ME 495 - 241 Proposal Submission

Ser.#	Advisor Name	email	Research Title	Research Description	Area of research
1	Hussain Alqahtani	Qahtanih@kfupm.edu.sa	Nonlinear vibration of cantilever beam; theory and experiment	The task is to conduct an experiment that measures the transverse displacement of a cantilver beam due to sinusoidal force at the tip. A theoretical model is to be validated by the experiment	Mecanics
2	Mohamed Abdrabou Hussein	mahussein@kfupm.edu.sa	Developing of Ti-containing High entropy alloy for bio implant applications	The student will engage in the experimental work to process the high entropy alloy using powder metallurgy, followed by materials and mechanical characterization. corrosion performance will be evaluation in simulated body fluid.	Materials & Manufacturing
3	Mohamed Abdrabou Hussein	mahussein@kfupm.edu.sa	Surface engineering of Ti alloy for dental implant applications	The work includes coating/surface treatment of Ti alloy, followed by surface and c	Materials & Manufacturing
4	Mohamed Abdrabou Hussein	mahussein@kfupm.edu.sa	Processing and evaluation of Mg nanocomposite for biomedical applications	The student will participate in the processing and performance evaluation of nanc	Materials & Manufacturing
5	Obaidallah Munteshari	obaidallah@kfupm.edu.sa	Humidification dehumidification desalination (HDH) system	The student will conduct a parametric study for HDH system using EES.	Thermal
6	Obaidallah Munteshari	obaidallah@kfupm.edu.sa	Bubble column humidifier	The student will build a setup for a bubble column humidifier and conduct the exp	Thermal
7	Abdullah Al-Sharafi	alsharafi@kfupm.edu.sa	Load type influence on the performance of solar energy systems	Solar energy conversion to electricity will be considered via using PV panels. Seve	Thermal-Renewable
8	Ammar Alsheghri	ammar.sheghri@kfupm.edu.sa	Design and additive manufacturing of cellular structures with enhanced mechanical properties for biomedical applications	Cellular structural design can provide optimized mechanical properties while maintaining small relative densities. There is a variety of traditional unit cell designs for cellular structures available in commercial software. This project aims to compare bio-inspired cellular structures with traditionally designed ones in terms of physical and mechanical properties to propose efficient designs for biomedical implants. The project involves 3D design using simple software, linear elastic finite element analysis, additive manufacturing and mechanical testing.	Biomechanics, 3D printing, and FEA
9	Sulaiman Alturaifi	sulaiman.alturaifi@kfupm.edu.sa	Development of a Portable Methane Sensor Using Laser Absorption Spectroscopy	This project aims to build a portable methane sensor capable of detecting atmospheric methane levels and measuring methane leaks with high sensitivity and accuracy. The sensor will utilize a tunable diode laser to detect methane concentrations by measuring the absorption of specific wavelengths of light. The device will be designed for field use, providing real-time data on methane levels in the atmosphere and enabling the identification of methane leaks in various settings, such as natural gas infrastructure and agricultural sites. The project will include construction, calibration, and field testing to ensure reliability and precision.	
10	Aamer Nazir	aamer.nazir@kfupm.edu.sa	Design for Additive Manufacturing of Mechanical gears using Topology optimization and mechanical metamaterials	This research involves Design work using Solidworks and other simple softwares, FEA using ansys, and additive manufacturing using FDM for validation.	Design and Additive Manufacturing
11	Sulaiman Alturaifi	sulaiman.alturaifi@kfupm.edu.sa	Development and Field Testing of a Portable Laser-Based Sensor for Measurin	This project aims to develop a portable laser-based sensor for real-time measurement of unburned hydrocarbons (UHCs) in vehicle exhaust. Students will engage in designing and assembling the sensor, calibrating it in the lab, and field testing it on various car types to measure UHC emissions. The project provides hands-on experience with optical sensing technologies, data analysis, and environmental monitoring. This project will be very interesting to car enthusiast offering valuable insights into vehicle emissions and pollution control.	
12	Abul Fazal Arif	abulfazal.arif@kfupm.edu.sa	Combining Simulation and Machine Learning for Predictive Maintenance of pipelines	This research proposal aims to enhance predictive maintenance of transportation pipelines by integrating finite element modeling and machine learning techniques. Using an existing finite element model, we will simulate pipeline behavior under various conditions to create a comprehensive dataset. Machine learning algorithms will then be applied to develop predictive models. Collaboration with a pipeline engineering expert from Saudi Aramco ensures real-world relevance and applicability.	
13	Abul Fazal Arif	abulfazal.arif@kfupm.edu.sa	Integrating Machine Learning in application-focused design and optimization of PVD coatings	This research proposal invites undergraduate mechanical engineering students to combine engineering and machine learning in a practical project. The focus is on designing and optimizing PVD coating systems for biomedical, advanced manufacturing, and new product development.	
14	Abul Fazal Arif	abulfazal.arif@kfupm.edu.sa	Application focused design and development of compposite materials	This research proposal invites undergraduate mechanical engineering students to combine engineering and machine learning in a practical project. The focus is on designing and developing new composite materials for new products.	
15	Pieter Boom	pieter.boom@kfupm.edu.sa	Numerical simulation of simultaneous multidimensional diffusion in materials	This project will help revolutionize numerical simulation of diffusion in complex materials using a multi-dimensional discrete approach. Consider water diffusing through a concrete slab, the water will pass differently trough the mortar and aggregates, as well as along the lower-dimension interfacial zones between the two. Traditional continuum methods – like finite-elements – cannot model these differences at a fundamental level. Discrete exterior calculus (DEC) describes the interaction of independent cells and the physics evolving on their geometric skeletons (eg. Faces and edges of the cell), making it ideal to model this simultaneously multi-dimensional diffusion. This project will apply existing DEC software to model diffusion through the microstructure of materials.	Engineering Simulation
16	Pieter Boom	pieter.boom@kfupm.edu.sa	Generalised summation-by-parts for solid mechanics	Finite-difference (FD) are known to be highly efficient numerical methods when the domain and solution are smooth. On the other hand, finite-elements (FE) are often preferred for modelling complex geometries. The generalized summation-by-parts (gSBP) framework provides a unified description of many FD and collocated FE methods that have an SBP property: the discrete analogue of integration by parts. This project will implement 2D linear elasticity using the gSBP framework to exploit the combined advantages of FD and FE methods.	Engineering Simulation
17	Pieter Boom	pieter.boom@kfupm.edu.sa	Generalised summation-by-parts for fluid-structure interaction	Finite-difference (FD) are known to be highly efficient numerical methods often applied in fluid mechanics. On the other hand, finite-elements (FE) are often preferred in solid mechanics to represent complex geometries. The generalized summationbyparts (gSBP) framework provides a unified description of many FD and collocated FE methods that have an SBP property: the discrete analogue of integration by parts. This project will implement the coupled quasi-1D Euler fluid and linear elastic solid equations using the gSBP framework to develop a monolithic implementation of fluid-structure interaction.	Engineering Simulation
18	Awad Alquaity	awad.alquaity@kfupm.edu.sa	Energy Efficiency Improvement of Air Conditioning Systems in Saudi Arabia	The student will develop an understanding of practical AC systems and collect data through market surveys. Based on the detailed market survey and simulations conducted in EES, the student will build a bottom - up model predicting the energy consumption for ACs in Saudi Arabia till 2050 while consdiering the Net Zero 2060 mandate. Previous study on a similar topic was presented at ASME Conference in 2023 and the paper was selected to be published in a special issue in an ASME journal.	Thermal; Energy Efficiency
19	Nesar Merah	nesar@kfupm.edu.sa	Determining the chemical, physical and mechanical properties of two new polymer based composite coatings destined for oil/gas drilling in harsh environements	The student will use existing characterisation techniques to deteremine the chemical compositions of the novel composites, their physical properties such as the thermal conductivity and their resistance to wear and indentation.	Materials

20	Abba Abubakar	abba.abubakar@kfupm.edu.sa	Utilizing Machine Learning for Design and Optimization of Cold Spray Coating	This undergraduate project proposal aims to explore the application of a machine learning approach in optimizing the cold spray coating process parameters for depositing metallic materials (e.g. Cu, Ni and Ti) onto polymer substrates (e.g. PVC, PEEK, PP, PTFE, etc.). Cold spray coating is a promising technique for depositing thin films onto delicate materials like polymers, offering advantages such as low-temperature processing and reduced thermal stress. The project will employ machine learning algorithms to enhance the efficiency and quality of the coating process by predicting optimal parameters, including particle size, velocity, temperature, spray angle and substrate surface type. The research methodology involves conducting numerical simulations and experiments to generate a dataset that correlates different process parameters with the resulting coating properties. This dataset will then be used to train machine learning models, enabling them to predict optimal parameters for achieving desired coating characteristics. The project also entails the development of a user-friendly interface for incorporating machine learning predictions into the cold spray coating setup. The anticipated outcomes include an optimized cold spray coating process that minimizes defects, enhances adhesion, and ensures uniform coating thickness on polymer substrates. The successful implementation of machine learning in this context can contribute to advancements in surface engineering, particularly in the realm of coating applications for sensitive materials.	
21	Abba Abubakar	abba.abubakar@kfupm.edu.sa	Utilizing Finite Element Analysis to optimize the Deposition of Cold Spray Coat	This undergraduate project seeks to advance the understanding and optimization of the cold spray coating process applied to polymer surfaces through a comprehensive approach integrating Finite Element Analysis (FEA) and experimental validation. The heart of the project lies in the implementation of Finite Element Analysis simulations to model the intricate dynamics of cold spray coating deposition on polymer surfaces. Simulations will account for varying parameters such as temperature, pressure, and particle velocities to comprehensively understand the complex interactions between coating particles and polymer substrates. Building upon the insights gained from FEA, the project aims to optimize deposition parameters. This includes identifying the ideal combination of variables to achieve uniform and high-quality coatings on polymer surfaces. The optimized parameters will then be experimentally validated, ensuring a seamless integration between simulation and real-world application. Experimental trials will involve the application of the optimized parameters to polymer substrates, and the results will be rigorously compared with the simulations. Performance metrics such as adhesion strength, surface finish, and overall coating quality will be assessed to validate the effectiveness of the proposed optimization. The research findings are expected to contribute not only to the academic understanding of cold spray coating on polymers but also to practical advancements in surface treatment technologies for polymer-based materials. The significance lies in the potential to improve coating processes, thereby enhancing the performance and applicability of polymer substrates in various industries.	
22	Abdul Samad Mohammed	samad@kfupm.edu.sa	Evaluating thermal and mechanical properties of UHMWPE polymer composites	The student will be responsible to develop the polymer composites and evaluate its thermal and mechanical properties.	
23	Dr. Atia Khalifa	akhalifa@kfupm.edu.sa	Water desalination Using Membrane Distillation technique	student is expected to develop a model for water desalination and investigate the performance of the system under consideration, for efficient use of energy and cost-effect water production.	Thermal, water desalination
24	Dr. Z. Gasem	zuhair@kfupm.edu.sa	Corrosion behavior of steel rebar in alkaline solutions	The student needs to run corrosion experiments and investigate the role of microstructure on the passivity of steel.	Materials and Corrosion
25	Dr. Z. Gasem	zuhair@kfupm.edu.sa	Monitoring corrosion under insulation	The student needs to prepare a setup for insulated pipe and attach various probes to monitor corrosion.	Materials and Corrosion
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27	Dr. Jafar Albinmousa	binmousa@kfupm.edu.sa	Design and Analysis of Type V Hydrogen Storage Vessel	The student will work with 2 graduate students who are working on the development of the material as well as finite element modeling of the vessel. The work might involve simple mechanical tests.	Mechanic of Materials
28	Dr. Jafar Albinmousa	binmousa@kfupm.edu.sa	Analysis of Mean Stress Effects using Polar Damage Sum Concept	The student will use an existing Matlab code toe perform analysis on fatigue data that involves mean stress. The purpose of the work is to examine the estimations using a new concept called Polar Damage Sum.	Fatigue Damage
29	Dr. Md Abdullah Al Bari	mdabdullahal.bari@kfupm.edu.sa	Synthesis of Carbon Materials for Energy Storage Using Petrochemical Byprod	Students will use the pyrolysis technique to develop hard carbon from low-value petrochemical byproducts, such as heavy oil fly ash (HOFA) or bitumen-derived waste. The ultimate goal is to utilize this carbon material for energy storage applications. After synthesizing the hard carbon, students will assist in characterizing it using Gas Adsorption/Desorption (BET) tests, High-Resolution Transmission Electron Microscopy (HR-TEM), and X-ray Diffraction tests. Through this project, students will learn how to convert petrochemical byproducts into value-added products (one route), supporting KSA's efforts to diversify its economy while contributing to the sustainable net-zero goals of the petrochemical industry.	Materials
30	Usman Ali	usman.ali@kfupm.edu.sa	Topics related to additive manuafacturing and numerical simulation	Various topics on AM, simulation tools and renewable energy are avaialable. Students will be working with current graduate students to enhane their understanding. The students should discuss the topic before selecting the course.	Materials, Manufacturing, Mechanics
31	Ravishankar Sathyamurthy	r.sathyamurthy@kfupm.edu.sa	Effective surface coating of double pass solar air collector	students will be fabricating the double pass solar air collector and study the influence of surface coating on thermal performance.	Renewable energy
32	Ravishankar Sathyamurthy	r.sathyamurthy@kfupm.edu.sa	Hemispherical solar thermal evaporator using porous medium	students will study the heat transfer characteristics from hemispherical distiller	Renewable energy
33	Ihsan ulhaq Toor	ihsan@kfupm.edu.sa	Various topics related to "metal alloy design and devlopment (for differnet applications) using differnet techniques, corrrosion studies (metal alloys with/without coating, Additive manufactured alloys), erosion and flow accelerated corrosion, Use of AI/ML in corrosion prediction and management, Corrosion modeling, corroison sensors" are available.	Interested students can select any one of these topics and finalsie after one on discussion. Selected students will be working together with senior students in the lab.	Material & Manufacturing,
34	Muhammad Hawwa	drmafh@kfupm.edu.sa	Acoustic Control System	Work on the emerging field of coming up with a material system with	Dynamics & Control: Metamaterials
35	Hafiz Ali	hafiz.ali@kfupm.edu.sa	Thermal Mangement using Advanced Materials	Thermal management is one of the important aspect for the electronic	Thermofluids