Department of Mechanical Engineering

Capstone Team Project Proposal Form

Part I. Students & Project Information [To be completed by the Students in Consultation with the Supervisor]

Student ID		Student Name	
Student ID		Student Name	
Student ID		Student Name	
Student ID		Student Name	
Student ID		Student Name	

Academic Year	20 [ ] / 20 [19]	Semester	[ ] Fall [x] Spring

Title of the Project	**Development of Friction Stir Welding (FSW) Monitoring System**
Supervisor	**Assoc. Prof. Dr. Qasim ZEESHAN**
Summary/ Scope of the Project (<200 words)	FSW is a unique and innovative method of jointing metals, which uses frictional heat combined with precisely controlled forging pressure to produce high integrity, full penetration welded joints with minimum defects. FSW has significant advantages over other joining techniques including good mechanical properties, low distortion, and an ability to weld some materials that cannot be welded by other methods. FSW current uses involve the joining of Al alloys, for applications including: aircraft components, ship structures, rail carriages, automotive components, bridge components, pressure vessels, and space launch systems. FSW has recently been reported for the joining of magnesium, copper, steels, and titanium alloys. The aim of the project is to design and develop a low cost FSW monitoring system that can be retro fitted to milling machines to facilitate their application to FSW. The device consists of **4 components; a general purpose FSW tool; a tool holding system; a weld monitoring system; and a display software system**. The device must be designed and manufactured to provide accurate monitoring of **forces, torque and tool temperature** during FSW. The system must accurately measure the vertical and horizontal forces and torque on the tool. The sensor design allows for various taper sizes to be attached to accommodate the requirements of the user. The device must have the capability to monitor user defined temperatures via thermocouples. All of the power requirements for the sensor transmitted using wireless digital telemetry, thus supporting two way communication for calibration and data collection. A separate housed electronics module that processes the information into a suitable format for interfacing with a PC. The **major phases** of the project are: **1. Background study and literature research:** Study the Standards involved. Review various FSW machine concepts. **2. Conceptual design and evaluation of manufacturability**: Concept Generation, Concept Evaluation & Concept Selection based on the Constraints (Design for: Cost, Availability, Manufacturability, Assembly, Environment, Reliability, Safety etc) & Performance Objectives. **3. Detailed Design:** Design and assess suitable material and component requirements. Select Materials using Ashby Charts. Select components according to design specifications. **4. Procurement:** Procuring the materials and components according to relevant Standards. The Procurement must be complete before the start of Capstone 2. **5. Manufacturing:** Manufacture with suitable materials and components according to relevant Standards. The manufacturing should be complete 6 weeks before the final submission. **6. Testing:** Develop a test plan and perform tests for mechanical properties according to the standards and performance verification. The testing must be complete 4 weeks before the final submission. **7. Documentation:** Document the design process in report according to the standard design practice. **PRE-REQUISITE:** MENG222, MENG286, MENG303, MENG331, MENG353, MENG364, MENG375, MENG482, MECT361, EENG320, EENG428 **SPECIAL REQUIREMENT: At least 2 team members should be from the Mechatronics Program** **Software: Solidworks, ANSYS, ARDUINO**
Constraints (Economic, Environmental, Sustainability, Availability, Manufacturability, Ethical, Social, Political, Health and Safety, Constraints etc.) * Please briefly explain the applicable constraints	**Economic:** The design should be economically viable. The budget must include the cost of materials, auxiliary materials, testing equipment, shipping & transportation, manufacturing etc. **Availability:** The product should be designed by employing materials and components available in the local market. **Manufacturability:** The product should be manufacture-able in the ME workshop. **Sustainability:** The design should be robust and sustainable. **Environment:** Hazardous materials should NOT be used. Recyclable materials should be preferred. **Health and Safety:** Safety standards should be adhered to while manufacturing. The final product should be safe to operate. **Ethical:** The design should be original and the references should be cited in the design report. **Time:** The project should be complete and all the deliverables should be submitted according to the stipulated timelines.
Standards (Relevant Standards for Materials/Components used/Procured, Product Design and Development Standards	The relevant standards for Materials, Components, Drawings (Tolerance, Dimensions etc), Manufacturing Process, Product Design and Operations should be identified and followed. The testing should be carried out according to the following standards: **ISO standard for Friction Stir Welding, ISO 25239, JSC - NASA PRC-0014 R B 0014, Rev. B, Process Specification for Friction Stir Welding; AWS standard D17.3M:2010 , AWS, Specification for Friction Stir Welding of Aluminum Alloys for Aerospace Hardware, MSFC - NASA-STD(I)-5006A, Welding Requirements for Aerospace Flight Hardware**

Manufacturing and Testing Equipment, Software and Lab Material Requirements

Please specify the method for satisfying your requirement if your answer is "not available".

1	CAD Software, Assembly tools, Safety Equipment, etc	[x] Available	[ ] Not Available
2	Welding Tool, Welding Material	[ ] Available	[x] Not Available
3	Sensors, Telemetry, Data Acquisition, Recording and Testing equipment etc	[ ] Available	[x] Not Available
4	Mechanical & Electrical Components, etc	[ ] Available	[x] Not Available
5	Machine Software	[ ] Available	[x] Not Available

Other Requirements, if any

Proficiency in CAD Solidworks, ANSYS Fluent, Manufacturing, Electromechanical Systems

Part II. Approval

Supervisor	Assoc. Prof. Dr. Qasim ZEESHAN	Signature		Date	
Coordinator	Assist. Prof. Dr. Mohammed Bsher ASMAEL Assist. Prof. Dr. Devrim AYDIN	Signature		Date	
Department Chair	Assoc. Prof. Dr. Hasan HACIŞEVKİ	Signature		Date	