# Spring 2023-24 - MECT410 & MENG410 CAPSTONE TEAM PROJECT GROUPS

| Gr. No | Supervisor | Project Title | Pre-Requisites |
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| 1 | **Assoc. Prof. Dr. Murat Özdenefe** | **Solar Powered Stirling Engine :** This project aims to design and fabricate Stirling engine using solar energy as a heating source. The objective is to implement the utilization of renewable energy to provide the heating source for the engine by designing a concentrated solar collector to produce a very high temperature similar to that of a small gas burner. Furthermore, this project will demonstrate the Stirling engine capacity to produce power that is eco friendly and very practical for many applications. | **MECT361, MECT444, EENG410, MENG442. Two students must be from Mechatronics Program.** |
| 2 | **Assoc. Prof. Dr. Murat Özdenefe** | **Smart Window Shade:** The objective of this project is: To design and manufacture an external shading element for windows that is movable and preferably modular. The objective of the system is to block the direct radiation incident on the window for mimimising the heat gains during cooling season and to allow it to fall on the window for maximizing the heat gains during heating season. The external shading element will continiously adjust itself accordingly relative to the sun during a day by means of motors. The system will also be designed to adjust itself seasonally. | **MECT361, MECT444, EENG410, MENG442. Two students must be from Mechatronics Program.** |
| 3 | **Assoc. Prof. Dr. Devrim Aydin** | **Sustainable Cooling System :** Students are expected to design, develop and test a sustainable cooling system based on evaporative cooling. System will use air-to -air heat exchangers and water citculation system. Within the project design, development and testing of thecooling system will be performed. | MENG246, MENG345, MENG303 |
| 4 | **Assoc. Prof. Dr. Devrim Aydin** | **Thermal Energy Storage Unit:** Students are expected to develop a compact heat storage box to store solar energy. System will use natural materials and water circulation. | MENG246, MENG345, MENG303 |
| 5 | **Assoc. Prof. Dr. Devrim Aydin** | **Refurbishment and experimental testing of a hybrid solar air-water heater:** Students are expected to complete and improve an existing solar system and carry out experimental analyses on the system performance. | MENG246, MENG345, MENG303 |
| 6 | **Prof. Dr. Uğur Atikol** | **Solar Air Conditioner** – It is required to convert an old airconditioner into a solar PV-operated air conditioner that will run from a battery directly.The battery will store the energy from the solar panels and will be able to run the air conditioner for 3 to 4 hours until it is charged again. It is required to have a multi-disciplinary team with a partner from the EE department. | **MENG345, MECT361, MENG364, EENG350, MENG443** |
| 7 | **Prof. Dr. Uğur Atikol** | **Wind Energy Storage System** – It is required to design an energy storage system for a wind turbine having the capacity for storing energy that can provide electricity to the internet, tv, a few bulbs and charging for the cell phone for at least 2 hours. The team should be a multi-disciplinary team formed by mechatronics and electrical engineers. | **MECT361, EENG350, MENG364, EENG342** |
| 8 | **Prof. Dr. Hasan Hacisevki** | **Drag Measuring System:** A drag for measuring device will be designed and manufactured for wind tunnel test equipment. The device will measure the drag force during wind tunnel test and display the result on a digital display. | **MENG201, MENG203, MENG375** |
| 9 | **Prof. Dr. Hasan Hacisevki** | **3 D carving machine:** A 3 D three axis wood carving machine will be designed and maufactured. The plane dimensions will be 40 cm by 40 cm and height 30 cm. The system will be controlled through a open source software and must allow to upload drawings from Solidwork software. | **MENG286, MENG303, MENG375, MECT444** |
| 10 | **Prof. Dr. Hasan Hacisevki** | **Pneumatic paper shear machine:** A pneumatically controlled paper shearing machine will be designed and manufactured. The plate dimension will allow A4 size paper up to 100 mm stroke distance. Must include alll safety functions and accesssories. | **MENG201, MENG353, MENG375, MENG376** |
| 11 | **Assist. Prof. Dr. Babak Safaei** | **Development and implementation of solid-state batteries**<br>Solid-state batteries replace the liquid or gel electrolytes found in traditional lithium-ion batteries with a solid electrolyte, which is safer, more stable, and potentially offers higher energy density. Solid-state batteries have the potential to offer faster charging times, longer lifetimes, and increased safety, making them attractive for use in electric vehicles, consumer electronics, and grid-scale energy storage. | MENG303, MENG331, MENG364, MENG375,MECT375, MECT361, MECT444<br>SPECIAL REQUIREMENT: At least 2 team members should be from the Mechatronics Program.<br>Software: Solidworks, ANSYS, Abaqus |
| 12 | **Assist. Prof. Dr. Babak Safaei** | **Energy Harvesting Storage Systems**<br>Energy harvesting storage systems combine energy harvesting techniques with energy storage to provide a reliable source of power for devices. These systems are being explored for use in applications such as remote monitoring and sensing, smart agriculture, and smart cities | MENG303, MENG331, MENG364, MENG375,MECT375, MECT361, MECT444<br>SPECIAL REQUIREMENT: At least 2 team members should be from the Mechatronics Program.<br>Software: Solidworks, ANSYS, Abaqus |

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| 13 | **Assist. Prof. Dr. Babak Safaei** | **Multi-functional sandwich structures**<br>The development of multi-functional sandwich structures that can perform multiple functions, such as providing structural support, thermal insulation, and acoustic absorption, is another current hot topic in the field. Research is being conducted to develop new core materials and face sheet materials that can provide multiple functions and to optimize the design of sandwich structures for multi-functionality. | MENG303, MENG331, MENG364, MENG375,MECT375, MECT361, MECT444<br>SPECIAL REQUIREMENT: At least 2 team members should be from the Mechatronics Program.<br>Software: Solidworks, ANSYS, Abaqus |
| 14 | **Assist. Prof. Dr. Omid Shekoofa** | **Renewing a PLC-based industrial automation demonstration and test platform:** The aim of this project is to renew a PLC-based industrial automation lab-scale system by replacing the old PLC module of the system with a new micro-PLC module and equip it with robotic arm to pick up different objects from a recirculating conveyor based on their size, color, etc... | MECT444, MENG 332, EENG 410, at least two members from the mechatronics program and one from mechanical engineering program |
| 15 | **Assist. Prof. Dr. Omid Shekoofa** | **Advanced Miniature Sun Simulator :** This capstone project focuses on the development of an innovative miniature sun simulator, representing a significant enhancement over an existing model. The primary goal of this project is to design and manufacture a compact, efficient, and highly accurate simulator that can mimic the spectral characteristics, sun light intensity, and limit the temperature of the device under test. This simulator will serve as a critical tool for research and development in various fields such as solar | MECT361, MENG 332, EENG 410, at least two members from the mechatronics program and one from mechanical engineering program |
| 16 | **Assist. Prof. Dr. Omid Shekoofa** | **Design and Fabrication of a Low-Cost Monochromator:** Monochromator is a sophisticated optical instrument essential in various scientific and industrial application, such as EQE measurement of solar cells and laser diodes. project will challenge students to integrate mechanical, electrical, and software engineering skills to create a device capable of isolating and precisely selecting a single wavelength of light. Throughout the project, students will gain valuable insights about mechatronics, optics, and | MECT444, MECT361, MENG 332, EENG 410, at least two members from the mechatronics program and one from mechanical engineering program |
| 17 | **Assist. Prof. Dr. Omid Shekoofa** | **Battery mangement system by PLC:** The goal of this project is to develop a sophisticated system capable of monitoring and managing the health, charge, and discharge cycles of battery packs, which are crucial for ensuring the longevity and efficiency of battery-operated systems in various applications such as electric vehicles, renewable energy storage, and portable electronic devices. The project aims to leverage the versatility and reliability of PLCs to create a BMS that offers real-time monitoring, predictive | MECT444, MECT361, MENG 332, EENG 410, at least two members from the mechatronics program and one from mechanical engineering program |
| 18 | **Assist. Prof. Dr. Omid Shekoofa** | **Smart Composting Garbage Bin:** This project involves the design and development of an intelligent garbage bin that facilitates efficient composting of organic waste. Students will employ sensors and automation to monitor and regulate composting conditions within the bin, optimizing decomposition rates and minimizing odor and pests.<br>The project's aim is to promote eco-friendly scalable waste disposal methods, reduce landfill waste, and produce nutrient-rich compost for agricultural use. | MECT444, MENG 332, EENG 410, at least two members from the mechatronics program and one from mechanical engineering program |
| 19 | **Sn. Lec. Dr. Cafer Kızılörs** | **Redesign the throatless shear machine** | **MENG303, MENG364, MENG375/MECT375** |
| 20 | **Sn. Lec. Dr. Cafer Kızılörs** | **Refurbishment of the Mini CNC Milling Machine** | MENG303, MENG331, MENG364, MENG375, MECT361, MECT444, EENG320, EENG410, EENG428<br>SPECIAL REQUIREMENT: At least 2 team members should be from the Mechatronics Program.<br>Software: Solidworks, MATLAB, Simulink, ANSYS, ARDUINO, PLC, ROS |
| 21 | **Sn. Lec. Dr. Cafer Kızılörs** | **Refurbishment of the Mini CNC Turning Machine** | MENG303, MENG331, MENG364, MENG375, MECT361, MECT444, EENG320, EENG410, EENG428<br>SPECIAL REQUIREMENT: At least 2 team members should be from the Mechatronics Program.<br>Software: Solidworks, MATLAB, Simulink, ANSYS, ARDUINO, PLC, ROS |
| 22 | **Sn. Lec. Dr. Cafer Kızılörs** | **Refurbishment of the Thin Walled Pressure Vessel Apparatus** | **MENG303, MENG364, MENG375/MECT375** |
| 23 | **Sn. Lec. Dr. Cafer Kızılörs** | **Refurbishment of the Thick Walled Pressure Vessel Apparatus** | **MENG303, MENG364, MENG375/MECT375** |
| 24 | **Prof. Dr. Qasim Zeeshan** | **Aqua Drone for handling aquatic waste:** Design and develop a small Autonomous Surface Vessel (ASV) Aqua Drone that excels in efficiently handling aquatic waste. The autonomous model must be designed for efficient operations based on pre-set mission routes. Users can select the desired operating route and predefine the ASv's path, ensuring thorough coverage of the target region for waste management or data collection. The work will cover several key areas of mechanical and mechatronics engineering. | MENG303, MENG331, MENG364, MENG375, MENG353, MECT361, MECT444, EENG320, EENG410, EENG428<br>SPECIAL REQUIREMENT: At least 2 team members should be from the Mechatronics Program.<br>Software: Solidworks, MATLAB, Simulink, ANSYS, ARDUINO, ROS |
| 25 | **Prof. Dr. Qasim Zeeshan** | **Snake Robot - 2.0:** This project focuses on the redesign, development and testing of the snake robot 1.0 which was inspired from real snakes. It consists of compact links (brackets) which allows to maintain smooth movements. The most effective movement pattern such as; crawling and slithering must be implemented. Servo motors, wireless cam, Arduino Nano and remote control are some of the components that must be used to develop this prototype. To make the snake robot function like a real snake, it is constructed using many brackets. To cut down the cost, these brackets must be designed and 3D printed. Each bracket can have a servo motor that enables the robot to have various degrees of freedom for different gaits. Modular design must give the robot flexibility to reach different territories and ability to move around in complex environments. The work will cover several key areas of mechanical and mechatronics engineering. | MENG303, MENG331, MENG364, MENG375, MENG353, MECT361, MECT444, EENG320, EENG410, EENG428<br>SPECIAL REQUIREMENT: At least 2 team members should be from the Mechatronics Program.<br>Software: Solidworks, MATLAB, Simulink, ANSYS, ARDUINO, ROS |

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| 26 | **Prof. Dr. Qasim Zeeshan** | **Automated Guided Vehcile - Mobile Robot** - Automated guided vehicle can be used in indoor environment, such as warehouse, hospitals, grocery stores, etc. They are designed for logistic purposes, disinfection and cleaning. The aim of the project is to design an automated guided vehicle robot that uses Lidar and SLAM to create a map of its environment and uses Robotic Operating System (ROS) to navigate the robot in the environment. | MENG303, MENG331, MENG364, MENG375, MECT361, MECT444, EENG320, EENG410, EENG428<br>SPECIAL REQUIREMENT: At least 2 team members should be from the Mechatronics Program.<br>Software: Solidworks, MATLAB, Simulink, ANSYS, ARDUINO, PLC, ROS |
| 27 | **Prof. Dr. Qasim Zeeshan** | **Human-powered Electric hybrid vehicles (aka Power-assisted Vehicle)**<br>A human–electric hybrid vehicle is a hybrid vehicle, or more specifically a hybrid human-powered vehicle, whose drivetrain consists of a human being and an electric motor/generator (and one or more electricity-storage device(s) such as a battery(ies) or ultracapacitor(s)). Some vehicles are able to operate off both human power and be plugged in to operate on battery power. The main aim of the project is to develop a hybrid electric human-powered vehicle. | MENG303, MENG331, MENG364, MENG375, MECT361, MECT444, EENG320, EENG350, EENG410, EENG428<br>SPECIAL REQUIREMENT: At least 2 team members should be from the Mechatronics Program.<br>Software: Solidworks, MATLAB, Simulink, ANSYS, ARDUINO, PLC |
| 28 | **Prof. Dr. Qasim Zeeshan** | **Refurbishment of a Mini Cricular Automated Storage and Retrieval System (ASRS)** - Automated Storage and Retrieval Systems (AS/RS) are used as warehouses, specifically designed for material handling in advanced manufacturing systems and are broadly utilized in distribution centers as subsystem for production area. The aim of the project is to refurbish the mini Circular AS/RS Configuration. The configuration is based on a single aisle; single S/R (Storage/Retrieval) machine. Randomly storage assignment policy is applied for the system. | MENG303, MENG331, MENG364, MENG375, MECT361, MECT444, EENG320, EENG410, EENG428<br>SPECIAL REQUIREMENT: At least 2 team members should be from the Mechatronics Program.<br>Software: Solidworks, MATLAB, Simulink, ANSYS, ARDUINO, PLC |