



APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

A Guide through Program in Engineering

Preamble:-

Students who join engineering programs are pretty aware of the significance of engineering in daily life. However they only have vague ideas on engineering education and the profession of engineering. Many think that engineering is all about modern gadgets, and their applications. The complexity of present day technologies and their knowledge bases are not well understood by them. It is thought that a proper induction to engineering education and career could give the students clarity and objectivity on the program they are about to start.

With this objective it is proposed to conduct an Engineering Induction program primarily aimed at exposing the students to the program and the significance of the courses they have to undergo. This induction program is planned to enthuse the students in engineering and make them aware of the expanding realm of this major profession. It will also expose them to the importance of other non engineering subjects and topics like economics, management, languages, communication skills etc., in engineering studies and in the practice of the profession. While guiding the students through the program, they are to be made aware of the learning aspects of engineering courses through micro, mini and major projects and experiments. Practical examples are to be put forward to them to appreciate the theoretical courses that are the foundations of engineering. While it is difficult to formulate the course content of this induction program and the extent of coverage envisaged, the following topics could give an idea of the contents envisaged. An imaginative speaker could expand on these and give further stimulus to the program.

Students joining the professional courses are unaware of the difference between general education and professional education. They have good exposure to science and mathematics. However they are yet to learn about harnessing this knowledge in to applications covering engineering and technology. So the Programme shall cover the following copies.

i) Give clarity on “Science, Engineering and Technology.

Science deals with the physical world and how it works. Engineering is about planning and designing to harness the scientific knowledge gained for practical applications benefitting the society. Technology is the means by which such plans and designs are realized. Science, Engineering and Technology co-exist and in engineering education all the three are of great importance. In earlier times technology was the starting point (making small tools out of stone, making fire,

arrows etc) Later this led to understanding the science behind them. Design and planning for realizing them came much later. However, today these hierarchies have altered.

One can expand on this by giving many examples in different branches of engineering.

ii) Role of Basic Sciences in Engineering- Physics, Chemistry and Biology

This can be given by one with science background

An example could be the principle of Laser, design of the laser, the hardware involved and its wide engineering applications.

Another example could be conversion of heat into work, design of heat engines and their applications.

Another simple one is that of clinical thermometer – thermal expansion for temperature measurement.

Polymerization and polymers – plastics and their processing; design of machinery for plastic products.

Though not included in many current engineering curricula, the role of Biology in engineering can be briefly explained (Living machines) as this could be an area of interest to engineering. There is a new branch of engineering named “Biological Engineering”(See MIT, USA programs).

iii) Mathematics

Engineers are not mathematicians. They are users of mathematics in a practical way. They formulate practical situations through mathematical tools and solve them. Often this is called mathematical modelling. Such models are of great interest in engineering practice. This gives considerable advantage for engineers to formulate and solve different variations/situations of the same core problem. It is to be understood that engineering approaches are not as exact as the scientific solutions where the input parameters are well defined. In engineering, there are many entities that can only be defined with a certain amount of variation. Hence experimental validation of theoretical solutions/ mathematical models is important. In advanced technological fields, mathematics is an essential tool for development (Robotics, Control systems, Artificial Intelligence etc). It is important that the teacher who covers the significance of mathematics in engineering has to illustrate the role of mathematics by giving engineering examples and not just the mathematical tools. Bring in the use of Differential calculus in engineering problem solving, use of transforms, numerical methods etc for engineering solutions, in a simple way.

Teachers from all branches of engineering who have used mathematics widely in their studies and research can explain their experience and make the students

comfortable with mathematics. Please note that many students are apprehensive of this subject and hence it is important to make them feel comfortable with the subject.

iv) Engineering

Give an exciting account of engineering and its role in contemporary society and world. Take examples from all branches for this. Use this occasion to elaborate the different branches of engineering that are currently in vogue. Explain the role of these branches as well as their commonality. It will be good to convince the students that it is not the branch that counts in the profession, but it is the understanding of the principles involved in engineering and the use of these in the planning and execution to solve practical problems. Engineers role in addressing societal needs as well as their ability to bring in innovative thinking in the field, matters.

Engineering is a well formulated discipline and has to follow a certain hierarchy in its academic coverage. So the courses in engineering are arranged like the steps in a ladder. If you miss one you cannot get into the next. So any slip in this schedule will have serious impact both on the individual's ambitions as well as on his/her professional knowledge. Professional education is a serious affair and requires full commitment.

Engineering and technology are constantly evolving. Presently the pace of this evolution is rapid as can be seen from the emergence of new technologies, totally replacing many of the established ones. In short, obsolescence in engineering and technology is palpable and the half life period for them is only 2 to 3 years, at the best. Though fundamentals remain the same, the applications and the tools used for them as well as the products that emerge are changing at fast pace. Engineers have to forget the obsolete contents that they had learned and learn the current ones of practical relevance.

v) Importance of Design and its Omnipresence in Engineering

Engineering is all about planning to achieve an objective. Such well thought out planning are called designs. Design is a systematic procedure to use the knowledge available from different sources in arriving at a viable solution to a need. Design need not always create physical products though many think it in that way. A computer program is a design to achieve a goal.

Many designs we see in day to day life are complex designs. They are systems and not just a part or element. Examples cover rockets, satellites, aircrafts, ships etc. Such major systems have many sub systems and each of these sub systems may have many other sub systems comprising of different components. The functioning of the main system depends on the design of the sub systems and components. Quality and reliability of such designs are critical to the performance of the main system. This requires good materials, good design, realization of quality parts, assembly, testing etc.

KTU has given considerable importance to design in all branches of engineering. To start with all students are exposed to the concepts and steps in design through the course in “Design and Engineering”. As they progress with their studies in different branches of engineering they learn many basic concepts in engineering design and various tools that could be used in design. Today many design tools are computer based ones and an exposure to these is essential for all engineers.

Explain the courses in Design for different branches in a brief fashion covering the common course in Design and Engineering, Design Courses in each specialization, Design Project, and the final semester capstone project. Engineering does not exist without design. This design thinking is the one which makes engineering different from other programs.

vi) Engineering Drawing:

Engineering drawing is to be explained well for the students to appreciate its significance. As engineering deals with the creation (Design) of totally new things, conveying the ideas and concepts about the new creations need an easy and clear approach. This is easily achieved through sketches and drawings. Engineering graphics deals with this idea of communicating the design or of any object that is already made. Unlike a picture or a photo, an engineering drawing should cover all details including the dimensions, if possible in full scale. Before the advent of computers manual drafting was the only means of preparing this communication. Such drawings have a major limitation. As they are physically drawn on a paper, these drawings are only two dimensional in nature. But the object that is being represented by these drawings is three dimensional. So to conceive the three dimensional object from two dimensional drawings need imagination.

vii) Role of Computers in Engineering:

Today design is done on computers. This approach has many advantages over manual drafting. Instead of two dimensional drawings, one can create the three dimensional object on the screen and visualize the details by moving this design in any fashion on the screen. The data created for drawing in a computer could be manipulated in different ways and different view angles can be created easily. Added to that it is also possible to use this design data to manufacture the part by the conventional approaches or by 3D printing technologies. No doubt one can extract the two dimensional drawings from this three dimensional design done on a computer. Software for this are available and learning to use them is an essential requirement for engineers. This is to be emphasised for all branches other than the Computer Sciences Branch, where it is the main theme. Explain briefly the software tools that could be used for problem solving, Design, Simulation, Optimization, etc.

viii) Other Topics that are of much significance to Engineering

Other areas that are to be discussed with the students include Sustainable Engineering and its importance, Materials in engineering, Measurements, Engineering communication covering graphics, technical writing, technical presentations, group discussions etc.

Role of Humanities in Engineering- Language skill,,Economics and Finance, Management,Social Sciences ,Human psychology, Ethics and values

Business of Engineering – Types of companies, Organization and Management, Finance, Labour, Marketing, Quality, Maintenance, Services, Product life cycle, Patents, Product liability etc

Explain to them the importance of personality development and development of leadership qualities while they are students. Briefly inform them the purpose of introducing activity points in the curriculum. Generally one is rather quick in knowing one's limitations or deficiencies. However understanding the strengths in you takes time. At times this may be too late. Participate in the activities listed and identify the one that gives you confidence. This will allow you to understand you inherent strengths. Added to this, through such activities you hone your personality and leadership qualities beyond your expectations.

ix) Session of KTU Curriculum:

Covering Lecture Courses, Lab courses, Projects, Credits, Evaluation etc.

A) PLEASE KEEP THE DURATION OF THIS PROGRAM FOR TWO DAYS ONLY

First 5 topics could be cover in the first day and the rest in the second day. Faculty for the program could be both from within the college as well as from outside.

B) A Three day bridge program in Mathematics and Sciences (Physics /Chemistry) for students needing such support can also be planned.

