



The Association of Mechanical Engineers

NEWSLETTER

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“The weak can never forgive. Forgiveness is the attribute of the strong.”

– Mahatma Gandhi

New directions in Mechanical Engineering

In the faculty meeting recently held to discuss future development of mechanical engineering as a discipline and the department that would be essential to implement this change, Dr. Amitabha Ghosh expressed the following views and set the ball rolling. The text below is adapted from his presentation.

AME coordinator

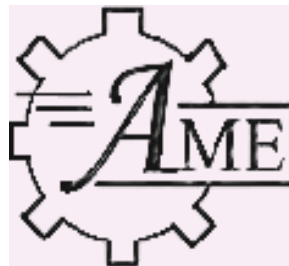
Before venturing into the future let us first go back in time. In the 60's, the Department was in its formative years and it was thought appropriate to impart strong theory and scientific knowledge to the students. By 70's, experimental laboratories started coming into existence, Mechanical engineering was re-organized into streams, and subjects such as Industrial Engineering, though popular had to be separated from the main program. By 80's, each stream of the department got compartmentalized as small units of specialization. The idea of faculty sitting in experimental laboratories and conducting research became quite common during this period. This was the time when Robotics was started as a new stream of Mechanical engineering. In 90's, while the undergraduate courses attracted students of excellent caliber, quality of the postgraduate program came under the scanner. In the past decade, the Department profile has firmly shifted towards research, with the faculty leaning quite heavily on the post-graduate programs.

There is a paradigm shift that is taking place in the world of science and technology. New materials are emerging, new processes invented, and challenges emerging with the all too familiar frequency. The next twenty five years may mark new targets reached in the areas of space programs and life sciences. It is imperative that we are prepared for revolutionary changes all around us. Yet, we cannot neglect the shift in the educational policy. IITs may have to increase the intake of undergraduate students and in consequence there may

be extra responsibilities with teaching and grading. This has to be handled with reconstruction and reorganization of the teaching load without sacrificing the basic objectives of education. The transformation must be eventually brought about in the future.

In the context of Mechanical engineering, we will see the paradigm shifts in the knowledge domain and professional activities in the following manner. The most visible would be in size, materials, actuation, structure, shape, control, system integration and environment. Size has shifted from macro to meso and further to micro and now to nano scales. Materials have become smarter and softer and may be essentially non-metallic in the future. Actuation, originally electromagnetic, hydraulic and pneumatic in form has reached smart materials. Structures have evolved from multibody to a monolithic form with localized compliance. Shape generation is proposed to be bottom-up (*atom-by-atom*) with self-assembly, instead of machining or shaping, the top-down approach. Control techniques now show intelligence and are self-evolving. Systems are no longer incompatible, isolated islands; they are now fully integrated to serve a larger purpose. The possibility of manufacturing in outer space or other hostile areas is no longer a figment of imagination. New laws of mechanics could be discovered at the micro-scale (affectionately called the μ -scale). New energy sources may be discovered and these would irreversibly accentuate the shifts that are taking place around us. We may rightly call the new epoch *the third industrial revolution* (IR).

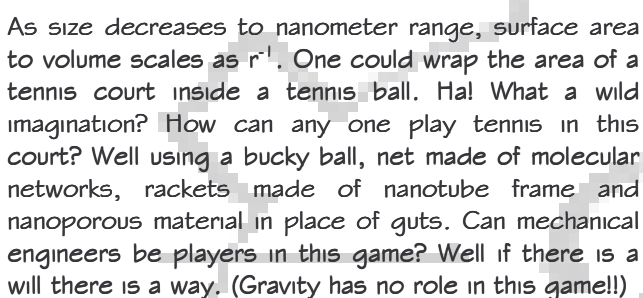
Happily, Mechanical engineers can drive the third industrial revolution as they did the first (with machines and engines). We need to anticipate the following. Far reaching impact is expected in the emergence of μ -system technology in the third IR and this may surpass the impact of the second that was associated with micro-electronics.



AME Freshers Nite – An Experience

For the first time in many years, the PGs were going to be a part of the AME freshers nite and my seniors wanted the Y6 PGs to come up with some act. However, due to the considerable workload that we had and with the freshers nite being just after the first midsems, none of us was even thinking about doing something in the freshers. After the midsems, I had just gone to a friend's room (who is also the general secretary of the AME PG council – Bhavesh Sharma) and found out that he really wanted us (Y6 PGs) to do something in the freshers nite. Since I was completely free that weekend, I agreed (still don't know why I did!). We decided to go for a skit but we had neither the script nor the actors. So first things first we went on a talent hunt looking for some more first yearites but were able to get only two more. Still we persisted to go ahead with the skit with some participation from the Y5 batch as well. Now, the major task at hand was to come up with a script. But being researchers inherently, we respected original work and did not want to pick up a script from the net. Out of the blue, Vaibhav (Y6 PG) suggested that we can have a mock interview in the skit. That very suggestion brought some amazingly funny ideas in our minds and we decided to go for a hilarious job interview. However, none of us had a prior scripting experience – never the less we were able to think out situations but not the dialogues. That's where Bhavesh came into picture. May be even he himself didn't know his capability of writing scripts. Though we had a nice start, but things were going really slow and we had less than 24 hours on our hands! We stayed awake till 3 am and nearly completed the script (with some nice inputs from the AME UG President – Prashant Saxena – thanks a lot!). The next morning – the day of the freshers nite – we had the script in our hands but still it needed some finishing touch. Finally a fair copy of the script got ready by noon. But now, we had just 3 hours effectively left with us to practice. It was getting difficult to remember the dialogues but we had the freedom of keeping the script in our hands during the skit in the form of some documents with the interviewers (a nice idea!). However, within an hour or so we realized that we were not just bad script-writers but bad actors too! No expressions were coming, we were forgetting the dialogues, swapping characters and actors, a new actor came in (Anant) and above all – slowly the script was looking boring! We had started with a hilarious script which seemed to be completely non-hilarious and boring now. We started having ideas of quitting! But somehow, somehow, we motivated ourselves to go with it since we had put in so much effort and finally performed the skit on stage. And to our surprise – the audience had a nice laugh!

Ankit Surti
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As size decreases to nanometer range, surface area to volume scales as r^{-1} . One could wrap the area of a tennis court inside a tennis ball. Ha! What a wild imagination? How can any one play tennis in this court? Well using a bucky ball, net made of molecular networks, rackets made of nanotube frame and nanoporous material in place of guts. Can mechanical engineers be players in this game? Well if there is a will there is a way. (Gravity has no role in this game!!)

One can also visualize newer possibilities in design, materials, control, actuation and manufacturing. In many contexts, smart materials will be employed and new concepts in system dynamics will emerge. Nonlinearities in system behavior will be predominant. A subject such as microfluidics will be important and will necessarily have a high degree of interaction with physics and molecular dynamics. Life science too will be closely connected with this discipline. Molecular chemistry, nanoparticle, physics, material science, computer science, and life sciences will play a more important role in the profession of mechanical engineers. Self-assembly can become an important method of producing small-sized objects. In most machines and systems, sensing and artificial intelligence will become a common feature. New sources of energy will introduce revolutionary changes in the design of new machines. It is possible that self-correction will also emerge as a major feature particularly for space and deep sea applications.

To face these challenges, major rethinking about our discipline is certainly in order. It is advantageous to plan now so as to get a lead and go ahead. Looking at the dynamic changes all around us, arming oneself with the required knowledge and technology can definitely prepare us for the future.

Contributions are invited from all UG and PG students. Send in your entries to shubham@iitk.ac.in