	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	Design of Heat Exchanger and Expansion Room for Joule-Thomson Cryogenic Cooler with Multiphase CFD Analyses with Evaporation and Condensation.
Purpose and Scope	The purpose of this project is to design a heat exchanger and expansion room for a Joule-Thomson Cryogenic cooler operating with nitrogen. The project will involve performing multiphase CFD analyses with evaporation and condensation to simulate and optimize the flow, heat transfer, and pressure drop in the heat exchanger and expansion room of the Joule-Thomson Cryogenic cooler. Ultimately, the project aims to deliver a comprehensive set of recommendations and guidelines for the Joule-Thomson Cryogenic cooler's heat exchanger and expansion room design, which will enable the engineers to improve the cooler's overall performance and energy efficiency.
Work Packages	• Introduction: Provide an overview of the project scope, importance, and objectives, along with the background information on Joule-Thomson Cryogenic coolers and their applications. • Literature Review: Conduct a comprehensive review of the existing literature on the design, analysis, and optimization of the heat exchanger and expansion room for Joule-Thomson Cryogenic coolers. • Design of Heat Exchanger: Develop a detailed design of the heat exchanger for the Joule-Thomson Cryogenic cooler that satisfies the required heat transfer at minimal pressure drop. • Design of Expansion Room: Develop a detailed design of the expansion room and pressure expansion device. • Multiphase CFD Analysis: Perform a multiphase CFD analysis to simulate and optimize the flow, heat transfer, and pressure drop in the heat exchanger and expansion room of the Joule-Thomson Cryogenic cooler, considering evaporation and condensation, and providing a detailed report of the results. • Conclusion: Summarize the findings and recommendations of the project, including the benefits of the developed design.
# of Team Members	Max 2 students

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This section to be filled by the Commission	The Project Proposal ☐ is approved. ☐ should be revised considering the following suggestions:

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