d. Clear sightlines from all student seating is required.
- e. Projection path from projectors to screens is essential. Avoid lighting and ceiling fan placement which interrupts or compromises projection paths.
- f. Power provisions for laptops; floor boxes are preferred.
- g. Movable furniture, with power plugs, if feasible.

3. Corridors and Seating outside of classrooms:

- a. Corridors, common areas, and areas outside classrooms should be considered valuable teaching and learning spaces. Design should utilize every opportunity to create multiple types of learning spaces.
- b. Bench type seating should be provided outside of classrooms. Provide backs on benches or protective wall mounted panel to lean against. Provide easy access to multiple electrical outlets to support student technology devices.
- c. Waiting / meeting alcoves along circulation paths encourages informal meeting and discussion while waiting for class changes.

4. Seminar, conferencing, and distance learning design guidelines:

- a. Specify lighting, window treatments, and interior room finishes and surfaces suitable for video.
- b. Provide permanent camera mounts with power and signal.
- c. Accommodate display of near and far participants at front and back of room.
- d. Provide network connection for conferencing codec at teaching station and at rear of room with necessary conduit pathways to teaching station.
- e. Provide a control station, or room, with pathways for display, audio and control to all displays.
- f. Provide adequate power for laptops; floor boxes are preferred.
- g. Moveable furniture, with power plugs, if feasible.

Classroom Types & Characteristics

1. Small Classroom: 21 – 35 students; moveable tablet arm chairs or moveable chairs and lightweight tables.
2. Medium Classroom: 36 – 60 students; moveable tablet arm chairs or moveable chairs and lightweight tables.
3. Large Classroom: 61 – 100 students; fixed seating with tablet arm or fixed tables with moveable chairs.
4. Lecture Hall: 100+ students; fixed auditorium seating with tablet arms or fixed tables.
5. Seminar rooms are general-purpose classroom designed for up to 20 students, comfortable moveable seating, and fixed or moveable tables.
6. Distance education classrooms are general classrooms specifically equipped with support facilities that include a control room, specialized lighting systems, camera positions, and additional audio/visual equipment.
7. Utilization of all four walls as potential instructional area is ideal for all learning spaces.
8. Flexible and Interactive Computer Classrooms include specialized instructional technology, hands-on wireless computers, and moveable furniture.
9. In addition to providing proper power and data for instructor use, provide adequate power and data for student laptops and student mobile technology devices.

Classroom Surfaces & Finishes

1. ALL finishes MUST be durable, easily cleaned, and easily repaired and maintained.
2. Latex paint is to be used; NO flat latex.
3. Access for Disabilities:
 - a. Small rooms; capacity 49 or less and different from above: minimum of one table with vertical adjustment and 2 wheelchair capacity.
 - b. Accessible tables must provide vertical height adjustment capability by individual users unassisted.
 - c. Large rooms; capacity over 49.
 - Floor slopes should be avoided. If they are necessary, floor slopes shall be 5% or less.
 - Access to front, rear, and middle seating.
 - Vertical adjustable writing surfaces.
 - Room controls at 18 – 48inch reach ranges.
4. Floors:
 - a. Classrooms include flat, sloping, or stepped floor types.
 - b. Seminar and small classrooms shall have flat floors.
 - c. Wood floor riser construction is NOT allowed.
 - d. Flooring finishes:
 - Shall be commercial / institutional grade.
 - Medium to light colors with pattern to conceal dirt and/or stains.
 - NO wood floors.
 - Carpeting is very hard to maintain in classrooms. However, if approved and used, carpet tile vs. rolls is preferred to allow easier spot replacement. Resilient flocked flooring product is appropriate if acoustics are an issue (Example: Forbo Flotex carpet tile).
 - Provide adequate power for laptops; floor boxes are preferred.
5. Chair Rail:
 - a. Classrooms with moveable furniture shall receive a simple profile chair rail to protect walls.
 - b. Rail finish shall not require painting.
 - c. Rail shall be installed 25 – 33 inches above finish floor AND verified with specified furniture height.

Classroom Surfaces & Finishes continued

6. Doorways:

- a. Doors shall be solid construction for durability and sound control.
- b. Door sweeps are recommended for sound control.
- c. Classroom doors shall have narrow reight windows.
- d. The main entry to classrooms shall be located at the rear.

7. Windows:

- a. Classrooms that have a projector shall be provided with blackout shades.
- b. Windows are strongly encouraged for all instructional areas.
- c. Windows shall not be placed along instruction walls.
- d. Windows shall not swing into the space where a hazard will be created.
- e. Windows and window treatments must address sound, light, and thermal controls.
- f. Window Treatments:
 - All exterior windows shall receive solar roller shades. (Metal blinds may rattle in the window frame due to sound waves or air currents in window).
 - Only when appropriate for teaching needs shall blackout shades be provided.
 - Motorized shades are acceptable if:
 - i. Budget allows.
 - ii. Window size or location makes manual cord control shades difficult to operate.
 - iii. Hard-wired; no remote controlled shades.

8. Ceilings:

- a. Ceilings shall be a light color with a minimum reflectance value of 80.
- b. Minimum ceiling height shall be 10'-0" above finish floor for all classrooms.
- c. In classrooms with sloping or stepped floor systems, the ceiling height shall be a minimum of 8'-0" from finish floor at the highest floor elevation.
- d. Acoustic panel and grid systems shall be a minimum of 24" x 24".
- e. Ceilings must have access to projector and speaker locations for future wire pulls or maintenance.

9. Acoustics:

- a. Careful acoustic consideration must be given to the configuration of each wall surface, ceiling plan, and floor finish.
- b. Walls and ceilings shall be designed to evenly distribute sound throughout the space.
- c. Acoustic control shall be designed so that sounds and voices are heard easily and accurately from all seating locations while keeping unwanted background or outside noises from intruding into the space.
- d. In small classrooms, modest wall and ceiling acoustic treatment is required.
- e. In larger classrooms and lecture halls, a thorough acoustic evaluation by an acoustic consultant will be required. A Design Acoustician must work with CMET, Information Services, and CAI for an understanding of room acoustics in regard to amplified speaker systems and oral sound origination. Acoustic evaluation must include consideration of reinforced, distributed speaker system.
- f. Classrooms for distance education have more specific requirements to prevent background noise that must be explored and implemented.

Classroom Casework, Fixtures, Furnishing, & Accessories

1. Chalkboards & Marker-boards:

- a. All general purpose classrooms shall be equipped with either chalk- or marker-boards. Chalkboards are acceptable if required by the needs of the faculty and instructors, the department program and curriculum and the currently adopted pedagogy.

Classroom Casework, Fixtures, Furnishing, & Accessories continued

- b. UO approval is needed for any rolling style boards.
- c. Chalkboards shall be black with a 50-year warranty against polishing.
- d. Marker-boards shall be: either white or off-white; concealed spine connections; porcelain enamel or glass material; 25-year warranty.
- e. All boards shall include chalk / pen trays, 2" cork strips at the top, and map hooks / rails.
- f. Boards shall extend the full length of the instruction wall with placement so that an 8ft board section can be used when projection screen is in use.
- g. Marker-boards are preferred in distance education spaces for better contrast.
- h. Classroom size and board requirements:

Number of Students	Minimum Board Size
0 – 35	12 feet long x 4 feet high
36 – 60	20 feet long x 4 feet high
61 – 100	30 feet long x 4 feet high
Lecture Halls	3 sections; 12 feet long x 4ft high

2. Projection Screens:

- a. Each classroom shall be equipped with one, or more, projection screen.
- b. Da-Lite projection screens with a white matte finish are preferred with out blackout blocking at the top of the fabric.
- c. Screen size is to be determined by individual project / user needs, or based on room depth and seating capacity. Viewable areas less than 84" wide or 72" high must be reviewed by CMET and CAI.
- d. The bottom of the viewable area shall be no lower than 48" from finish floor and should be above 36" unless viewing height will be compromised.
- e. Projection width-to-height ratio shall be 16:9; however, screen height should not be compromised in pursuit of a framed image with that ratio.
- f. Screen height should follow the guideline of 1/5 the maximum viewing distance.
- g. All screens are to be mounted to allow sufficient clearance from the board trays.
- h. All screens are to be positioned so that a minimum of 8ft linear of board remains usable while screen(s) is in use.
- i. All screens wider than 6ft shall be motorized with a wall-mounted toggle control switch. Classrooms with control consoles (i.e. Crestron) shall provide screen control from the console. If screen control is incorporated in AV control system, also include wall mounted screen control switches.
- j. All screens shall be seamless.
- k. Screen gain shall be between .9 and 1.5. Preferred is 1.0, matte finish.
- l. For ceiling recessed screens, the screen and screen housing shall be able to be independently of one another and removable.

3. In seminar and conference rooms plasma, LCD displays, or smart boards may be installed. Sufficient reinforcement structure for weight of displays shall be incorporated in walls at designated locations. Consultation with CMET and CAI is needed for review and approval.

4. Seating:

- a. Seating style shall be determined by individual projects and/or user needs.
- b. ALL seating MUST be durable, easily cleaned, easily repaired, and easily maintained.
- c. Seating types include:
 - Moveable tablet-arm chairs.
 - Fixed seats with folding or fixed tablet arms.

Classroom Casework, Fixtures, Furnishing, & Accessories continued

- Moveable tables and chairs.
 - Fixed tables and moveable chairs.
 - Fixed auditorium seats with folding tablet arms.
 - i. Tables shall be sturdy, minimum of 24 inches deep, and minimum of 30 linear inches per student.
 - ii. Tablet arms shall be as large as possible; 280 square-inches preferred; 212 square-inches minimum.
 - iii. Tables must not tip easily.
5. **Instructor Consoles & Podiums**
- a. Use approved UO designed and developed standard podium & lectern whenever possible. Podium shop drawings are available for integration in to drawings sets and bid documents. Contact Capital Construction Project Planner or Capital Construction Project Manager.
 - b. Media credenza, whether custom fabricated or purchased, must be approved in collaboration with CMET, Information Services, UO Capital Construction, and CAI.
 - c. Instructor furniture shall serve as both the instructor's desk, instructor podium, and a locking cabinet for technology components.
 - d. If UO standard podium is not used, podium and/or lectern design, whether custom fabricated or purchased, must be developed and approved in collaboration with CMET, Information Services, UO Capital Construction, and CAI.
 - e. AV equipment shall be controlled at the podium.
6. **Signage:** Clear signage must direct students to classroom spaces. This may be a building directory at each entry, or if necessary, highlighted way finding signage place at strategic locations.
7. **Digital Signage:** Digital signage, if requested and approved for a project, should follow campus hardware and software standards. Contact Information Services for complete and comprehensive system requirements and standards.
8. **Other Fixtures:**
- a. A large clock shall be mounted in the classroom so that it's easily read by the instructor/presenter.
 - b. A minimum of one manual pencil sharpener is to be installed.

Classroom Mechanical Systems

1. Classroom renovations shall include a mechanical system that generates a background noise of no more than NC25 to NC30.
2. New classroom construction shall include a mechanical system that generates a background noise of no more than NC20 to NC25.
3. Low velocity transfer grills and low velocity air shall be included.
4. Supply outlets and return air intakes shall be located away from lecterns, podiums, projection screens, and fixed microphones.
5. **Supply Air:**
 - a. Supply air shall not be located at or directed onto projection screens. The preferred arrangement of supply air outlets is toward the front, with return air intakes at the rear of the classroom.
 - b. Supply grille colors should be considered in spaces with cameras.
 - c. Supply grille openings should be orientated not to face mounted cameras as the openings distort captured image.
6. Thermostats are to be housed in locking covers.

Classroom Mechanical Systems continued

7. Distance education classrooms require:
 - a. Constant temperature between 65 – 80°F and 65 – 75°F for distance learning control rooms, both with relative humidity between 30 – 75%.
 - b. Noise and vibration must be minimized.
 - c. No higher than NC-20 noise levels at each grill.
 - d. Return air grills shall be located near equipment to help draw heat from the room.
8. **Control Room / Projection Booth Mechanical Requirements:**
 - a. Different HVAC zone than classroom or surrounding corridors.
 - b. Return air near equipment location for extraction of heat from equipment.
9. For distance education and video conferencing control rooms and/or projection booths HVAC noise is more of an issue and supply air shall be located at perimeters with sound levels no more than NC 20 at each grill.

Classroom Lighting Systems

1. All classrooms shall be designed with lighting zones so that the lighting for instructor/presenter, whiteboard / projection screen, and audience can be adjusted in such a way that they do not interfere with each other.
2. Room lights shall not shine directly on projection surfaces.
3. Ambient room light shall be minimized for the projection screen.
4. Lighting for instructor / presenter and white board / chalkboard should be separate and adjustable so that the instructor / presenter are well lit for recording without busy-patterned or over-bright background.
5. For video, lighting for instructor / presenter/panel should be as even and 3-dimensional as possible and not directly above the presenter. Lighting instruments for front of room should be adjustable for brightness and throw pattern with barn doors, louvers or baffles.
6. Lighting must be installed to be independently controlled by the instructor, but must be capable of interface and control by a UO CMET installed AV control system.
7. Lighting of classrooms shall include the following zones as applicable:
 - a. Main classroom lighting; student seating area.
 - b. Instruction area lighting; front of class and lectern.
 - c. Non-projection board lighting; board that is not obscured by a lowered projection screen.
 - d. Projection board lighting; board that is obscured by a lowered projection screen.
 - e. Instructor lectern / workstation lighting.
 - f. Spot lighting with correct lighting angles for recording / taping of the instructor and the projection screen / white-board.
 - g. All classrooms must have lighting that while projection area is darkened, the general lighting is sufficient enough for student work surfaces and note taking.
8. Seminar rooms, small classrooms, and conference rooms must have lighting systems designed to accommodate projection, wall mounted flat panel displays, and/or video conferencing.
9. All fixtures must be coordinated to avoid conflict with projectors and screens so that they do not cause shadows on projection screens.
10. Bulb replacement must be considered; scaffolding for bulb replacement is not acceptable.
11. If multiple occupancy sensors are used in one classroom, they shall be installed in a parallel fashion, when an individual enters the classroom late the rear sensor sees them but do not turn on the lighting to a normal level; the selected scene for presentation must be maintained.

Classroom Lighting Systems continued

12. Classrooms must have a dimming range of 1% to 90% with variable switching options available.
13. **Required Lighting Controls:**
 - a. Light switches at entrance(s) to classroom shall turn on and off lighting to preset levels.
 - b. Wall mounted switch controls for lighting and projector(s) shall be adjacent to the teaching station / podium. (AV equipment shall be controlled at the podium).
 - c. Scene controls with clearly labeled pre-sets at teaching station podium.
 - d. If there is a control room and/or projection booth, full lighting and scene controls must be installed within these spaces as well.
 - e. Each room with dimming capabilities shall have a dedicated control panel. Multiple rooms shall not be on the same dimming panel.

 - f. Lighting scenes shall be preset and clearly labeled. Instructors, presenters, etc. shall not have access (locked-out) to scene control settings in order to avoid inadvertent reprogramming. UO Facilities and/or CMET shall have access to these control settings.

Classroom Power & Communication Systems

1. All communication (voice & data) design requires collaboration and consultation with UO Information Services.
2. Provide a minimum of 2 duplex power outlets on each wall; maximum spacing is to be 16ft.
3. Spaces without control rooms but with cameras require a 1" conduit pathway from the camera location to the podium / lectern.
4. Provide 2 duplex receptacles on a dedicated circuit on the exterior of the AV / lectern casework.
5. Provide 4 duplex receptacles inside the lectern casework in the rear of the cabinet; coordinate location with CMET.
6. Provide a minimum of one duplex outlet in the ceiling for projection per projector location.
7. Additional outlets may be required at fixed student seating for laptops, etc. as requested by the University and/or classroom users.
8. Interactive and flexible classrooms may require wall boxes or floor boxes, as requested by the University and/or classroom users.
9. Classrooms and control rooms shall be equipped with cable TV in buildings that have such service. These spaces in buildings without an existing cable TV service shall have cable pulled for future service.
10. A minimum of 6 cat5e cables must be installed into AV casework and/or lecterns. A minimum of 2 cat5e cables must be installed into a faceplate on the exterior of AV casework and/or lecterns.
11. Each projection booth and/or control room needs to be equipped with a minimum of 6 cat5e cables.
12. All classrooms shall have wireless network coverage and classrooms seating 75 or more students require multiple wireless transmitter point locations cabled with 2 cat5e cables each.
13. All spaces require at least 1.5" minimum conduit pathway provisions for 2 current and/or future camera locations; one in the front of the space and one in the rear of the space.
14. A minimum of one phone line per classroom is required.

Classroom Power & Communication Systems continued

15. Possible cable needs for cameras include one of each:

- a. Camera cable needs vary according to what type of camera will be installed. Conduit should be sufficient for control cable and signal path according to specifications of cameras being considered for the project.
- b. Cat5, RG59 video coax, 9 conductor VISCA / RS232 / RS422 control cable; minimum of 1.5" conduit.
- c. Depending on the type of camera, power through cable or nearby on the wall. Minimum 1.5" conduit pathway.

16. Flat Panel Displays:

- a. Adequate mounting reinforcement shall be part of the wall makeup wherever flat panels will be installed.
- b. Standard 15 amp power shall be supplied on a double gang plate, preferably inset and hidden from view.
- c. If the flat panel requires local user access an accessible connection plate will be provided, typically below the mounted screen.
- d. For flat panels that will receive signals or supply signals to/from other equipment or remote switching/control equipment in a nearby room, signal routes shall be of sufficient number and volume to accommodate these wires. 2" diameter conduit is strongly recommended; 1.5" may be adequate in some installations.

Projection Booths and Control Rooms

1. Booths and control rooms are typically required for large lecture halls and distance education classrooms. Pathways to shared control spaces and routing for communication cable paths outside the building shall be included in the design of booths and control rooms.
2. Booths/Rooms are to be 12ft wide by 7ft deep at a minimum per classroom space the booth/room serves.
3. Doors shall be oriented so that no direct exterior light is allowed into the space or classroom.
4. A single projection window shall be provided with good visibility and flexible projector locations.
5. Full lighting and scene controls must be installed within these spaces as well.
6. The floor, window, counter height, etc. shall be accessible for ADA users and equipment carts.
7. Film projection locations shall have space to the right of the projector for access to projector controls.
8. Cable pass-through required for temporary cabling from the booth to the space.
9. No plumbing equipment and/or piping shall be routed through these space types.
10. A minimum of one equipment rack location is to be provided within each space. Additional rack requirements are to be determined with CMET consultation during design.
 - a. Racks are from the ERK series; Height 7ft, width 22in, depth 22in.

11. Projection Windows:

- a. Dimensions shall be as high and wide as possible.
- b. Shall be set high enough so that projected images pass completely over the heads of students/audience.
- c. Shall contain glass of optical quality or water white seamless glass without visual imperfections.
- d. Provide glass with gasket seals for sound control.
- e. Shall be installed in a tilted orientation to prevent reverberations within the classroom.
- f. Any projection window shall be placed so that the projector(s) (slide or data/video) may be placed at a perpendicular angle to that projector's portion of the projection screen, both horizontally and vertically.

12. Projection-booth & control-room countertops:

- a. Minimum countertop depth should be 29inches.
- b. For each conferencing/camera control station, counter length should be 30".

Projection Booths and Control Rooms continued

- c. If a projection window is specified, counter length should be full length of the window wall, with no cabinet doors or kick plates under the counter to allow for operator knee room or portable cabinet placement.

13. Electrical:

- a. Each projection location shall be provided with a duplex outlet at countertop height.
- b. Each equipment rack shall be provided with a 4-plex, 20amp outlet on a dedicated circuit.

14. Lighting:

- a. Provide 1 lighting system of general fluorescents for high illumination during maintenance and setup.
- b. Provide a second lighting system of dimmable task lighting to illuminate workspaces during lectures and/or programs.

15. Telephone, Data, and Cable TV:

- a. Cable TV shall be installed in all control rooms and/or projection booths. These spaces in buildings without an existing cable TV service shall have cable pulled for future service.
- b. A minimum of 16 cat5e cables, multi-mode, and single-mode fiber optic cables shall be installed for voice and data.

16. Distance Education and Video Conferencing:

- a. Lighting: 100 FC for general lighting.
- b. Electrical: Duplex outlet at each camera location; 1inch conduit from camera location to control room.

Wireless laptop classrooms:

1. Closets and/or carts are required for computer storage, recharge, and disk maintenance.
2. Additional network for disk maintenance.
3. Multiple projectors and projection surfaces.
4. Moveable furniture.
5. Maximum wireless coverage (multiple access points) to address high and simultaneous demand.
6. Power provisions for laptops during use; floor boxes, moveable furniture with power & plugs, etc.
7. Additional power for battery recharge.
 - a. Generally, we should provide 110 Watts worth of power for every laptop. Provide one 20A circuit for every 15 laptops.
 - b. Calculation it is to take the current rating of the notebook brick and multiply by number of notebooks. For example a Mac book uses a 65watt brick, while the 15in latitudes tend to use 90 watt bricks. Then add in a factor for AC/DC conversion losses (20% is more than enough). If you are sure the notebooks will never be operating when charging, you can get by with less.

End of Section