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Revolutionizing Mechanical Engineering Undergraduate Curriculum

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Abstract

In this age of technological advancement, there comes an expectation of employee experience; a need not being met by the higher education provided to mechanical engineers new to the workforce. This research describes the establishment of goals and processes used to modernize a mechanical engineering curriculum. Integrating a change of this magnitude necessitated consideration of a multitude of factors. The primary motivation being to supply students with more flexibility within course requirements, as well as offer more availability in degree emphases. Incorporating experiential learning was also given acute attention. With these initiatives in mind, the department began formulating a reformed mechanical engineering curriculum based on review of peer institutions and educational literature (documents such as the ASME Engineer of 2030). Faculty, as well as student and industrial advisory boards, aided in validating this adjusted degree program. During this development phase, several constraints had to be addressed: the curriculum must continue to be ABET accredited, align with university degree policies, appease stakeholders, and serve as an overall practical solution. The process of developing goals and constraints for a revolutionized mechanical engineering curriculum that will serve the students of the future will be described in this presentation.

REVOLUTIONIZING MECHANICAL ENGINEERING UNDERGRADUATE CURRICULUM



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CONTRIBUTING FACTORS

INTRODUCTION

Described in this poster are the motivations, targets, and constraints that were developed by faculty at Boise State University to revolutionize the pre-existing Mechanical Engineering curriculum. The implementation of these results will serve future students for years to come.

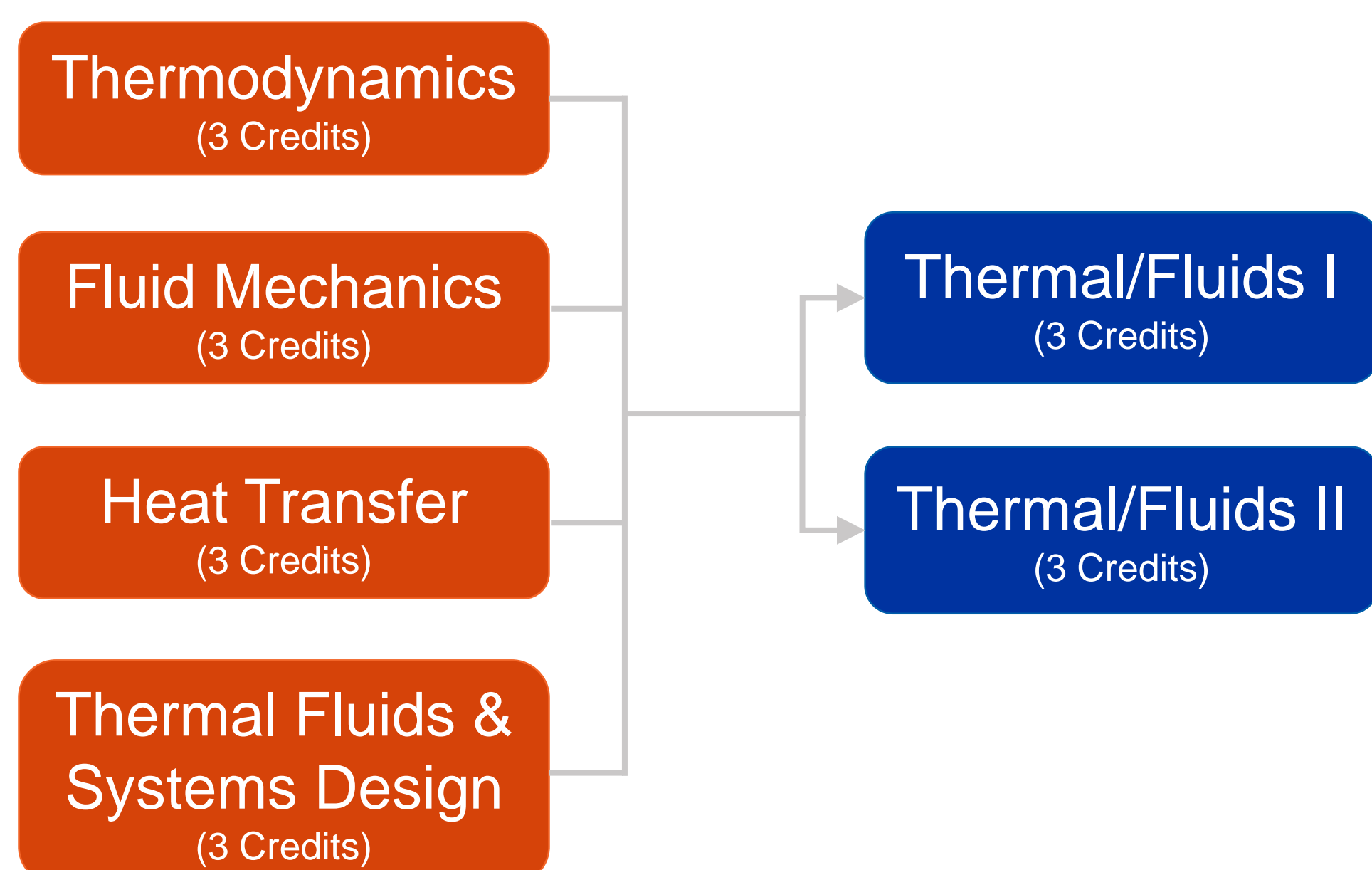
CURRICULUM OUTLINE

Dividing Program Outline into 3 Topics

- Thermal and Fluids
- Solid Mechanics
- Dynamics and Controls

Elimination and Implementation

- Faculty made the decision to eliminate unrelated courses within the three topics and instead implement levels of understanding
- For example, thermal and fluids requirements dropped from 12 to 6 credits (this alteration is shown in the figure below)



MOTIVATIONS

The idea for a modernized bachelor-level program formed through course evaluations and direct reflection of learning, undergraduates had requested more flexibility with class selection, more hands-on engineering, and more themed learning tracks.

Faculty recognized these inquiries to be of similar premise to those presented by numerous mechanical engineering education reform initiatives and publications, and understood that the present curriculum had not been revitalized to accommodate current workforce demands.

LITERATURE REVIEW

ASME's Vision 2030

- This piece of academic literature served as the primary motivator and model for Boise State's revolutionized ME curriculum
- The following six aspects described in ASME's Vision 2030 were used as an umbrella over further research:

1.) Valuable Hands-On Experience	4.) Curriculum Flexibility
2.) Focus of Professional Integrity	5.) Technical Specialization
3.) Opportunities for Innovation	6.) Faculty Skill Adjustment

Other Supporting Publications

- NAE's Engineer of 2020 Project also served as a foundation for the renovated mechanical engineering undergraduate curriculum
- National Science Foundation Revolutionizing Engineering Departments Program (NSF RED) also served as a driving force

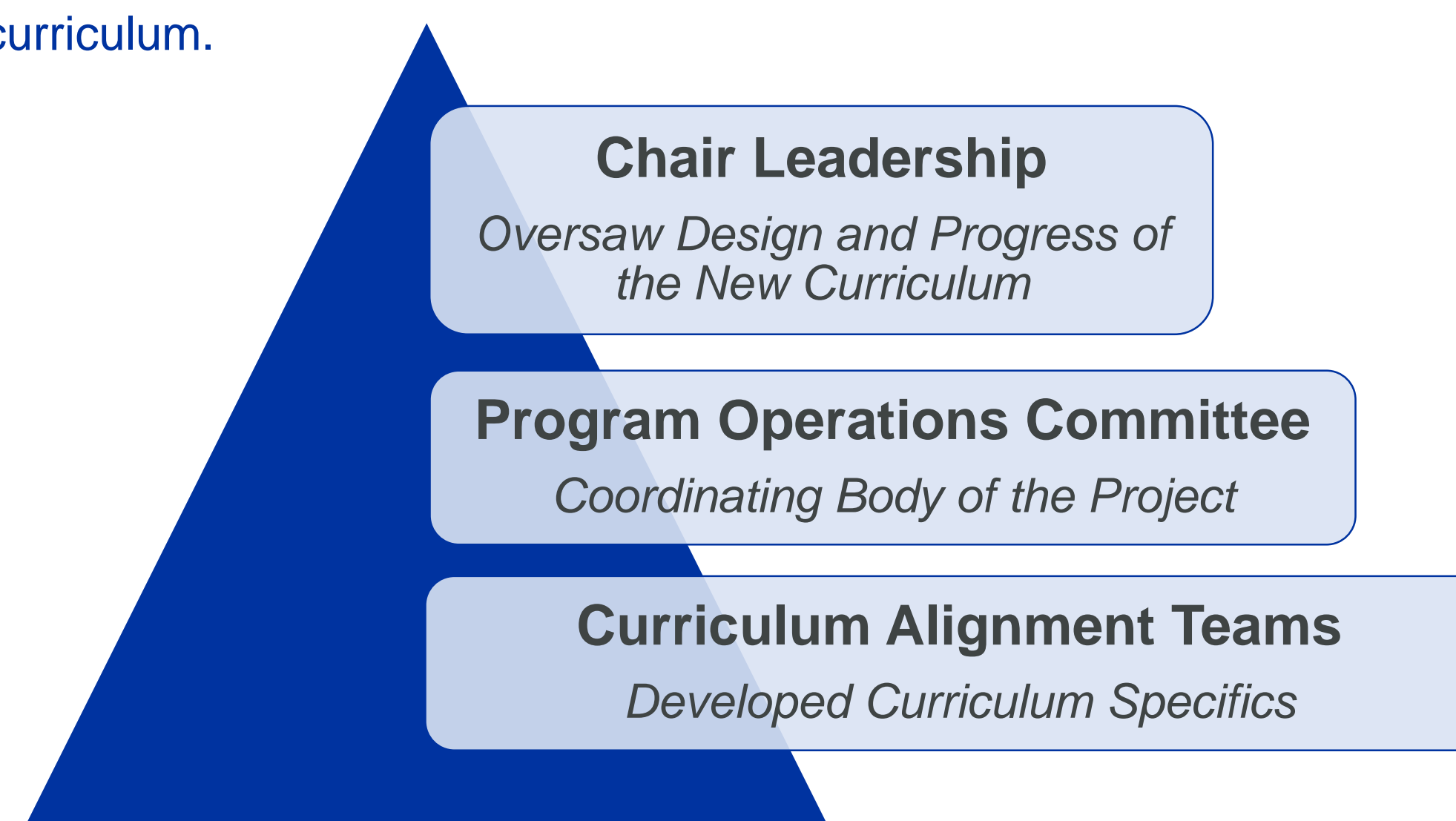
ASPIRATIONAL TARGETS

- Provide students with more flexibility when selecting courses
- Give students the ability to move classes around without the limitation of excessive prerequisites
- Curriculum will be required to expand upon experiential learning
- Grant faculty the chance to integrate authentic problems from industry versus the typical textbook questions that lack real-life applications
- Create a curriculum that offers more focused themes and emphasis areas
- Help students more easily seek cross-disciplinary experience
- Include student and industrial advisory boards in decision-making



OTHER CONSIDERATIONS

Without the relentless support and drive of BSU's Mechanical Engineering Department faculty and administration, educational revolutionization would not be fathomable. Most universities shy away from such an overwhelming task, but here in Boise the staff would be reminded before each meeting of their professional values: to be innovative, impactful, inclusive/respectful, cooperative/collaborative, and professional/ethical. The cultivation of these shared values ultimately served as the initiators of the revolutionized curriculum.



CONSTRAINTS

University-Based

- Must meet credit-hour criteria specified by the university
- Gain acceptance by the UCC and the university financial board
- Inspire faculty to develop new teaching methods
- Desirable to undergraduate mechanical engineering students

Outer Sources

- Accepted by the Accreditation Board for Engineering and Technology
- Appease the program's stakeholders and advisory boards

CONCLUSION

The twenty-first century has borne witness to profound technological and societal advancements, some taking the world by storm overnight. While companies have done their best to adjust to their ever-transforming surroundings, undergraduate level mechanical engineering education has fallen behind. In simplest terms, colleges are producing students underprepared for future challenges. In order to bridge this divide, industry and education must serve as one another's primary stakeholders, and work closely together in expressing their individual needs.

With motivations, research, and constraints carefully considered, Boise State University's Mechanical Engineering Department strongly believes that they are on the right track to providing their students with the skills and experiences needed to be successful and valuable in their future careers.

Thank You to All Those Who Made this Research Possible!