The Cooper Union
Vertically Integrated Projects (VIP)
Course Syllabus *VIP Topic (1 Credits Each Semester for 3-6 Semesters)*

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Background

In the following proposal, we outline a credit structure for multidisciplinary courses that is new to Cooper, but well established in other universities. The VIP model, initially developed at Purdue and currently housed at Georgia Tech, was awarded the 2019 ABET Innovation Award. Over the past 2 decades, over 36 institutions (i.e. NYU, ASU, Drexel, Rice, Stony Brook, Texas A&M, etc.) have adopted the VIP model while adapting and improving the structure to the nature of the respective institution. The essential elements of the VIP model include:

1. A structure designed to address the challenges in accrediting long-term and large-scale projects (those continuing for many years). Currently professors ad hoc link a series of 3-credit independent study courses, but the VIP structure divides the credit into smaller chunks and provides a structure to be cohesive.
2. Learning outcomes focus on the development of both disciplinary and professional skills.

Many studies have demonstrated the effectiveness of the VIP model in incorporating high impact practices. The VIP model is a transformative approach to enhancing higher education by engaging undergraduate students in long-term, large-scale, multidisciplinary project teams that are led by faculty. Students earn academic credits, while effectively contributing to the teams' design and discovery efforts.

VIP@Cooper Course Description

Multidisciplinary course supporting student and/or faculty-initiated projects guided by faculty mentorship and professional research. Undergraduate students that join VIP teams earn one credit each semester for their participation in design/discovery efforts that enable them to explore their interests through long term projects. Students are encouraged to take the course for at least three consecutive semesters

Students:

- In the first semester, they will familiarize themselves with the project, gain knowledge/skills, and begin making meaningful contributions
- In the second semester, they will begin to master the foundations within the discipline, pursue needed knowledge/skills, make meaningful contributions, and assume technical/leadership responsibilities.

- In the third semester, they will have mastered the foundations within the discipline, pursue further knowledge/skills, make meaningful contributions, and assume significant technical/leadership responsibilities.
- In the fourth semester, they will pursue needed knowledge/skills, make meaningful contributions, provide leadership in technical area and team management.

The teams are:

- *Multidisciplinary* - drawing students from all disciplines on campus;
- *Vertically-integrated* - maintaining a mix of freshmen through senior students each semester;
- *Long-term* - each undergraduate student may participate in a project for up to three years.

The continuity, disciplinary depth, and professional breadth of these teams intend to:

- Provide the time and context necessary for students to learn and practice many different professional skills, make substantial technical contributions to the project, and experience many different roles on a large, multidisciplinary design/discovery team.
- Support long-term interaction between the students and faculty on the team. The more senior students mentor the undergraduates as they work on the design/discovery projects embedded in the course.
- Enable the completion of large-scale design/discovery projects that are of significant benefit to faculty members' research.

Course Pre-requisites

Students must be pursuing their undergraduate degree in order to enroll in VIP for credit. Enrollment is based on a rolling application process with a decision made before the beginning of each semester.

VIP@Cooper Possible Course Structure

- All VIP teams are listed as different sections of
    - **VIP 381X:** students taking it for the first time
    - **VIP 382X:** students taking it for the second time
    - **VIP 383X:** students taking it for the third time
    - **VIP 384X:** students taking it for the fourth time
    - **VIP 385X:** students taking it for the fifth time
    - **VIP 386X:** students taking it for the sixth time
- Each team is designated by a section letter and course code.
- VIP courses are open to all Cooper Students from any school.
- Each course counts as 1 credit.

Credit Policies

- Students are expected to enroll in the course for three consecutive semesters.
- As an incentive to take at least three credits with the same team, the credit can apply towards the students' degree based on the respective department degree policy (to be determined with each department/school).

New VIP Sections

Prospective instructors can request a new team at any time. Projects should have an initial scope of 3-5 years, with a project description general enough to last many semesters. Requests must be submitted to the VIP coordinator for approval and should include the following information:

- Goals
- Issues Involved or Addressed
- Methods and Technologies
- Academic Majors of Interest
- Preferred Interests and Preparation
- Team Advisors

VIP Sections Examples

Section 1: Smart Cities Course Description

***Advisors**: Neveen Shlayan, Mili Shah, Dirk Luchtenburg, Ben Davis*

The Autonomy of "Smart" Cities is a cross-disciplinary course that is dedicated to finding technology-based solutions to some of the most pressing issues that are currently facing our cities. This course will focus on closed-loop systems in order to explore a more sustainable transportation, energy, and urban agricultural structures that promote the autonomy of our communities and enhance the livability of our cities. Students will be expected to develop complete solutions (design and implementation) integrating ideas and concepts from different disciplines such as: design, ML, Robotics, IoT, hardware design, vision, lighting, and control theory.

Example Projects:

- Self-Drive: an autonomous vehicle project.
- Net-Zero-Surrey: designing a sustainable transportation solution for more livable future cities.
- Urban Agriculture: enabling the urban community to produce their own food.
- Robotics Arms: modeling human motion with robotics arms.
- Drones: sling load and cooperative drones

Section 2: Solar Decathlon Course Description

***Advisors**: Cosmas Tzavelis, Lorena Del Rio, David Wooton, Neveen Shlayan*

The Solar Decathlon course forms a cross-disciplinary team that engages in a design phase and a build phase of highly efficient and innovative buildings powered by renewable energy. Students are expected to prepare creative solutions for real-world issues in the building industry. The focus of this course will be High-performance building design includes comprehensive building science, energy efficiency, optimized structural and mechanical systems, indoor air quality, resilience, and water conservation while maintaining the highest spatial design standards. Engineering students will be working closely with

Architects to design an efficient and innovative system to support the functional and aesthetic characteristics of their projects while experimenting with the use of standard as well as unconventional materials. Students will be taught the basics of statics, strength of materials, structural analysis and design. Teams will be expected to participate in the Solar Decathlon Design and Build Challenge: https://www.solardecathlon.gov/about.html.

Course Objectives

- Introduce students to state of the state-of-the-art industry standard technology to better prepare them to enter the workforce.
- Allow students to engage with their specialized knowledge and skills in the contexts of a team-based research project.
- Provide students with the opportunity to conduct research at an early stage to better prepare them for possible academic careers.
- Enable students to work in multidisciplinary teams in the pursuit of designing effective solutions to modern complex issues.

Course Schedule

Week	Assignments Due
1	• Orientation and Review of Last Semester • Setup VIP Notebook (New Students)
2	• Setup new and/or Review Sub-Team Communication and task management, Software: Slack, Monday, GitHub
3	• Review of Sub-Team Papers from Previous Semesters
4	• Document all work in VIP notebook • Brainstorming focus areas and conducting relevant literature/background review • Create a project timeline
5	• Milestone 1 Presentations
6	• Document all work in VIP notebook
7	• Mid-Semester VIP Notebook Check • Mid-Semester Peer-Evaluations
8	• Document all work in VIP notebook
9	• Milestone 2 Presentations
10	• Document all work in VIP notebook
11	• Rough draft of presentation and report due
12	• Document all work in VIP notebook
13	• Final Presentation and demos
14	• Final Report Due • Final VIP Notebook Check • Final Peer-Evaluations

Course Structure

Each team will determine working times, designated as "sub-team meetings." Students are responsible for participating in their team and sub-team meetings. If you miss any meeting, you are responsible for knowing what occurred in that meeting (typically by discussing it with other team members). An excused absence does not relieve you of that responsibility.

Course Policies

Expectations for this course include weekly meetings with your team, sub-teams, or the team members designated for specific tasks related to the project. Weekly meetings should take place for 1-2 hours with the instructor of the course and it is expected that approximately 3 additional hours will be spent on the project each week.

Grades

Item	**Breakdown**
Documentation and records (VIP Notebook)	20%
Personal accomplishments and contributions to your team's goals	30%
Teamwork and interaction	25%
End of Semester Presentation or Report	25%
Total	**100%**

Academic Honesty

The main principle in VIP academic honesty is that you will not present someone else's work as your own. Tests and specific assignments (homework, lab assignments, etc.) must be your own work. For other work you are encouraged to consult whatever sources are helpful in learning and understanding the issues associated with the material, but you should always provide appropriate references and citations where such material is included in your VIP notebook, programming code, presentations, etc.

Additionally, to provide a good working environment for all students, you're expected to adhere to rules given here, posted, or disseminated in class. Academic Honesty is taken seriously and failure to follow these principles will result in disciplinary actions as stated in the Student/Faculty Handbook.