



# An Automated Report Generating System for Accreditation Process

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**ABSTRACT:** India had witnessed an explosive growth in the number of institutions offering engineering programmes in the last two decades. This unprecedented growth obviously led to several problems with regard to quality of technical education. In order to ensure the quality of technical education, Automation in accreditation established to formulate the criteria or standards, by which individual programmes in any engineering institution can be evaluated. India has recently taken a big leap forward in the area of engineering education by becoming a provisional member of the Washington Accord on 20<sup>th</sup> June 2007. As per the requirement for becoming a full-fledged member of the Washington Accord, the automation in accreditation has revised the procedures and criteria of accreditation to bring it to international standards. The new procedures and criteria of accreditation came to effect from 1st January 2009. This paper presents a comparison of the revised system of accreditation with the earlier system

**KEYWORDS:** Engineering education; quality assurance; accreditation; programme objectives; programme outcomes.

## I. INTRODUCTION

Engineering education has reached high priority in recent years due to the rapid development in technology world over. India has been one of the pioneers of this development. The system of engineering education in India has become a formidable reservoir of technical expertise in terms of the magnitude of human resources and expertise available and of infrastructural facilities created over the last six decades. There has been a steep increase in the growth of engineering institutions in India in the last two decades. This unprecedented growth obviously led to several problems with regard to quality of engineering education.

Improving quality of education offers exceptional benefits to the society. The accumulated knowledge and good skills that are relevant for economic and social development over time represent an important component of human capital. High quality of education equips learners with a diverse set of knowledge and skills that are relevant to the nation on one hand, and to attain levels of international recognition and reputation on the other [1].

## II. ACCREDITATION OF ENGINEERING PROGRAMMES

Quality remains an utmost concern for all engineering educators. A way to assure quality in engineering education system is by adhering to accreditation by a certified body. Accreditation of an engineering educational programme is the primary quality assurance process used to ensure the suitability of programme as the entry route to the engineering profession [2]. Accreditation involves a periodic audit against the present standards of the engineering education provided by a particular programme.

Accreditation is intended to provide degree-granting academic programmes with a credential. The credential can be used by the programmes and their constituencies – the general public, students and prospective students, employers, industry, and governmental bodies – to assess the quality of the programme and the extent to which it achieves its own goals as well as agreed-upon educational standards. The process of accreditation also serves to foster self-



examination by educational institutions;

The value of the accreditation credential depends on the clarity of the description, which defines what it ascertains, the reputation and independence of the accrediting body, the fairness and transparency of the process leading to credential granting, and the time at which the credential was awarded. It has been experienced that credentials provided by non-governmental bodies with a broad base of support by academia, professional associations, governmental agencies and industry tend to be more valuable than those granted by government-dominated bodies or bodies that are controlled by a single industry or a single corporation [3].

At its best, accreditation serves to encourage progress in higher education and increase adaptation of programmes and curricula to new developments in science, technology, and the marketplace. Accreditation can foster the development of more responsive and adaptive programmes, lead to superior pedagogical methods, and make education more exciting, effective, and relevant. At its worst, accreditation can serve as a vehicle to entrench old traditions, perpetuate rigid prescriptions that inhibit innovation and progress, and act as a sinkhole for programme resources that are devoted to over-elaborative preparations for accreditation visits rather than to improvement of education. When misused, accreditation can become an intimidation tool in the hands of the establishment, a mechanism for pressing school administrations for resources, or a vehicle for political manoeuvring [3].

### III. THE AUTOMATION IN ACCREDITATION

The Quality Assessment and Accreditation System for engineering education got off to a start with the Accreditation to periodically conduct evaluation of technical institutions or programmes on the basis of guidelines, norms and standards specified by it. It is dedicated to building a technical education system, as vendors of human resources that will match the national goals of growth by competence, contributions to economy through competitiveness and compatibility to societal development. It provides the quality benchmarks targeted at global and national stockpile of human capital in all fields of technical education [4].

Accreditation means “a process of quality assurance, giving credit where it is due for some clearly visible and demonstrable strategies of academic activities and objectives of the institutions, known to be honestly pursued and efficiently achieved by the resources currently available with a potential for continuous improvement in quality for effective growth”. It is charged with the task of evolving a procedure for assessment of quality in the technical education sector in India on the basis of specified guidelines, norms, benchmarks and criteria. The basic objectives of accreditation are:

- To assist all the stakeholders in technical education (like parents, students, teachers, educational institutions, professional societies, potential employers, Government agencies) in identifying those institutions and their specific programmes which meet the norms, standards and other quality indicators specified from time to time.
- To provide guidelines to the technical institutions for the desirable upgradation of existing programmes and for the development of new programmes.
- To encourage the maintenance of a standard of excellence and to stimulate the process of continual improvements in technical education in the country

It aims to recognize and acknowledge the value addition in transforming the admitted raw student into a capable engineer having sound knowledge of fundamentals and acceptable level of professional and personal competence for ready employability in responsible engineering assignments [5].

### IV. EARLIER SYSTEM OF ACCREDITATION

As per the earlier system of accreditation which came into effect from 1<sup>st</sup> January 2004, the criteria and standards, by which individual programmes in any institution will be judged, have been carefully formulated so as to give a clear and transparent indication of the strengths and weaknesses of the programmes. These are classified into three indices that measure the quality of different aspects of the programmes, viz., Organization / Infrastructure Indices, Academic Performance Indices and Industry Interaction Indices. Eight criteria were evolved for the measurement of performance under these indices as shown in Table I. Various parameters were defined for assessing the quality of a programme under these criteria. Table I also shows the number of parameters assessed under each criterion.

Although it has taken into account international practices in arriving at these criteria and adapted them to suit Indian conditions, a few major deficiencies seem to have crept into the assessment of engineering education programmes based on these criteria [6]. They are:

- Assessment criteria are largely oriented to determine various parameters of the programmes / institutions related to accreditation approval process, rather than to evaluating programme outcomes, so necessary for their quality assessment



**Table I**  
**Criteria And Parameters Used In The Earlier System of Accreditation**

No.	Criterion	Weights	No. of Parameter
1.	Organization and Governance	80	9
2.	Financial Resources, Allocation and Utilization	70	9
3.	Physical Resources	50	4
4.	Human Resources: Faculty & Staff	200	8
5.	Human Resources: Students	100	4
6.	Teaching – Learning Processes	350	7
7.	Supplementary Processes	50	7
8.	Research & Development and Interaction Effort	100	
	<b>Total</b>	<b>1000</b>	<b>56</b>

- Inadequate importance given to curriculum structure, content, professional component, testing and achievement

In the criterion on teaching – learning process, resulting in some gaps in its evaluation.

- The assessment criteria followed have many limitations, as colleges in India being generally of the affiliated type; do not have control on student admissions, academic calendar, curriculum, examination system, degree award and related activities.
- Absence of scientific / technical basis for giving proportional weights to different criteria and using the scores in such proportion to determine the accreditation status of a programme.
- Compliance of each criterion for deciding the accreditation status of a programme not given importance, leading to doubts over error-free certification of the status.
- Orientation / training of assessors to serve as experts in visiting teams inadequate, leading to doubts on their fairness and accuracy of giving marks at criterion / sub- criterion levels.

## V. SOFTWARE REQUIRMENT

### 1. Vision, Mission and Program Educational Objectives

This will require adding the mission, vision and objectives of institute & courses. Here Institute Vision and Mission statements will be stored to ensure consistency with the department Vision and Mission statements; the assessment of the Vision and Mission will be done here. Also it will require the places where the mission and visions would be published in order to display the effective process implementation.

### 2. Program Curriculum and Teaching-Learning Processes

It will define the process for designing the program curriculum which will periodically documents & demonstrates how the curriculum is evolved considering the program outcomes and program specific outcomes. It will also require teaching and learning process and the evaluation of the student's assignment and evaluation. It will also have requirement for quality of student projects and initiatives related to industrial interaction and industrial training.

### 3. Course Outcomes and Program Outcomes

It will require correlation between the program outcome and program specific outcome. It also has assessment tools and process to gather data upon evaluation of course outcome. It requires self attainment levels and records the attainment process in order to measure the similarity. Type of survey and the location of source also would be required. Direct attainment and indirect attainment of PO & PSO needs to be determined. Attainment and assessment of program outcomes & program specific outcomes. Provide result of evaluation for each PO & PSO. This will have attainment results of students by direct (student performance) and indirect (surveys) to be presented through program level course PO & PSO

### 4. Students' Performance

Information to be provided for all shifts with explicit headings, data to be added for sanctioned intake, total no of students admitted in firsts year minus total no of students migrated. No of students admitted in second year via lateral



entry, total no of students in separate divisions and total no of students admitted in program. Success rate with and without backlogs in any semester of study. Assessment of students performance. Student faculty ratio, students inter college competitions, industrial interactions.

### 5. Faculty information and contributions

Generation of faculty ratio based on no. of students which includes 0020 professors, associate professors, assistant professor. Qualification of faculty is also required with faculty retention and faculty competencies in correlation to program specific criteria.

Innovations done by faculty in learning and training , participation in faculty development programs. Research activities done with sponsored and un sponsored research. Information of visiting faculties.

### 6. Facilities and Technical Support

It requires information of no of laboratories with facilities available in laboratories. Also information about safety measures and maintenance of laboratories with technical manpower allot to each of laboratories.

### 7. Continuous Improvement

It requires information related to actions taken on results of evaluation of each of Co, PO & PSO's. Attainment level & Actions of improvement. Auditing of academics and actions taken to improvement during period of assessment. Improvement in quality of students admitted to program.

## VI. ANALYSIS

### 1. Vision, Mission and Program Educational Objectives

Vision statement typically indicates aspirations and Mission statement states the broad approach to achieve aspirations. Here Institute Vision and Mission statements have been asked to ensure consistency with the department Vision and Mission statements; the assessment of the Institute Vision and Mission will be taken up in Criterion. State the PEOs of program seeking accreditation. Describe where (websites, curricula, posters etc.) the Vision, Mission and PEOs are published and detail the process which ensures awareness among internal and external stakeholders with effective process implementation. Internal stakeholders may include Management, Governing Board Members, faculty , support staff, students etc. and external stakeholders may include employers, industry, alumni, funding agencies, etc. Articulate the process involved in defining the Vision and Mission of the department and PEOs of the program.

### 2. Program Curriculum and Teaching – Learning Processes

Describe the process that periodically documents and demonstrates how the program curriculum is evolved considering the POs and PSOs. # Seminars, project works may be considered as practical. Process used to identify extent of compliance of the curriculum for attaining the Program Outcomes and Program Specific Outcomes.

Processes may include adherence to academic calendar and improving instruction methods using pedagogical initiatives such as real world examples, collaborative learning, quality of laboratory experience with regard to conducting experiments, recording observations, analysis of data etc. encouraging bright students, assisting weak students etc. The implementation details and impact analysis need to be documented.

Mention the initiatives, implementation details and analysis of learning levels related to quality of semester tests, assignments and evaluation

Quality of the project is measured in terms of consideration to factors including, but not limited to, environment, safety, ethics, cost, type (application, product, research, review etc.) and standards. Processes related to project identification, allotment, continuous monitoring, evaluation including demonstration of working prototypes and enhancing the relevance of projects. Mention Implementation details including details of POs and PSOs addressed through the projects with justification

Give details of the industry involvement in the program such as industry-attached laboratories, partial delivery of appropriate courses by industry experts etc. Mention the initiatives, implementation details and impact analysis  
Mention the initiatives, implementation details and impact analysis

### 3. Course Outcomes and Program Outcomes

Accreditation defined Program Outcomes as mentioned in Annexure I and Program Specific Outcomes as defined by the Program. Six to ten matrices of core courses are to be mentioned with at least one per semester. Select core courses to demonstrate the mapping/correlation with all POs and PSOs. Number of Outcomes for a Course is expected to be around 6.

Correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) ; 2: Moderate (Medium)

3: Substantial (High)



Describe different assessment tools (semester end examinations, mid-semester tests, laboratory examinations, student portfolios etc) to measure the student learning and hence attainment of course outcomes. (Student portfolio is a collection of artifacts that demonstrate skills, personal characteristics and accomplishments created by the student during study period.

The process adopted to map the assessment questions, parameters of assessment rubrics etc. to the course outcomes to be explained with examples. The process of data collection from different assessment tools and the analysis of collected data to arrive at CO attainment levels need to be explained with examples

Program shall set Course Outcome attainment levels for all courses.

Measuring Course Outcomes attained through Semester End Examinations (SEE)

Target may be stated in terms of percentage of students getting equal or more than the target set by the Program in SEE for each CO.

Measuring CO attainment through Cumulative Internal Examinations (CIE)

Target may be stated in terms of percentage of students getting more than class average marks or set by the program in each of the associated COs in the assessment instruments (midterm tests, assignments, mini projects, reports and presentations etc. as mapped with the COs)

Describe the assessment tools and processes used to gather the data upon which the evaluation of each of the Program Outcomes and Program Specific Outcomes is based indicating the frequency with which these processes are carried out. Describe the assessment processes that demonstrate the degree to which the Program Outcomes and Program Specific Outcomes are attained and document the attainment levels

The attainment levels by direct (student performance) and indirect (surveys) are to be presented through Program level Course-PO&PSO matrices as indicated.

Mention the type of survey conducted and the location of its source

C101, C102 are indicative courses in the first year. Similarly, C409 is final year course.

- Direct attainment level of a PO/PSO is determined by taking average across all courses addressing that PO/PSO.
- Indirect attainment level of a PO/PSO is determined based on the student exit surveys, employer surveys, co-curricular activities, extracurricular activities etc.

#### 4. Students' Performance

Information to be provided cumulatively for all the shifts with explicit headings, wherever applicable. Sanctioned intake of the program, Total number of students admitted in first year minus number of students migrated to other programs/institutions, plus no. of students migrated to this program, Number of students admitted in 2nd year in the same batch via lateral entry, Separate division students, if applicable, Total number of students admitted in the Program. Students enrolled at the First Year Level on average basis during the previous three academic years starting from current academic year.

Success rate without backlogs in any semester/year of study (15)

SI= (Number of students who have graduated from the program without backlog)/(Number of students admitted in the first year of that batch and actually admitted in 2nd year via lateral entry and separate division, if applicable)

Average SI = Mean of Success Index (SI) for past three batches

Success rate without backlogs in any semester/year of study = 15 × Average SI

Success rate in stipulated period of study [Total of with backlog + without backlog]

SI= (Number of students who graduated from the program in the stipulated period of course duration)/ (Number of students admitted in the first year of that batch and actually admitted in 2nd year via lateral entry and separate division, if applicable)

Average SI = mean of Success Index (SI) for past three batches Success rate = 5 × Average SI Academic Performance in Second Year

Academic Performance = Average API (Academic Performance Index), where API = ((Mean of 2<sup>nd</sup> Year Grade Point Average of all successful Students on a 10 point scale) or (Mean of the percentage of marks of all successful students in Second Year/10)) x (number of successful students/number of students appeared in the examination) Successful students are those who are permitted to proceed to the Third year. Professional societies/chapters and organizing engineering events Publication of technical magazines, newsletters, etc. The Department shall list the publications mentioned earlier along with the names of the editors, publishers, etc. Participation in inter-institute events by students of the program of study (10)

The Department shall provide a table indicating those publications, which received awards in the events/conferences organized by other institutes)

#### 5. Faculty information and contributions

All the faculty whether regular or contractual (except Part-Time), will be considered. The contractual faculty (doing away with the terminology of visiting/adjunct faculty, whatsoever) who have taught for 2 consecutive semesters in the corresponding academic year on full time basis shall be considered for the purpose of calculation in the Faculty Student



Ratio. However, following will be ensured in case of contractual faculty:

- i. Shall have the accreditation prescribed qualifications and experience.
- ii. Shall be appointed on full time basis and worked for consecutive two semesters during the particular academic year under consideration.
- iii. Should have gone through an appropriate process of selection and the records of the same shall be made available to the visiting team. The reference Faculty cadre proportion is 1(F1):2(F2):6(F3)

F1: Number of Professors required =  $1/9 \times$  Number of Faculty required to comply with 20:1 Student- Faculty ratio based on no. of students (N) as per 5.1

F2: Number of Associate Professors required =  $2/9 \times$  Number of Faculty required to comply with 20:1 Student-Faculty ratio based on no. of students (N) as per 5.1

F3: Number of Assistant Professors required =  $6/9 \times$  Number of Faculty required to comply with 20:1 Student-Faculty ratio based on no. of students (N) as per 5.1

List the program specific criteria and the competencies (specialization, research publications, course developments etc.,) of faculty to correlate the program specific criteria and competencies.

Innovations by the Faculty in teaching and learning shall be summarized as per the following description.

Contributions to teaching and learning are activities that contribute to the improvement of student learning. These activities may include innovations not limited to, use of ICT, instruction delivery, instructional methods, assessment, evaluation and inclusive class rooms that lead to effective, efficient and engaging instruction. Any contributions to teaching and learning should satisfy the following criteria:

- The work must be made available on Institute website
- The work must be available for peer review and critique
- The work must be reproducible and developed further by other scholars
- The department/institution may set up appropriate processes for making the contributions available to the public, getting them reviewed and for rewarding. These may typically include statement of clear goals, adequate preparation, use of appropriate methods, significance of results, effective presentation and reflective critique
- A Faculty scores maximum five points for participation
- Participation in 2 to 5 days Faculty/ Faculty development program: 3 Points
- Participation >5 days Faculty/ Faculty development program: 5 points

Academic research includes research paper publications, Ph.D. guidance, and faculty receiving Ph.D. during the assessment period.

- Number of quality publications in refereed/SCI Journals, citations, Books/Book Chapters etc.
- Ph.D. guided /Ph.D. awarded during the assessment period while working in the institute. All relevant details shall be mentioned.

• Funded research from outside:

(Provide a list with Project Title, Funding Agency, Amount and Duration) Funding Amount (Cumulative during CAYm1, CAYm2 and CAYm3):

Amount > 50 Lakh – 20 Marks,

Amount > 40 and  $\leq$  50 Lakh – 15 Marks, Amount > 30 and  $\leq$  40 Lakh – 10 Marks, Amount  $\geq$  15 and  $\leq$  30 Lakh – 5 Marks, Amount < 15 Lakh – 0 Marks

Provide details:

- Product Development
- Research laboratories
- Instructional materials
- Working models/charts/monograms etc.

(Provide a list with Project Title, Funding Agency, Amount and Duration)

Funding Amount (Cumulative during CAYm1, CAYm2 and CAYm3): Faculty members of Higher Educational Institutions today have to perform a variety of tasks pertaining to diverse roles. In addition to instruction, Faculty members need to innovate and conduct research for their self-renewal, keep abreast with changes in technology, and develop expertise for effective implementation of curricula. They are also expected to provide services to the industry and community for understanding and contributing to the solution of real life problems in industry. Another role relates to the shouldering of administrative responsibilities and co-operation with other Faculty, Heads-of-Departments and the Head of Institute. An effective performance appraisal system for Faculty is vital for optimizing the contribution of individual Faculty to institutional performance.

The assessment is based on:

- A well-defined system for faculty appraisal for all the assessment years (5)
- Its implementation and effectiveness (5)

Adjunct faculty also includes Industry experts. Provide details of participation and contributions in teaching and learning and /or research by visiting/adjunct/Emeritus faculty etc. for all the assessment years:



- Provision of visiting/adjunct faculty (1)
- Minimum 50 hours per year interaction with adjunct faculty from industry/retired professors etc.

### 6. Facilities and Technical Support

It requires information of no of laboratories with facilities available in laboratories. Also information about safety measures and maintenance of laboratories with technical manpower allot to each of laboratories.

- Name of the Laboratory
- No. of students per setup (Batch Size)
- Name of the Important equipment
- Weekly utilization status (all the courses for which the lab is utilized)
- Name of the technical staff
- Staff Designation
- Staff Qualification
- Safety measures

### 7. Continuous Improvement

Identify the areas of weaknesses in the program based on the analysis of evaluation of COs, POs & PSOs attainment levels. Measures identified and implemented to improve POs & PSOs attainment levels for the assessment year including curriculum intervention, pedagogical initiatives, support system improvements, etc.

Course outcomes for a laboratory course did not measure up, as some of the lab equipment did not have the capability to do the needful (e.g., single trace oscilloscopes available where dual trace would have been better, or, non-availability of some important support software etc.). Action taken—Equipment up-gradation was carried out (with details of up-gradation)

Academic Audit system/process and its implementation in relation to Continuous Improvement

Assessment is based on improvement in:

- Placement: number, quality placement, core industry, pay packages etc.
- Higher studies: performance in GATE, GRE, GMAT, CAT etc., and admissions in premier institutions
- Entrepreneurs

Assessment is based on improvement in terms of ranks/score in qualifying state level/national level entrances tests, percentage marks in Physics, Chemistry and Mathematics in 12<sup>th</sup> Standard and percentage marks of the lateral entry students.

## VII. CONCLUSION

Automation in accreditation is entrusted with the task of evolving a procedure for quality assessment in the engineering education sector and to assist the stakeholders in technical education to identify those institutes and their programmes which meet the quality benchmarks setup by international agencies. The process of accreditation is being reviewed periodically to make it reach the new global standards, so that many of the institutions will be accredited and India can become a full-fledged member of the prestigious Washington Accord. The system of accreditation should be continuously reviewed to enhance its validity, reliability and usability and bring it on par with international standards.

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