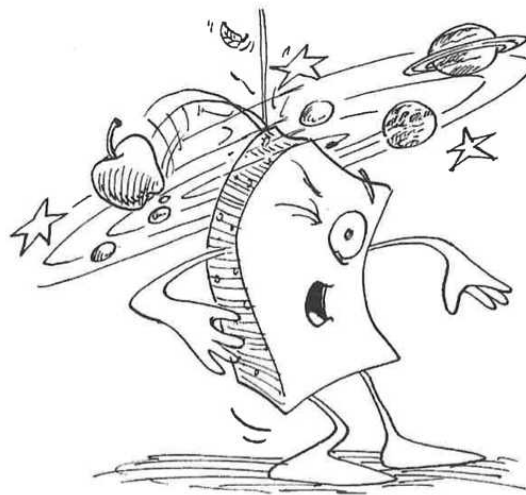


PHYSICS CLINIC HANDBOOK



2018–2019

HARVEY MUDD COLLEGE

I. SCHEDULE OVERVIEW

I. Schedule Overview

Tues., 9/4	11:00–12:15	Meeting in Galileo McAlister
Thurs., 9/6	11:00–13:00	Launch Day — Face-to-face team meetings with liaisons

Tuesdays	11:00–12:15	Weekly meetings in Galileo-McAlister through 12/4
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Mon., 10/1	by 10:00	Draft statement of work due to advisor (with cc to Clinic Director and DruAnn Thomas or Lorena González) — deadline extensions must be pre-approved by <i>both</i> the clinic director and the faculty advisor
Mon., 10/8	by 10:00	Faculty-advisor-approved, printed statement of work due to DruAnn Thomas or Lorena González
10/22–23		Fall break
11/21–25		Thanksgiving break
Wed., 12/12	by 10:00	Faculty-advisor-approved, printed Midyear Update due to DruAnn Thomas or Lorena González— all extensions must be pre-approved by both the faculty advisor and the clinic director
Fri., 12/14		Fall semester classes end
12/17–21		Final exam week

Tuesdays	11:00–12:15	Phase III Clinic presentations run in Galileo McAlister and possibly other locations TBD. <i>Attendance is mandatory.</i>
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3/18–22		Spring break
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Mon., 4/1	by 10:00	Draft of poster design due to advisor
Fri., 4/26		Draft final report due to advisor
Tues., 5/7		Projects Day
Fri., 5/10		Final report due

I. SCHEDULE OVERVIEW

INTRODUCTION

“I gained the idea that engineering was like dancing; you don’t learn it in a darkened lecture hall watching slides: you learn it by getting out on the dance floor and having your toes stepped on.”

Jack Alford, Cofounder of the Engineering Clinic,
Harvey Mudd College 1963

In 1963, Professors Jack Alford and Mack Gilkeson invented the Engineering Clinic, a series of required courses in which junior and senior students form interdisciplinary teams to tackle company-sponsored design and research projects.

The Physics Clinic is an outgrowth of the clinic model developed and refined by the Engineering department. Like the “clinical” experience at medical school where students learn the practice of their profession by working with real patients and real problems, in the Physics Clinic you will be exposed to the art and practice of physics by working on real problems for real clients.

This Clinic handbook is intended to assist you in participating effectively in the Physics Clinic program and to understand what is expected of you during the academic year. The handbook is divided into the following sections:

- Section I - Course Information
- Section II - Clinic Operation
- Section III - Project Planning and Communication
- Section IV - General Information
- *Appendix A* - Sample Forms
- *Appendix B* - Resources and Facilities
- *Appendix C* - Presentation Assessment
- *Appendix D* - People, Places, and Extensions to Know

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II. COURSE INFORMATION

II. Course Information

A. What is Clinic?

The Physics Clinic is a pair of three-unit courses for junior and senior physics majors (Physics 193–194) with an average of 10 hours of work per week. The Physics Clinic is an industry-oriented introduction to physics research. Students work in project teams of four or five juniors and seniors. The teams work on professional design, development, and research projects for clients from industry, government, and the community.

The clients pay a fixed fee (\$50,000 for the current academic year) for student teams to work on current problems which the company or agency needs solved. The client/sponsor appoints a liaison who will have contact with team members at least once a week to offer clarification and direction. The client/sponsor expects a level of effort of 1200–1500 hours per year per project team. The objective is to produce useful results on an open-ended authentic project to the client's satisfaction within the constraints of time and budget. The students do the work; the faculty advises, coaches, and evaluates; the client informs, guides, and accepts or rejects the results.

B. Educational Goals

To gain experience with the nature, demands, and ramifications of real-world problems:

- Decisions and trade-offs
- Effective reporting
- Project control via schedule and budget
- Vendor relations
- Client's changing expectations
- Resource limitations
- Confidentiality

To develop leadership/followership in team efforts:

- Divisions of work
- Delegation
- Authority/responsibility/accountability
- Resolution of personal conflict
- Use of diverse talents and skills
- Personnel evaluation and criticism
- Error correction

To increase student understanding of design processes:

- Proposal, negotiation, contract, execution, evaluation
- Feasibility study

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- Research
- Preliminary design
- Detail design
- Revision
- Release
- Field test
- Production
- Service
- Salvage

To increase students' ability to apply course material:

- Recognize applications and limitations
- Reality vs. model
- Prediction and variety of checks
- Balance of analysis, experimentation, computation, simulation, optimization

To gain real world insights:

- Develop career goals and a plan for achieving these goals
- Learn about patents and reinforce notebook recording
- Get acquainted with engineers, scientists, and companies
- Sense the complexity, difficulty, and time span involved in solving real problems

To assist HMC toward its goals:

- Lead toward new private/public financial support
- Encourage interdisciplinary exchange and cooperation
- Keep faculty abreast of new technology and science

C. Course Requirements

The main requirement of the Clinic program is to execute the project successfully. The students in a team are jointly responsible to the faculty, the client liaison, the Clinic office, and to each other for organizing, scheduling, budgeting, implementing, time-managing, and reporting. It is particularly important to be able to report progress (including both successes and failures) in a time-effective manner.

In addition to executing the project and reporting progress, the course requires:

- Weekly contact with the company liaison
- Weekly meeting with the faculty advisor
- Weekly meetings of the team
- Maintenance of a team headquarters, message center, and lab area
- Attendance and participation in the weekly Tuesday 11 a.m. oral presentations

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(includes evaluating presentations of other teams)

- Presentations to the client, including Projects Day (liaisons and company representatives should be encouraged to attend your Tuesday presentations)
- Planning at least one client-site visit each year and giving at least one on-site presentation to the client
- Coordination with the Clinic office on travel, purchases, and all other expenses
- Signing confidentiality and patent agreements
- Completing the end of project wrap-up (returning notebooks, room keys, dismantling and storing all materials used during the project)
- Arranging delivery to client of hardware/software as promised

D. Grading

The faculty advisor assigns the semester and year-end grades. The faculty advisor may choose to write and file a letter of special commendation for a student doing an outstanding job.

Criteria for Clinic Project Grades

Technical Contribution

- Quality and appropriateness of analyses, syntheses, tests, conclusions, covering library, field, laboratory, computer, or shop work

Project Management and Control

- Initiative and imagination in taking responsibility either as a leader, or in volunteering as a team member
- Giving and taking criticism is a part of the job
- Keeping team, client and advisor informed
- Quality of written and oral work
- Taking obligations seriously in meeting deadlines
- Attendance at team meetings
- Attendance at the 11 a.m. Tuesday presentations

Overall Effect

- Useful results from the individual's efforts

Note: Each faculty advisor ranks the relative importance of the above *according to his/her own values*. Normally, at the semester's end, team members are asked to rank themselves and the other team members on the above or similar criteria. A sample assessment form is shown in *Sample Form A*.

Graduation Requirements

The award of the bachelor's degree for a physics major at the college requires the completion of the program of coursework stated in the current *HMC Catalog*. Specifically,

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in relation to the Clinic courses, the catalog states as a graduation requirement:

“Seniors must submit a final Clinic report that is acceptable to the project’s faculty advisor.”

In addition to assigning a letter grade to a student for the Clinic course, the faculty advisor must also inform the Clinic director that the final Clinic report was acceptable. The director will then inform the registrar that the student has fulfilled the clinic requirements to graduate.

An acceptable final project report is of paramount importance both to you and to the faculty advisor. By accepting your final report, the faculty advisor assumes responsibility for delivering a final report of appropriate standard to the client without further contributions from the student team. The faculty advisor will not accept a report that is incomplete.

E. Team Assignments

In the spring semester of each year, the Physics Clinic Director interviews each student interested in participating in the clinic program during the following academic year. The Director notes the interests and career goals of each student and solicits clinic projects that will best serve the group of prospective physics clinic students. During the summer, the Director communicates with each student and makes team assignments based on student interests and backgrounds. The Director also takes into account any expressed interest on the part of an individual student to assume the role of team leader/project manager.

III. Clinic Operation

A. Milestones

There are three major milestones during the academic year for your project, each marked by delivery of a written report.

Milestone 1: Project Proposal (Statement of Work)

Within First Six Weeks of the Start of the Project—late Sept., early Oct.

To begin a clinic project, each team orients itself with the client liaison and the faculty advisor by preparing, submitting, and coming to an agreement on a “proposal-to-do-work,” which covers the team’s activities and expectations for the whole year. Writing and negotiating this document takes two to four weeks of consultation, background study, and revision at the beginning of the semester. The following are among the considerations:

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- What do you understand the problem to be?
- Is it the same as the client views it?
- What are the various approaches to a solution? Literature search?
- What do you expect to deliver at the end?
- Can you do it?
- How are you going to schedule your work?
 - Work breakdown structure
 - Gantt chart
 - Description of progress monitoring

Sample “Project Proposals” are available from your faculty advisor or the Physics Clinic Director.

Milestone 2: Mid-Year Report

End of First Semester — early December

The Mid-Year Report is the halfway point for the Clinic team’s project and should state the team’s progress to date, including any changes in the work scope, decisions, etc. It is especially important to report all progress (including both successes and failures). If any changes in the project’s direction need to be made, the sponsor and liaison should be informed through this report. When done carefully, appropriate parts of the material may be used in the final report as well. Sample “Mid-Year Reports” are available from your faculty advisor or the Physics Clinic Director.

Milestone 3: Final Report

End of Second Semester — early May

The final report is one of the most important aspects of the Clinic program. Through this report your project is communicated to others. Documentation can represent the success or failure of your project and should be considered a top priority. The following is a suggested sequence of steps and due dates for a well-planned final report:

5 weeks before last class	Draft outline, then final outline
4 weeks before last class	Separate sections drafted by team members individually
3 weeks before last class	Draft with figures complete
2 weeks before last class	Draft read by faculty advisor and returned with comments
1 week before last class	Revisions, added work, re-write
1 week after last class	Approved final draft, ready for archiving, to the faculty advisor

Planning your schedule around these three milestones is an important part of the clinic

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experience.

B. Reports

Note: To make Clinic reports more uniform and useful to the sponsor, **all reports are to be written starting from a standard template in L^AT_EX or Microsoft Word format.**

Submission of Reports

All proposals, mid-year reports, and final reports must be stored in the team's Charlie/clinic folder. Make sure all reports have all required data including all figures. Do not leave for an end-of-term vacation without making sure that all necessary work has been reviewed by your faculty advisor. Your faculty advisor must approve the report/drafts **before** they are sent to the project liaison.

To assist you in writing your reports, you are encouraged to peruse samples of proposals available from your faculty advisor or the Physics Clinic Director. CDs of past projects contain copies of previous reports.

Format

Check with your faculty advisor and/or the Physics Clinic Director for templates for the final report. Keep in mind that all reports should use a standard format to achieve a professional appearance. The **Proposal** should be laid out as follows:

- Title Page
 - Title of project
 - Sponsor and liaisons
 - Clinic team
 - Faculty advisor
 - Date
- Abstract
 - One-page overview of the proposal
- Table of Contents
 - List each section
 - List of Figures
 - List of Tables
 - Appendices
- Introduction
 - Introduce project
 - Brief history
- Project Statement
 - State exact expectations of Clinic team
- Technical Background and Approach

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- State theory, if appropriate
- State procedure(s)
- Proposal Solution(s) or Designs
 - List design alternatives with rationale
- Statement of Work
 - Your proposed work plan: steps and priorities
- Schedule/Timeline
 - Ideal dates for goals to be reached
- Budget
 - Clarify how much money will be spent and for what
- Capabilities
 - Short personal team-member summaries
 - Relevant college facilities, etc.

For the **Mid-Year** and **Final Report**, the Report Format examples are offered as guidelines in *Appendix A*. The client/sponsor generally wants to learn how the problem has been attacked, the recommended solutions or designs, and enough of the arguments to qualify the team's choices among alternatives. Generally, the client wants the most important material first, so that he/she can stop reading when satisfied, without missing any essential material.

Do not write a long history of the project. Get to the vital interests of the client early in the report.

The client liaison will want full details, primarily in the appendices, of the ground covered by the team and the peripheral topics and issues investigated. The appendices are written in detail for completeness, academic rigor, and reference to the literature. The latter may include avenues not followed and negative decisions made. Include sample calculations. Extensive data should be published in a separate volume.

Templates/Forms

Templates for proposals, midyears, and final reports are available in the **Charlie/Clinic/Templates** folder. Consult your faculty advisor for details.

C. Formatting Guides for the Final Report

There are three books suggested to assist you in formatting your reports. The first is *Style: Lessons in Clarity and Grace* by Joseph M. Williams and Joseph Bizup. The second is *Elements of Style* by E.B. White and William Strunk, Jr. Either of these first two books will answer most questions on correct usage of English in your report. The third book is *A Manual for Writing, 5th ed.* by Kate L. Turabian. This book will answer questions about how to correctly cite works in the footnotes and the references (bibliography). Both books are available in most book stores.

Order the sections of all the reports correctly

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1. Title Page
2. Abstract
3. Acknowledgments
4. Table of Contents
5. List of Figures
6. List of Tables
7. Body
8. References
9. Appendices

Number all the pages correctly

- **Abstract and Table of Contents:** Lower-case Roman Numerals - page number not to show on first page (i)
- **Body:** Arabic Numerals - page number not to show on first page (1)
- **Appendices:** A-1 corresponding to Appendix A, B-1 corresponding to Appendix B, etc. (see *Appendix A.*)

Figure captions are below the figure, and table headings are above the table in the body of the report

All professional technical and scientific reports follow this format. All figures and tables need captions, including titles, and these titles should be included in the appropriate section of the Lists of Figures and Tables.

D. Conferences with Advisors, Client, Team

- Team/advisor meetings scheduled weekly at regular times
- Client liaison meetings (or conference phone/video calls)
 - Scheduled weekly so that progress (or delay) is promptly known
 - Effective guidance for the attainment of project goals can be communicated to the team only by the client.
- Team meetings to be scheduled weekly or more frequently if needed
- Records of minutes
 - Current decisions
 - Accomplishments of each team member during the past week
 - Agenda for the next week
 - Any important new item or problem
 - Each team member should have a copy as a reminder of his/her obligations for the next period
 - Job of secretary should be rotated
- Always prepare an agenda for meetings so questions and problems are ready for discussion.

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E. Presentations

Fall Oral Presentations

During the fall semester, each team assigned to a Computer Science rotation will present twice, whereas teams assigned to an Engineering rotation will present three times. These latter presentations will be made in small groups of 3–4 teams with faculty advisors present. The fall presentations are informal. Use of overhead short PowerPoint presentations may be helpful, but are not required. The purpose of these discussions is to get to the technical meat of the project. The following guideline is useful for the fall presentation:

First presentation	Specification requirements
Second presentation	Overall system design
Third presentation	Complete analysis of one subsystem

Teams will typically have a full hour to present the following material in the order shown:

2–5 minutes	Describe company and project
5–10 minutes	Project outline/schedule including hours spent on tasks and hours remaining
Remainder	Technical content

Questions should be taken as they arise.

Spring Oral Presentations

Read *Appendix C* to guide the preparation of your presentations.

These are 15-minute professional-level presentations, appropriate to the audience and guests, and should include a balance of spoken words, slides, charts, and operating demonstrations. At least the following four slides are required for all formal presentations:

- Project statement
- Project deliverables
- Tasks remaining and amount of time required to finish each task
- Budget status expressed in terms of percentage of total allocated funds for each line item

All team members participate, noting that this is an opportunity for all students to gain confidence and ease in what later, for most of you, will be a frequent demand in your profession. Here are some guidelines:

- Prepare notes, but DO NOT read them verbatim

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- Prepare your presentation so that those at the back of the room can understand
- Be aware of the lighting
- Don't speak in the dark
- Don't over-light your slides
- Take into account the audience
 - What has already been said
 - Need for overview or a repeated statement of the project's objectives
- Rehearse (with a friendly critic)
- If you make a mistake while talking, correct yourself and keep going
- Don't worry if you can't answer all the questions from the audience
 - Make a mental or written note, however, to follow up
 - Rehearse the "question and answer" part of your presentation
- You will receive evaluations of your talk.

F. Clinic Events

Project Launch Day — Thursday, 6 September 2018

This is the first formal clinic meeting of the academic year. Clinic Orientation Day began in 1978 and has proved to be a very successful method of getting the projects off to a good start. Company liaisons are invited for a 10:00 a.m. briefing by the Clinic Director. At 11:00 a.m. the company liaisons meet with the team to explain the details of the project. This is followed at 12:00 p.m. by a box lunch for the student teams, liaisons, and the faculty advisors. Discussion continues through lunch until 1:00 p.m. Depending upon student class schedules, discussion may continue into the afternoon until the liaisons must leave.

Clinic Seminars — 11 a.m., Tuesdays

Shortly after the beginning of each semester, a schedule of the presentations will be posted. The 11 o'clock hour is free of other courses so that you can attend these weekly meetings. Your attendance and participation **is expected**. If you have a conflict you must contact your faculty advisor and/or the Clinic Director.

Projects Day — Tuesday, 7 May 2019

The last formally scheduled presentation of the academic year is **Projects Day**. On this day, each team formally presents to clients, invited industrial guests, faculty, staff, and students. These are carefully prepared presentations, lasting about 20 minutes each, and are repeated for a total of three times during the afternoon. They correspond to project reviews for the "board of directors," with both the oral and visual elements and a "question and answer" period at the end. The audience includes client representatives, as well

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as scientific, engineering and management personnel from present sponsors and potential sponsors. The audience size at each presentation ranges from 10 to 40.

The schedule of events begins in the morning with a continental breakfast and poster session in the Platt Campus Center. The poster session in Platt is the focus of activity in the morning. If necessary, team meetings are held with sponsors. Opening and welcoming remarks for the afternoon session begin at 1:00 PM, followed by the Clinic presentations during the remainder of the afternoon. At the close of the day, teams and liaisons meet for a final inspection and tour of posters in Platt. Dinner provides a festive culmination to the day's activities and includes teams, liaisons, and advisors.

Team Leader Meetings

Team leader meetings are a forum where the leaders can get together and discuss mutual pertinent problems. In the past, we have invited experts in management to come and talk on a particular aspect of project management. We attempt to have at least four meetings a year—early Fall, before semester break, early Spring, and just prior to Projects Day.

Oral Presentations to Clients

At least one oral presentation should be given at the client site, typically at the end of the year. If possible, an additional presentation at the end of the fall semester can serve as a formal design review and can be one of the most valuable forms of feedback from the client about your project. You should ask your liaison to arrange these meetings to which other client engineers and scientists are usually invited.

G. Wrap Up

The completion of a project includes:

- Detailed work related to the final report delivered to the faculty advisor.
- The completed hardware and software for delivery to the client. Work with B.J. Haddad to arrange deliveries.
- Clean-up of the laboratory space, and return of tools and instruments to the person loaning them.
- Return project notebooks to the clinic lab and keys to the Physics office.
- Return all library books, borrowed texts, etc.
- Storage (or scrapping) of left-over special test equipment, or delivery to client as appropriate.
- Leave instruction manuals for equipment, guarantees, parts list, etc., on file in the Clinic lab.
- Submit all receipts to the Physics office by the last day of classes.

IV. Project Planning and Communication

A. Safety

At the first Team Leaders meeting of the year, safety rules and guidelines will be discussed. The information discussed has been taken from a survey of professors, staff, and students.

Regulations for Laboratory Areas

- It is the responsibility of the Clinic Team Leader and Faculty Advisor to ensure that the experiments and testing performed under their direction meet the appropriate safety standards.
- At least two people must be in the work area at all times. Any exceptions must be approved by the Faculty Advisor and the Chair of the Campus Safety Committee.
- Performance of unauthorized experiments and unauthorized removal of equipment or chemicals from a laboratory are cause for dismissal from the course and possibly from the college.
- When using rotating machinery, do not wear loose clothing. Long hair must be tied back. Minimum wearing apparel includes a shirt, pants, and covered shoes. Safety or personal prescription glasses must be worn at all times. All rotating elements must be surrounded by a protective shield to prevent accidental contact by the user, or to contain parts should the rotating element fail.
- When using compressed gases or hose air above 20 psig., all hoses and connectors must meet the standards set out by the vendor and/or the appropriate codes. Testing of pressure vessels should **never** be done with compressible gas.
- When using 110-V or 220-V power, all connectors must be properly grounded. Further, all instruments must be properly fused. Any connection to higher voltage power sources must be supervised by the Faculty Advisor or the Campus Safety Committee Chair.
- Before using hazardous materials or gases, refer to the Material Safety Data Sheets—available from B.J. Haddad—for information regarding special handling, storage, and disposal methods. The area containing the hazardous materials must be clearly marked and must have a copy of the Material Safety Data Sheet within the area. Appropriate eye protection and clothing must be worn at all times.

B. Project Schedule

Various software programs are available to assist in allotting your time, setting schedules, and assigning resources. An example of a typical Gantt chart, useful in establishing timelines for project completion, is shown in Fig. 1. You can download a free template for Excel or Google Sheets from <https://www.vertex42.com/ExcelTemplates/excel-gantt-chart.html>.

IV. PROJECT PLANNING AND COMMUNICATION

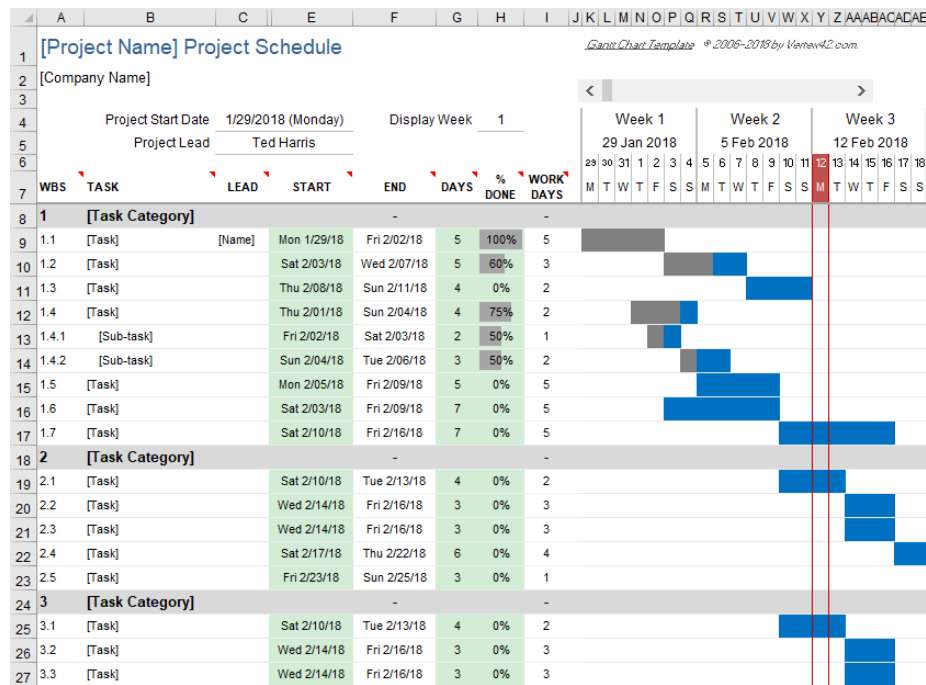


Figure 1: An example Gantt chart, which is one way to plot a project's progress.

The Final Report always takes longer than most people anticipate, because unfinished work perversely crops up, needing settlement before the final report can be finished. The team works “forward” during the first half, under information constraints—rather than time constraints. During the last half it must work “backward,” limited by the due dates of 4) the final report, 3) the draft report, 2) the working “prototype,” and 1) the final decision.

C. Keeping Records

Minutes of Meetings

Some record should be retained of all transactions (i.e., major decisions and basic assumptions) of team meetings or trips throughout the year. This is not merely to justify later decisions. Such a record keeps clear the various and frequently changing agreements among the client, advisor, leader, and team members.

- Minutes should include:
 - Date, location, time, and persons present
 - Items accomplished since the last meeting
 - Individual responsibilities for next week's work

IV. PROJECT PLANNING AND COMMUNICATION

- New facts and data; changed work plan; special problems, etc.
- Remember to
 - Write legibly—or type—as the meeting progresses
 - Use enough detail and clarity to be understandable
 - Keep the original minutes in your lab notebook if written by hand, but also type a copy of the minutes for distribution by email and archive that copy in a “Minutes” folder, in the Charlie/Clinic folder.

Trip Reports

Designate someone in advance to take notes, so that a copy of new information can be transferred into the Clinic records. Sharing this copy with company representatives provides a check on the accuracy of the information and corrects misunderstandings.

Project Records

The team is expected to maintain electronic copies of correspondence, vendors’ catalogs, reports, proposals, etc., that comprise the project’s written component. These electronic copies should be stored on the Charlie/Clinic account, so they are automatically backed up.

Project Notebook

The Clinic supplies one page-numbered notebook per student, at the beginning of the term, to retain a permanent file of important project developments. This book carries the developing thoughts, suggestions, sources, data, circuits, sketches, test results, and conclusions as the project proceeds. It may form the basis for any possible patent application. (Note: many patents have already resulted from such work.)

Write or letter in ink. Use all the odd-numbered pages in sequence (start with pg. 3 leaving pg. 1 for Table of Contents...) leave no blanks for later fill-in...cross out work later found erroneous...date and initial every entry...get a witness’s signature for important ideas...paste or staple in extra needed sheets of information curves or computer print-outs...use the book for vendors’ names, telephones...make the sketches complete, so they can be photocopied...label curves, oscillograms, etc.

On test runs, list equipment used and circuit diagrams so the experiment can be duplicated. Write so that someone else on the team can understand your notes.

When you do literature searches, take notes. Also, highlight important pages, data, or conclusions in journal articles to make it easier to find material when writing your progress or final reports later.

At the end of the term, or the closing of your assignment to the project, turn in your notebook to the faculty advisor for inspection and then file it in the Clinic workroom.

IV. PROJECT PLANNING AND COMMUNICATION

Correspondence, Original Reports, and Project Records

- The team is responsible for archiving and storing:
 - CD, DVD, or USB drive with proposal, mid-year report, final report, final presentation; essentially all of the contents of the Charlie/Clinic folder.
 - Originals of vendors' inquiries and answers
 - Originals of oral presentation evaluation sheets after delivery to Clinic office for review
 - Minutes of meetings
 - Technical notes/manuals
 - All of these materials must be filed carefully in the Clinic workroom at the end of the project.

Inventory Control

B.J. Haddad is responsible for equipment checkout and inventory control. See him in Jacobs B122, extension 73940.

D. Communication

Client Contact

The company liaison represents the customer's needs and usually is the technical authority and information resource. The liaison may not know the solution, but is probably aware of some alternatives that haven't worked in his/her experience, and he/she may also know of experts in the field that may help. More importantly, the liaison's decisions should guide the team in its work.

When the project is first negotiated, the Clinic office will have requested (and secured) agreement on weekly contact. It is of great importance to keep up this contact in order to avoid dead-ends and wasted efforts. If weekly contact in some form is not pursued, there should be good reason, and both the faculty advisor and the company liaison should be informed of the reason.

Team Responsibilities

- Keep the client informed about progress.
- Get necessary information from the client.
- Put important information/decisions in writing, distributing copies to all concerned.
- Keep the Clinic office informed, especially about any problems that may occur.

E. Team Leader Responsibilities

Although it is possible that the project leader could function within the group as a secretary or by carrying out the group consensus, it will be to your advantage if the leader functions as a supervisor. Such a structure has the merits of fixing the responsibility for making decisions. Consult books on Project Management.

Management

It is the team leader who will bear most of the management responsibilities, and it should be recognized by all team members that a significant amount of his/her time and energy will need to be devoted to such managerial tasks. The following nine-point plan has been suggested for successful supervision:

- Clarify roles and responsibilities
- Define objectives
- Provide information
- Provide education
- Monitor progress
- Solve the unsolvable problems
- Praise and blame
- Evaluate results
- Sell the results

Put it in Writing

So that essential understandings are preserved, the team leader must make sure that important objectives, schedules, decisions, and changes are in writing and circulated to all who need to know.

Running a Meeting

- Have a mental plan for the goals of a meeting
- Have an agenda and deal with:
 - What has been done since the last meeting
 - New data, new problems, new sources
 - New conclusions, hence new decisions
 - What each member's responsibilities are for the next week
- Suggest, monitor, avoid unproductive tangents
- Other subjects needing attention are:
 - Preparation for next client meeting or Clinic Oral Presentation.
 - Position as to schedule (ahead, on, or behind).
 - Extra help needed (shop, computer, expert consultant).

V. GENERAL INFORMATION

As with any group activity, everyone's time is wasted if a participant doesn't come prepared. If last week's work is not done, one should present a plan for catching up next week. Delays due to illness or other emergencies must be resolved quickly.

Personnel Problems

Conflicts, disagreements, and hurt feelings often arise during the close, highly interdependent team relations in a project. Conflicts must be faced and resolved, whether by compromise, discussion or through an external arbitrator. Even more serious is the problem of a teammate who does not do his/her share of the work. All of these situations are real and present, and beg for tactful and positive handling. The Faculty Advisor and Physics Clinic Director can help with these difficult situations and should be notified promptly.

V. General Information

A. Purchasing

As a member of a clinic team, you will probably find it necessary to purchase equipment, software, parts, etc. for your clinic project. Before deciding on any of the purchasing procedures below, check first with the stockroom to be certain the item you require is not already available.

If it is determined that the item must be purchased or leased, there are a number of vendor references at your disposal. The physics stockroom has a small set of references. In addition many vendors and products can be located by using the search engines on the internet. Consult with the stockroom or technical support manager (B.J. Haddad in Jacobs B122) for help in locating suppliers.

Procedures for making purchases are outlined below. Consult with B.J. Haddad on all purchases.

Purchases made with a Purchase Order (PO) or with the HMC Physics credit card

For expensive items (over \$1,000), B.J. Haddad will use a purchase order and place the order by email or by phone. You will need to specify to B.J. the vendor, the item you wish to purchase, and of which clinic team you are a member. You should also specify the speed of the delivery required: overnight, second day, 3–5 business days, etc. All of this information is best conveyed to B.J. in person, but an email will also work if you are careful to include all of the required information.

For items costing less than \$1,000, B.J. will probably use the Physics Department credit card and place the order by phone. This ordering method is usually faster than using a

V. GENERAL INFORMATION

purchase order. You must convey to B.J. the same information as above—vendor, item, your clinic team, and speed of delivery.

Purchases made with your own funds

For inexpensive items or for items that are urgently needed on the weekend, you may choose to purchase an item using your own funds—either cash or credit card. You must then present to B.J. Haddad an appropriate receipt and request reimbursement for your purchase. If your purchase is justified (it is wise to obtain prior approval from your faculty advisor), B.J. will complete a Request for Check form so that you will be reimbursed in 2–3 weeks. This method of purchasing an item is fast, but the obvious drawback is that you will be in the red on cash-flow for a couple of weeks. If your purchase is for less than \$50, you may be able to be reimbursed from petty cash, a procedure that only requires the approval of your faculty advisor. A receipt is needed for that as well—see B.J. Haddad or Alison Rauchfuss in Keck 1234.

If you place an order yourself, be sure to use the following shipping address:

Harvey Mudd College
Department of Physics
241 Platt Boulevard
Claremont, CA 91711
Attention: (Your name and clinic team name)

B. Travel

During the academic year, most project teams have the opportunity to visit their sponsoring company and to make trips on behalf of their project. Please inform Alison Rauchfuss as early as possible of your intentions to make a trip and she will make all the travel arrangements.

Clinic Vehicle

A clinic vehicle may be checked out for Clinic business if you are an authorized user. You will need to see Eva Gomez in Human Resources to apply for authorization as a user. The car should always be returned with at least a 1/2 tank of gasoline. Please make all arrangements through the Engineering Clinic Office.

College Insurance

If you use your own car, you are paid 55.5 cents per mile to cover expenses. If you have an accident, the only coverage is your own insurance. If you do not carry insurance, you may not use your own car at any time for college business.

A. SAMPLE FORMS

A. Sample Forms

A. Clinic Project Evaluation Form

NAME: _____ DATE: _____

CLINIC PROJECT: *Sandia Ferroelectric Nanoparticles Project — Joint Engineering-Physics*

This form is used to provide feedback to the clinic team members and to the faculty advisors on the effectiveness of the clinic experience, and to help the faculty advisors assign grades to the team members at the end of the fall semester. Please evaluate yourself and your teammates, and also evaluate the performance of the faculty advisors in facilitating the overall clinic experience. Please complete one form and return by email attachment to Profs. Dato and Saeta.

Complete the following numerical matrix regarding your own performance and the performance of your teammates. Be candid and fair. Obviously, the numbers you assign to yourself and your teammates are somewhat arbitrary, but the exercise should prepare you for the more narrative evaluations in Section II.

Grading Scale 1 2 3 4 5
Low → Average → High

Team Members	(1)	(2)	(3)	(4)	(5)	(6)
Cooperativeness						
Initiative						
Quality of Technical Work						
Communication						
Meeting Promises						
Useful Results						
Reliability						
Creativity						
Promptness						
Preparation						

List team members (1) (yourself) _____
(2) _____
(3) _____
(4) _____
(5) _____
(6) _____

A. SAMPLE FORMS

B. Final Report Format

This is a sample Final Report Format which may help to understand the correct format for numbering pages.

Preface:	Title Page	Abstract	Acknowledg. ii
	Table of Contents iii	List of Figures iv	List of Tables v
	1st page of body	2nd page of body 2	etc. 3
Appendices:	Appendix A A-1	Appendix B B-1	Appendix C C-1

A. *SAMPLE FORMS*

C. Table of Contents

This is a sample table of contents which may help to understand the correct format for the table of contents.

Table of Contents

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List of Figures.....	iv
List of Tables.....	v
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1.1. Overview.....	1
1.2. Specifications.....	2
1.3. Summary.....	3
2. Design Approach	4
2.1 Optical System.....	4
2.2 Mechanical System.....	8
2.3 Air Flow System	13
2.4 Signal Detection and Processing	15
3. Photometer Operation.....	20
3.1 Controls.....	20
3.2 Field Operation	23
3.3 Laboratory Operation.....	25
3.4 Noise Considerations	30
4. Construction Considerations	35
5. Testing and Calibration.....	36
6. Results and Conclusions	38
7. Recommendations for Future Work.....	42
Appendix A:References.....	A-1
Appendix B: Simplex Method	B-1

A. SAMPLE FORMS

D. Team Meeting Minutes

These sample team meeting minutes may help give you an idea of what sort of information is important to keep records of during team meetings.

Team Meeting Feb. 14, 1994

Present: Joanna, Imber, Erika, Prof. Cha

- Agenda:**
1. Report on week's activities (incl. the photometer purchase)
 2. Work Assignments
 3. Clinic Presentation, March 2
 4. Effect of Utility Rate Structure on Estimated Energy Savings
 5. Brief Biographies for the new proposal

Minutes:

	DONE	TO DO
Jo:	Received info from Mainstem Co. on vehicle system for Palo Alto. Found book on IES light standards at Sprague.	Jo: To contact mfrs. re filters for YAC. To recommend light meter to buy.
Team:	Measured light levels at YAC building. Problems in transmissivity ratios.	Eri: To meet Brotzman re street lights.
Jo:	Found light meters to range from GE \$50 ($\pm 15\%$) to Weston \$170 ($\pm 7\%$).	Jo: To get vehicle data from J. Kennedy.
Imb:	Has YAC floor plans.	Team: To get light measurements at Baseline today noon.
Eri:	Has info on lamp mfrs.	Imb: To get ANSI standards and market data on lights.
Imb:	Tried to get info on projections of energy prices from D.O.E.	Eri: To talk to factory re theory of heat-flux meter.
		Imb: To get more info by tomorrow on actual use time of city bldgs.
		P. Cha: To check LWV on their use of new Home Energy Audit forms.
		Team: Meeting Thurs. 4pm on oral presentation.

A. *SAMPLE FORMS*

E. Prepared Questions for Meeting with Client

These are some sample questions that were prepared for a meeting with a client to give you an idea of what your Clinic Team should prepare.

Automatic Sun/Wind Data Recorder

1. Does the client expect the same instrument to be used from the tropics to the arctic? What changes are permissible?
2. What are the expected production quantities of the recorder, and how is this related to their costs?
3. What computer type (manufacturer) and data format is the information to be collected for?
4. Does the client have any present test data on competitive components or vendors? (e.g., anemometer towers?)
5. How many persons and at what technical level will visit the recorder location for the periodic “memory dumps?”
6. What proportion of test sites will have AC power available? etc.

A. SAMPLE FORMS

Comments on Oral Presentation

A subset of teams will be asked to evaluate each of the spring presentations using a form like one of the following (the CS/Math form is more condensed than the Engineering version). The forms are very useful for presentation improvement, so please evaluate other Clinic Teams in a way that will be helpful to them.

Name: _____

Sponsor's Name (CS or Math) Evaluation Form, Date

1. **Do you have suggestions that could help improve the team's presentation?** For example, was the presentation clear? Were the slides or other presentation aids useful? Did the presenters speak clearly?

2. **Did you understand the goals of the project and the teams' contribution to those goals?** Does the team appear to be on track to meet the goals? Does the team's approach appear to be sensible and likely to succeed?

3. **Overall, what is your impression of the project and the quality of the work?** For example, is there any portion of the project or presentation you found particularly compelling? Was there anything that you feel could be improved?

Figure 2: Presentation feedback form used by CS and Math.

A. SAMPLE FORMS

**ENGINEERING CLINIC PRESENTATION EVALUATION FORM
SPRING 2018**

Team Presenting: _____ Date: _____

Note to Evaluators: This is a program evaluation form. Our program goals for presentations precede evaluation questions. Teams should be evaluated as if they were industry professionals. Evaluators should expect well-developed, corporate-level presentations, with a defined time for audience questions.

Rating Scale:	1	2	3	4	5	6	7	NA
	Strongly disagree					Strongly agree		Cannot determine

Goal: Students practice and improve presentation skills

- _____ 1. Overall, this presentation was prepared well and professionally presented.
- _____ 2. The project, from problem statement to solution options, was clear to the audience.
- _____ 3. The presentation reflects thoughtfully on the social implications of the work.

Goal: Students develop critical thinking skills in the presentation environment

- _____ 4. The presentation stimulated a number of questions by student observers.
- _____ 5. The team answered questions well.
- _____ 6. The questions from audience members were analytical and reflected critical thinking.

Goal: Students are able to use technologies currently used in industry

- _____ 7. Students are using appropriate techniques, skills, and tools.

Goal: Students demonstrate progress on projects

- _____ 8. Based on observation, the team appears to be on schedule.

Goal: Students are able to function on multidisciplinary teams

- _____ 9. The project required a multidisciplinary approach by team members.
- _____ 10. Each member of the team seemed to make a contribution to the team's work.

See back side.

Please return to the table outside the presentation room

Figure 3: Presentation feedback form used by Engineering. The back of the page is used for comments.

B. Resources and Libraries

A. Libraries of the Claremont Colleges

Library Search

The Libraries' online catalog is available wherever you can connect to the website of the Libraries of The Claremont Colleges <http://libraries.claremont.edu/>.

Research Resources

Databases

The website <http://libraries.claremont.edu/resources/databases/> has an impressive array of databases spanning all disciplines. For example, under "Science" there are over 40 databases listed that range from the life sciences to the physical sciences through mathematics and computer science. If you do not have a favorite, a recommended starting point is the "Web of Science" which includes the Science Citation Index. A user-friendly GUI facilitates searches by subject, author, journal, or cited work.

Electronic Journals

The website <http://ry6af4uu9w.search.serialssolutions.com/> (click on "electronic journals" on the main Libraries page) lists many professional associations and institutions that publish journals. Just type in the name of the journal you are looking for, and you will be connected eventually to the home page of the journal, with all the rights and privileges associated with the subscription of the Libraries of The Claremont Colleges. You may download a PDF version of the article of interest.

Interlibrary Loan and Document Delivery

The website <http://libraries.claremont.edu/resources/interlibraryloan/> provides an interlibrary loan service and journal photocopy service that is remarkably prompt. If the journal or book in which you are interested is not available locally, try the interlibrary loan service.

Miscellaneous Resources

Physics Stockroom (Jacobs B122)

The stockroom is open the following hours: Monday through Friday from 8:00 a.m. - 12:00 p.m. and 1:00 - 5:00 p.m. B.J. Haddad, the Physics Lab Manager (Jacobs B122, ext. 73940) will assist you with many of your technical problems. He will see that many small items such as electronic components, wire wraps, small tools, etc. are kept in supply. Contact him when you are considering space requirements, local suppliers,

B. RESOURCES AND LIBRARIES

equipment needs, and special experimental requirements. You should also discuss safety procedures with B.J. before starting any hazardous experiments.

Photocopy Machines

The copy machine in Keck 1227 may be used. See Alison Rauchfuss in Keck 1234 for the code.

Teleconferences

A clinic conference phone is available in each of the two physics clinic rooms, Jacobs B117 (Ph: 909 607 1187) and Keck B126 (Ph: 909 607 4171).

Fax Machine

A fax machine is available in the Physics Department in Jacobs B122. Please see B.J. Haddad or Alison Rauchfuss for details. The fax number is (909) 621-8887.

Electronics Development Room

Jacobs B110 is available for fabrication of electronic equipment.

B. Audience Assessment of Clinic Presentations

Dress Are presenters wearing clothing of professional appearance?

Introduction Do we learn who the speaker and other team members are? Do we understand who the client is and what its business is?

Problem Statement Do we understand the problem presented to the team and how it fits into the client's business? Do we learn why the problem is important?

Objectives Are the objectives of the clinic clear? Is what constitutes a solution clear?

Constraints Are the constraints on the clinic objective clear? Are there cost, quality, performance, accuracy, reliability, usability, or other constraints?

Approach Do we understand the approach to be used in reaching the project objectives? Is the reason for the approach clear? Is the sequence of activities clear?

Alternatives Has the team studied alternative approaches to reach a solution of the problem? Have all plausible alternatives been considered? How were the alternative approaches evaluated?

Evaluation Have the criteria for ranking and evaluating solutions been explained? Is there a metric? Do the ranking criteria meet the objectives and constraints?

Budget Is the budget for the project clear? Is it complete? Is it realistic? Achievable?

Schedule Is there a detailed schedule of work, with milestones and personnel identified? Is the time line or Gantt chart useful for detailed planning and assessment of progress? Can it be modified to deal with delays?

Deliverables What exactly will be the deliverables for the project to the client?

Acknowledgments Have the liaison, advisor, consultants, and staff been recognized for their efforts?

Questions Has the team as a group responded adequately to the questions asked? Did they seem receptive to advice? Were the questions repeated for clarity?

Visuals Were the slides clear, not cluttered, attractive and adequately informative?

Speaking Did the students speak clearly and confidently in standard English? Were the talks well organized? well paced? Was the logic clear? Were all important points covered in adequate detail?

If your audience is satisfied on all these points, you've made an excellent presentation!

C. People, Places, & Extensions to Know

Physics Department

Department Chair: Theresa Lynn	Keck 1232	74493
Clinic Director: Peter Saeta	Keck 1231	73939
Faculty Advisor: Peter Saeta	Keck 1231	73939
Physics Stockroom: B.J. Haddad	Jacobs B122	73940
Administrative Assistant: Alison Rauchfuss	Keck 1234	18024

Others

Chemistry Stockroom: Dan Guerra	Jacobs 2310	72957
Engr. Computational Facility: Willie Drake	Parsons B178A	74128
Engr. Stockroom: Sam Abdelmuati	Parsons B174	73530
EDP Coordinator: Sue Lindley	Parsons 2373	18594
Engr. Academic Program Coordinator: Sydney Torrey	Parsons 2373	18124
Machine Shop: Paul Stovall	Galileo B5	73050

Audio Visual: <https://www.hmc.edu/cis/services/audiovisual-event-support/>
Sprague 5th floor 77777

Facilities & Maintenance: <https://www.hmc.edu/facilities-maintenance/>
Platt Basement 18226