

Handbook for Quality Assurance

It should be borne in mind that purpose of Engineering College is to produce professionals of High calibre to boost Research, Design, Development and Entrepreneurship so as to help building the Nation. The Institutes, therefore, must function as a processing unit which builds all the required capabilities in its students and not just function as a facilitator that bestows Engineering degrees. Therefore, students must have:

- **Acquisitive Capabilities** i.e. the capability to acquire appropriate knowledge, skills and attitudes in the specific domain/discipline which primarily deals with development of learning-to-learn skills in the students to search for, assess and transfer technologies for effective functioning in various functional area like: **R&D, design and drawing, planning, shop-floor management, quality control operations, repair and maintenance, marketing and sales etc.**
- **Adaptive Capabilities** i.e. the flexibility of an individual to use new machines; technologies and processes; systems; graphic tools; internet; patented software and programming languages for modifying existing processes or product design; problem-solving and technology development in the world of work. The individual must be capable of self learning to remain abreast with fast changing technology developments. **Exposure to e-learning and MOOCs (Massive Open Online Courses)** may go a long way to meet this requirement.
- **Operative Capabilities** : i.e. proper understanding of shop-floor operations; knowledge of codes and standards; production management and production engineering; diagnostic skills; project planning; and financial budgeting; quality engineering and total quality management; generic skills of problem-solving; time and stress management; managing change; interpersonal and communication skills for effective functioning in the world of work etc.
- **Innovative Capabilities:** i.e. the ability to think; anticipate future demands; **develop new designs; prototypes, processes and technologies; develop**

creative thinking and problem-solving skills, Reengineering and Reverse Engineering.

ROLES AND RESPONSILITIES OF PRINCIPALS, HODS AND FACULTY

- **Roles and Responsibilities of a Principal:**

- Besides routine management, Principal is the chief executive to monitor teaching-learning process by each department of the institute. Principal is also required to ensure the availability of appropriate infrastructure; faculty (their training and retraining for effective instructional process so as to develop appropriate hard and soft skills in the students leading to their gainful employment). Principal is also supposed to get established linkages with industrial and other organizations for mutual growth and development; monitoring the system; getting collected regular feedback from stakeholders; determining gaps at the institute level and bridging the same and promoting research culture are major responsibilities of a principal, which can be accomplished with help of departmental heads and training and placement division.
- It is important to mention here that preparing students to qualify a written test is not enough to prepare good engineers. The students are required to be given varied learning experiences through laboratories, workshops, project work, industrial training etc. to shape them as good engineers. Therefore, Principal has to see whether students are being given all these experiences by the departments in a planned way.
- The principal is also responsible to maintain the institute's reputation and must ensure that the capabilities of the institute student do not fall below a minimum level even though the students easily qualify the theory exams.

- **Roles and Responsibilities of Head of Department:**

- Head of department have exactly the same roles as that of a principal but are limited to a department level and to assist the Principal to carry out all above functions. Besides this, it is the responsibility of Heads of department to ensure proper planning of entire instructional process(theory and practice); training and retraining of faculty of the department; identification of suitable industrial and field organisations for effective curriculum implementations with specific reference to organizing structured industrial/field visits; structured and supervised industrial training of students and undertaking mutually beneficial project assignment; organizing extension lectures on specialized topics; promoting research culture and consultancy in the department etc.
- In addition, working out transparent and objective formative process of evaluation; performance assessment of students; guidance and counselling of students; record keeping of entire teaching-learning process are most important activities/responsibilities of a departmental head.

- **Roles and Responsibilities of the faculty:**

- Faculty is required to keep themselves abreast with the advances in technology; clear understanding of general and specific objectives of teaching the subject(s) allotted to them and managing teaching-learning process by providing varied learning experiences to students to develop hard and soft skills in them for gainful employment.
- In the respect they should have clear understanding of basic principles of pedagogy for making teaching-learning process effective. Continuing their studies; conducting research in the area of their specialization; performance evaluation of students; guidance and counselling and Effective Mentoring; maintaining a record of the performance of students are some of the important functions of the faculty.

- The faculty must ensure that they are fully aware with the requirements of the industry/world of work by developing close linkages and keep abreast with their requirements by working with them by providing consultancy.
- The faculty must avail benefits of e-learning to explain various theoretical concepts and principles to the students for their better understanding and further by sharing example on how the knowledge gained is applied in the industry, faculty is also required to take full advantage of MOOCs (like NPTEL online Course)for knowledge up gradation and building self-learning skills.

INITIATIVES TO REVAMP THE SYSTEM

a) Training and retraining of faculty for improved instructional processes

- As mentioned above, it is the responsibility of Principal and Heads of Departments to keep the faculty abreast with the latest developments.
- It is essential that the faculty should be competent in domain specific subjects (Theory and Practice), should have appropriate industrial exposure and also should have clear understanding of Applied Aspects of Educational Technology for effective instruction. Besides imparting theoretical instructions, faculty is required to be competent in managing tutorial classes; laboratory/workshop experiences; project work and industrial/practical training of students. They are required to be able to plan entire teaching-learning process. To develop appropriate communication skills, presentation skills, blackboard writing skills, motivational skills, research methodology, student evaluation technique and appropriate attitudes and values.
- Institutes may prepare training roaster in respect of each faculty member and take the help of resource institutions like IITs and other quality improvement centres to train the faculty in a phased manner. The institute is required to keep record of such training initiatives. Sponsorship of faculty for participation in National and International

conferences to share their research experience is another added dimension in training and retraining of faculty.

b) Faculty at Associate Professors, Professor and Principal's Level need to acquire knowledge pertaining to:

- Institutional Management
- Curriculum Development and student evaluation.
- Entrepreneurship development.
- Patent development and registration etc.
- Product Development ,Consultancy etc

c) Laboratory should be treated as a place for discovery learning. Present practical work in labs needs radical change to make it relevant with professional life.

- Each department must identify projects for a particular section every year by consulting industry and other relevant organizations well in advance.

It is important that advance planning is required to organize practical work in laboratories/workshops, project work and industrial training. Proper record is also required to be maintained regarding the conduct of practical work by each student.

IMPROVEMENTS IN TEACHING LEARNING PROCESS

- **Lecture Classes**

- Around 60 to 65% of time in an Engineering college is spent on theoretical instructions which are meant to develop acquisitive capabilities in the students .In the lecture classes we aim at teaching concepts, principles, procedures, and application of a particular subject for developing desired knowledge in the students for application in the Professional world.

- To make students active learners, it is important for the teachers to involve students in teaching learning process by implementing Innovative Teaching Methods. It is also important that students are taken for industrial /field visit to show the application of the subject in the actual world of work, for which advance preparation is required.
- Teachers must ensure to strengthen Internal Assessment by considering Outcome based Education Process. Understanding of blooms Taxonomy is fundamental for all Teachers .
- Teachers are advised not to give their notes to the students in any form. Students are required to prepare their own notes by referring to text book and other resources.
- Teachers are expected to be punctual in taking classes, prepare the lessons thoroughly, encourage students to ask questions, match eye with all students while teaching and have some smile on the face. Teachers are expected to keep record of attendance and progress/performances of each student on regular basis.

Output from Lecture Classes:

Each teacher teaching a subject in a semester may identify application oriented topics.

A student or group of three students may prepare one write up on one topic of their interest by consulting books and other literature per semester and get it signed by the concerned teacher.

This means, a student will develop mastery of topics after completing his/her studies. These write ups are required to be typed and well bound.

Students should carry these write ups in placement interviews to show their output.

- **TUTORIAL CLASSES**

- Tutorial classes aim at developing conceptual understanding in the students regarding concepts, principles, procedures and applications taught by the teacher to the entire class of 60 students.

To make tutorial classes meaningful and motivating, following suggestions are made:

- Tutorial classes should not be used as formal lecture classes. These are meant for students to develop thinking and problem-solving skills.
- Depending on the subject, teachers are expected to formulate chapter-wise tutorial assignments covering the entire syllabus of the subject and ultimately divided into number of tutorials which will be available in a semester. These assignments should be so framed by taking into consideration from simple to complex and may include objective type, short answer type and graded numerical problems.
- Teachers may ensure that students should work independently to solve tutorial assignment and teachers provide only hints to the students where necessary and not the complete solution.
- Teacher should solve the problem only if the whole class is unable to do so.
- Teachers are expected to keep record of the performance of students.

Out Come from Tutorial Classes:

Teachers may ensure that:

Each student should solve problems which based on Practical exposures of a subject involving all concepts, principles and applications.

Each student may keep record of such solutions. This will in still lot of confidence in the students to solve such problems.

- **DRAWING CLASSES**

- Drawing is the mother of engineering profession. All structures and systems are manufactured/fabricated/constructed/installed based on clear understanding of drawings. Materials estimation and preparation of tender documents are also prepared by referring to drawings. It has been observed that majority of engineering students are generally weak in reading and interpreting engineering drawings.

Following suggestions may help the teachers teaching drawing to create conceptual understanding in the students:

- Provide graded i.e. simple to complex exercise for making drawings.
- Ensure that students follow proper signs conventions in preparing the drawings.

Out Come from Drawing Classes

Provide drawings with missing dimensions/views/specifications and ask students to identify the gaps. Therefore stress should be on conceptual understanding of the drawings.

- **LABORATORY CLASSES**

- Laboratory experiences aim at developing clear understandings of concepts, principles, procedures; measurements and testing skills and interpretation of test results as well as Data Analysis skill. Followings suggestions may help to make laboratory experiences purposeful:

- Heads of Departments may ensure that teachers taking laboratory classes should conduct all the experiments by themselves, understand the procedure and application of such experiments in the professional life of students. They should draw conclusions and prepare viva questions to be administered on students after conduct each experiment in the laboratory.
- All teachers/laboratory supervisors should ensure availability of raw material, proper functioning of all machines and equipments before students come for practical work.

- Teachers are expected to prepare an action plan for conducting practical classes so as to ensure that there should not be more than 3-4 students for conducting one experiment.
- Teachers may add some extra new study experiments; e-learning experiments etc to keep the remaining students meaningfully busy rather allowing them to sit idle.
- Check whether students are following correct procedures and taking proper precautions while conducting the experiments.
- Train students to interpret test results.
- Conduct viva voce after each experiment to ensure proper understanding of practical application of each experiment in professional life.
- Maintain proper record of the conduct of each experiment by each student.
- Principals and Heads of Department should regularly monitor the progress of conduct of laboratory sessions.
- Laboratory classes should be considered as places for discovering learning, which require radical changes to promote the concept. Huge equipment is being wasted because of non-usage.

Out come from laboratory

Students may be encouraged to prepare a small diary to maintain specifications and importance of each experiment in the professional life.

• WORKSHOP PRACTICE

- Workshop Practice aims at developing basic manual and machining skills; repair and maintenance skills; time and motion study; habit of following safety precaution and above all dignity of labour in the students.
- Therefore workshop experiences are very important in shaping students as engineers. Workshop practice is also not taken very seriously by majority of engineering colleges. Following suggestions may be useful to make workshop experiences purposeful:

- Prepare a booklet for each shop which provides graded workshop experiences to the students.
- Provide independent task to each student and supervise them independently for correct use of tools and precautions.
- Hold skill competitions from time to time.
- Display good skill work done by the students in the workshops.
- Provide disassemble/assemble as workshop experiences to understand internal mechanism of machines and equipments.
- Encourage students to understand the mechanism of toys.
- Promote prototype development of making utility jobs to save wastage of raw material.
- Keep a record of performance of each student.

Out Come from Workshop Experience

Each student is expected to produce some utility item per semester. This will again in still lot of confidence in the students.

Each department may prepare a list of such utility jobs which will vary from discipline to discipline.

It is also possible to make utility jobs in the other discipline also.

• PROJECT WORK

- Project work forms the most important component of engineering education. Project work aims at developing problem-solving skills, learning-to-learn skills, transfer skills i.e. application of knowledge and skills learnt in solving an open-ended problem, creativity, team spirit, communication and report writing skills.
- Following suggestions may help in making project work as meaningful experience: Provide well thought out project assignment leading to development of competencies for wage and self employment opportunities.

- As far as possible, live problems from the industry/community/institute etc should be explored well in advance which can be given to students as project assignments.
- Project work should match with the interest of students.
- Repetitions of same project work from year to year should be avoided.
- There should not be more than five students for one project.
- Each teacher is expected to guide the project work of students in his/her area of specialization.
- Project work exhibition should be organized every year and best project work should be awarded.

Out Come from Project Work

Each Institute may develop a format for writing project report.

Each student should prepare a project report as per format developed by the Institute. Students should carry project reports with them during placement interviews.

- **INDUSTRIAL TRAINING**

- This is another important experience for the engineering students which are again not given desired attention by majority engineering colleges. It has been gathered that good percentage of students submit fake certificate of having undergone practical training. Such students are deceiving themselves, their parents and the institute. This generally happens when Industrial training is not planned and supervised by the faculty of the institute for some reason or the other.
- Industrial training aims at exposing the students to the size and scale of operations; understanding the functions being performed by engineers in different functional areas; industrial environment; industrial processes and practices; challenges; application of knowledge and skills acquired at the institute to problems of interest to the industry and explore employment opportunities based on the performance in work setting.

- Industrial training should be either task-oriented or problem-solving oriented and be supervised on regular basis by the faculty.
- Industrial establishments, Tasks/problems in these establishments should be selected well in advance and students and faculty should be matched with such tasks/problems.
- Tasks/problems should be such which are beneficial to the industrial/field organizations as well as students.

Outcome from Industrial Training

Department must prepare a format for providing guidance to students to prepare their industrial report.

It is mentioned once again that purpose of industrial training is not to send without any purpose. Purpose is apply the knowledge and the skill attend at the in solving some tasks/problems beneficial to the organization where students are sent for training.

Students' performance should be monitored at regular intervals by the faculty through this process faculty will be exposed to industrial environment as well as guide the students.

Students should prepare industrial report in the prescribed format and they should carry industrial training report with them during placement interviews.

IQAC Coordinator