	T.R. **İZMİR KÂTİP ÇELEBİ UNIVERSITY** **FACULTY OF ENGINEERING AND ARCHITECTURE** **MECHANICAL ENGINEERING DEPARTMENT**	**Form No:** FRM-1 **First Pub Date:** 15.11.2016 **Revision Date:** 15.02.2017

DESIGN PROJECT PROPOSAL FORM

Academic Year	**2022 -2023**	**Semester**	Fall ☐ Spring ☒
Project Type	**Research** ☐ ME 411 Thermal & Fluid Design ☐ ME 413 Mechanical Design ☐ ME 415 Robotics & Control Design	**Application** ☒ ME 412 Thermal & Fluid Design ☐ ME 414 Mechanical Design ☐ ME 416 Robotics & Control Design	
Advisor	Assoc.Prof.Dr.Sercan Acarer		

Project Title	System Design and CFD simulations of a vacuum-type supersonic wind tunnel for high-speed research purposes.
Purpose and Scope	The purpose of this undergraduate thesis is to design and simulate a small vacuum-type supersonic wind tunnel for high-speed research purposes using computational fluid dynamics (CFD) techniques. The goal of this project is to investigate the feasibility of using a vacuum-type wind tunnel to achieve high-speed but low Reynolds number flow conditions and to assess the suitability of such a tunnel for research purposes. A masters student will provide mentorship to the student.
Work Packages	• Literature review: Conduct a comprehensive review of the existing literature related to supersonic wind tunnel design and operation, as well as the use of CFD techniques for simulating such tunnels. • Wind tunnel design: Based on the literature review, design a small vacuum-type supersonic wind tunnel suitable for high-speed research purposes. Consider factors such as the tunnel length, diameter, nozzle design, vacuum tank and vacuum pump capacity. • CFD simulation: Use computational fluid dynamics software to simulate the flow conditions inside the wind tunnel. Verify the accuracy of the simulation by comparing the results with experimental data from existing wind tunnels. • Flow analysis: Analyze the flow conditions inside the wind tunnel and evaluate the suitability of the tunnel for high-speed research purposes. Consider factors such as the Reynolds number, Mach number, and the presence of shock waves and boundary layer effects. • Discussion and conclusion: Discuss the limitations of the study, suggest future research directions, and draw conclusions about the feasibility and suitability of using a vacuum-type supersonic wind tunnel for high-speed research purposes.
# of Team Members	1 student
This section to be filled by the Commission	The Project Proposal ☐ is approved. ☐ should be revised considering the following suggestions:

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The projects are aimed to prepare students to attain the following program educational objectives:
(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Therefore, the final report of the project should contain the followings:

i. Definition of the design problem and its limitations
ii. Theoretical information about the topic, standards and patents
iii. Different design options and selection criteria
iv. Optimal solution with appropriate selection criteria
v. Cost accounting, feasibility, compliance with regulations and standards, environmental impacts, and compliance with ethical rules
vi. Engineering drawing and presentation methods for presenting