



## Introduction to Virtues in Engineering

What does it take to be a good engineer? Good engineers need computational, design, and problem-solving skills. Nevertheless, it is possible to master these skills and still not be *truly good*. In 2015, Volkswagen engineers installed software that cheated emissions testing, altering vehicle performance during evaluation. These engineers excelled at all of the skills we mentioned, but there were other, more important abilities that they obviously lacked.

Notre Dame's mission is for its students to become a "force for good" in the world. What would it take to be a good engineer in this sense? They would not only learn many skills, but they would also develop a number of *virtues* as well. Much like computational, design, and problem-solving skills, virtues make it possible for us to be good, both as engineers and as people. In your time here at Notre Dame, our goal is to help you build both the skills *and* the virtues necessary to be a good engineer.

Engineering requires intellectual, civic, moral, and performance virtues in order to be successful and to meet the University's mission as "a force for good in the world". Engineering education that prepares students to be a force for good, requires that we build both technical skills and character as it pertains to our professional identities. Some of this information may be information you've learned in theology classes, philosophy classes, or other points of your education. However, character and virtue development are not exclusive to religious thinking. The notion of needed virtues and how to behave virtuously may even change depending on the circumstances in which you find yourselves. Therefore, this practice will be about deliberative and reflective building of virtues as it pertains to your future career.

The following list of character building blocks builds off of the [Jubilee Center's Framework](#) and the work of [Dom Chaloner](#), (ND COS), and the Virtue in Engineering Working Group (ND COE). You will find many examples of virtue education, Catholic virtues, and engineering ethics that will all define these needs differently.



**Civic virtues** allow engineers to define and understand their ties and responsibilities to society. The unique influence of engineers on society makes civic virtues integral to engineering character development. These are necessary for engaged, responsible citizens contributing to the common good of society. Three important civic virtues are:

- **Deliberation** is reasonableness and good judgment.
- **Community awareness** is inclusion of community partners in dialogue
- **Respect for others** is the capacity to engage others and not overstate one's own status in the community.
- **Justice** the commitment to give others their due, including what they deserve socially and economically. Characterized by avoiding cheating, stealing, or otherwise disadvantaging others and making efforts to restore others to a place of justice.
- **Solidarity** is the willingness to partner with those who are striving for justice and equal treatment



**Performance virtues** help us respond well to various situations. These are often tested at job interviews with questions like "How do you handle conflicts?". These are often defined as virtues that enable people to manage their lives effectively. Without performance virtues, you are unlikely to be able to live the intellectual, civic, and moral virtues in everyday life. Several performance virtues will help you flourish as an engineer, including:

- **Confidence** is the belief of yourself arising from appreciating your own abilities and qualities.
- **Determination** is having purpose and resoluteness towards a goal.
- **Leadership** is a set of behaviors that can be used to align people, groups, or organizations in a collective direction.
- **Teamwork** is the combined action of a group towards a goal, especially when effective.
- **Perseverance** is the ability to withstand or recover quickly from challenges in order to eventually achieve success



## Intellectual VIRTUES

**Intellectual virtues** are necessary for educational and mental growth. These build habits for learning now, in your engineering classes, and lifelong learning as well:

- **Open-mindedness** is being receptive to new ideas, especially those that go against conventional wisdom. Characterized by considering other viewpoints and perspectives.
- **Tenacity** is the willingness to embrace intellectual challenges. Characterized by being able to focus on long-term objectives and not giving up when confronted with challenges.
- **Creativity** is thinking of new ways to solve problems and create new opportunities or products.
- **Curiosity** is being interested in new ideas, experiences, and people.



## Moral VIRTUES

**Moral Virtues** enable us to act well in situations that require an ethical response.

- **Humility** is the willingness to admit one's own limitations and mistakes. Characterized by being unconcerned about one's intellectual status and willing to admit what is not known as much as what is known.
- **Wonder** is the disposition to be inquisitive and to ask why, and as a consequence the desire to explore in search of understanding. Characterized by asking deep and meaningful questions.
- **Autonomy** is the capacity for self-directed thinking. Characterized by being able to think and reason independently.
- **Attentiveness** is the ability to remain focused on the task at hand while noticing important details. Characterized by being able to avoid becoming distracted when a task is especially difficult or easily completed and by looking for ways to better understand information rather than simply rote memorization.
- **Thoroughness** is a willingness to probe for deeper meaning and understanding. Characterized by not being satisfied with easy and superficial answers.
- **Critical Thinking** is being analytical and approaching challenges from multiple perspectives.
- **Integrity** is a commitment to align your conduct with the way you view the world. Characterized by backing up your words and beliefs with how you act.
- **Respect** is the disposition to give others the attention and consideration that they deserve, and is characterized by treating others with dignity and diligence
- **Courage** is a readiness to continue thinking despite the possibility of embarrassment or failure.

- **Charity** is an unlimited loving-kindness towards others that results in care, empathy, and compassion for those around us.
- **Hope** is an orientation that works for a better future. Characterized by perseverance and fighting through challenging times with the expectation of something worth working for.

Characterized by being willing to take intellectual risks.

- **Honesty** is an awareness of the need to be fair and straightforward in one's conduct. Characterized by always adhering to the facts and being transparent about what has been done.