University of Bridgeport
Office of the Executive Vice President
Research and Economic Development

To whom it may concern

May 31st, 2008

Expert opinion on the Mechanics Curriculum developed by
the al-Farabi Kazakh National University

This letter constitutes my opinion regarding the recently-developed draft of the Mechanics undergraduate curriculum developed by the Faculty of the Al-Farabi Kazakh National University in Kazakhstan.

The proposed curriculum provides for a rigorous training within the general areas of Mathematics, Physics, mechanics and mechanical engineering and general engineering. The first two years of the curriculum allows for building a strong foundation within the various typical threads of an engineering undergraduate degree as exemplified by ABET-accredited engineering programs in the United States.

In particular, within the mathematics curriculum; the program provides for an eminent foundation in college-level engineering Math thread, as evidenced by the presence of: Calculus I, Calculus II, Calculus III, Differential Equations, Probability and Statistics, Numerical Analysis, Linear Algebra and Optimization Theory. The program could benefit from a course in discrete mathematics within the technical electives; if the curricular design allows. The topics of Fourier Transform, Laplace Transform and Z-Transform, which are crucial for the areas of control theory, robotics, automation, systems engineering, and dynamical systems are intended to be covered with the Mathematics or Systems threads within the curriculum.

The curriculum thread within the core area of Physics is well covered by the inclusion of Physics I and Physics II. For the purpose of providing a well-rounded education; that is multi-disciplinary in nature; and conducive to the production of functional interdisciplinary engineers and scientists; the Faculty has agreed to include the Courses Electrical Circuits I + Lab., and Electrical Circuits II and Lab. To the curriculum; specifically within the "Restricted Elective" course slots in Semesters 4 and 6. These 2 courses would provide; in addition to the mechanics curricula included, a very strong basis for further studies in areas like Mechatronics, Robotics, Automation, PLC and other emerging disciplines; which are intended to take place in semesters 7 and 8.

The Mechanics sequence of classes in not only adequate, but is very strong and varied. Starting with and introduction to mechanics and progressing to Mechanics, Dynamics, Thermodynamics, Strength of Materials, Heat Transfer, Solid and Fluid Mechanics and then finishing with Mechanical systems design, CAD/CAM and dynamical systems. I would strongly suggest the inclusion of discrete event dynamical systems and soft computing systems (Petri-Nets, Neural Networks Fuzzy and Genetic systems) into the dynamical systems included course work.

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Given the recent trends in STEM and the futuristic job market, and the fact that we are preparing our students now for jobs that do not even exist or have a title yet, I foresee a very significant expansion of interdisciplinary majors and the development of theme-based multi-disciplinary course threads. The major mechanics-related area that exhibits these trends now is obviously the general area of robotics, automation, machine and sensory perception and autonomous navigation (air/land/sea). The Faculty has graciously adopted my recommendation for the inclusion of two courses within the "Restricted Electives of the machines/robots/control thread" in the 7th semester to allow for significant progress of students in understanding these areas and also in preparation for their future studies and career endeavors in automation, robotics, sensory perception, autonomous systems, MEMS, NEMS, PLC, etc.. These 2 courses are: [1] Introduction to robotics and automation; and [2] Introduction to image processing for automation and robotics.

The robotics course would have the pre-requisites of: (1) programming (which is covered in the numerical analysis and programming class in semester 5), (2) Control Theory (which is covered in semester 6; and its co-requisite, circuits II is also covered in semester 6) and (3) Linear algebra (which is covered in the tensor analysis course in semester 2)

The Image processing for Robotics course would include primitives to prepare them for analyzing 2-D visual and sensory data and provides strong foundation for analyzing 2 ½ and 3-D data for future courses and applications. The pre-requisites for this course are: (1) programming (which is covered in the numerical analysis and programming class in semester 5), (2) Linear algebra (which is covered in the tensor analysis course in semester 2) and (3) Calculus 3 (which is covered in semester 3)

It is my very strong recommendation that particular emphasis be given to the senior design project in semester 8 and that the project should exhibit significant student and Faculty collaboration, team work, design innovation, entrepreneurship, integration of knowledge gained through the curriculum, presentation and writing skills, intellectual merit, societal and global impact, community service and scholarly value.

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Overall, the curriculum proposal is impressive and I commend the Faculty for working on it. I very much look forward to continuing to work with the Faculty on delivering the content within the courses and witnessing the student outcomes after having been through the program of study.

Best Regards,

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and Dean of the College of Engineering, Business and Education

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