Accreditation of Undergraduate Engineering Degree Programmes in India: Changes due to Washington Accord

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Abstract: This paper discusses accreditation instruments which were being used in India for accreditation of under-graduate degree programs, and changes made in the same recently as a move towards India becoming a member of Washington Accord. It brings out some important features of the new instruments, and makes suggestions to implement the same. It also raises a few pertinent issues which need attention.

Keywords: Continuous improvement, Programme Educational Objectives, Accreditation, Washington Accord.

I– INTRODUCTION

All India Council for Technical Education (AICTE) was set-up before Indian independence in November 1945, as a national level Apex Advisory Body to conduct survey on the facilities of technical education and to promote development in the country in a coordinated and integrated manner [1]. Before independence, there were very few engineering degree colleges in India. After independence and during fifties, a few institutions were established mainly by the Government of India, State Governments and charity trusts. These colleges used to invite visiting teams from Institution of Engineers (India) to evaluate them. After the favourable findings of the visiting teams, degrees awarded by these colleges were considered equivalent to Sections A & B of AMIE [Associate Membership of Institution of Engineers (India)].

During sixties and seventies, there was almost a constant rate of increase of engineering colleges in the country. A sudden spurt in establishment of self-financed colleges occurred during eighties, mainly in South India and Maharashtra. [2]. This ‘mushroom growth of colleges’, in an unplanned manner was considered a serious matter by the Government of India. It wanted to put a check on it. The Ministry of Human Resource Development of Government of India constituted a National Working Group to look into the role of AICTE in the context of proliferation of technical institutions, maintenance of standards and other related matters. On the recommendations of the Working Group, AICTE Act No. 52 of 1987 was passed by Indian parliament and Act came into force from March 28, 1988. AICTE became a statutory body with necessary authority for the promotion of qualitative improvement of technical education in relation to planned quantitative growth and the regulation and proper maintenance of norms and standards for making it more effective. [1, 3]

Although AICTE has the power to sanction the establishment of new institutions, starting of new programmes in an institution and permitting increased intakes etc., it constituted a National Board of Accreditation (NBA) in 1994 for the purpose of accreditation of various diplomas to post-graduate degree programmes in Engineering and Technology, Management, Pharmacy, Architecture, Town Planning and related disciplines in India.

NBA Manual of Accreditation [4, Page 1, paragraph 2] states “Accreditation is a process of quality assurance, whereby a programme in an approved institution is critically appraised at intervals not exceeding six years to verify that the institution or programme meets the Norms and Standards prescribed by the AICTE from time to time. Accreditation does not seek to replace the system of award of Degrees and Diplomas by the Universities and Boards of Technical Education. But, accreditation provides quality assurance that the academic aims and objectives of the Institution are known to be honestly pursued and effectively achieved by the resources currently available, and that the institution has demonstrated capabilities to ensure effectiveness of the educational programme(s), over the validity period of accreditation.”

With India planning to be a member country for Washington Accord [5], major changes have been made in the Accreditation philosophy and process. It can be seen what NBA states on its website now [6] “Accreditation is a process in which certification of competency, authority, or credibility is presented. Educational accreditation is a type of quality assurance process under which services and operations of an educational institution or program...
are evaluated by an external body to determine if applicable standards are met. If standards are met, accredited status is granted by the agency.” These changes relate primarily to outcome based evaluation, which is in tune with Washington Accord [5] and ABET [7].

The purpose of this paper is to draw attention to these major changes in accreditation process, so that management of institutions, faculty, staff and students prepare themselves for accreditation based on new guidelines. It also brings out the necessity of drawing attention of evaluators to these changes so that they are able to do accreditation in the right spirit.

II– PREVIOUS SYSTEM OF ACCREDITATION

Criteria for Accreditation prescribed by NBA and the corresponding marks for the accreditation process being followed up till now are given in Table 1 from [4]. Institutions were expected to fill up two proformas; one related to Institutional Information and the other related to Programme being accredited. These proformas were being submitted to NBA, and were being provided to accreditation team members visiting an Institution for the purpose of accreditation. The team members would visit the Institution, visit the concerned department and see central facilities, look into the various documents, and interact with management, faculty, supporting staff, alumni, employers and parents/guardians. Based on inputs from all these sources, the team members would submit their report.

Document which was made available to the institutions by NBA contained:

Section I : Accreditation Process- This contained information about the total process.

Section II : Criteria and Weightages- This contained information about various criteria and their weightages. As can be seen in Table 1, maximum weightage (70%) was for Academic Performance Indices, and in that too teaching-learning processes had major share (35%).

Table 1: Criteria and Marks Allotted for NBA Accreditation

<table>
<thead>
<tr>
<th>Indices</th>
<th>Criteria and sub-criteria</th>
<th>Maximum marks allotted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization/ infrastructure</td>
<td>Organization and governance</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Financial resources allocation and utilization</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Physical resources (central facilities)</td>
<td>50</td>
</tr>
<tr>
<td>Academic performance</td>
<td>Human resources - faculty and staff</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>Human resources - students</td>
</tr>
<tr>
<td></td>
<td>VI</td>
<td>Teaching-learning processes</td>
</tr>
<tr>
<td></td>
<td>VII</td>
<td>Supplementary processes</td>
</tr>
<tr>
<td></td>
<td>VIII</td>
<td>Research and development and interaction effort</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>1000</td>
</tr>
</tbody>
</table>

Section III : Academic Proformas- This section contained proformas related to the institution and program to be accredited.

Section IV : Accreditors manual-This provided useful information to Accreditors. However, this information was useful to institutions also, because it provided guidance on what institutions should keep ready for Accreditation team.

III– WASHINGTON ACCORD AND NEW SYSTEM OF ACCREDITATION

The Washington Accord, signed in 1989, recognizes substantial equivalence in the accreditation of qualifications in professional engineering degrees normally of four years duration. It is an agreement between the bodies responsible for accrediting professional engineering degree programmes in each of the signatory countries. It recommends that graduates of accredited programs in any of the signatory countries be recognized by the other countries as having met the academic requirements for entry to the practice of engineering. [5]

Signing the accord by India will enhance global mobility of the engineering graduates from India who can pursue further studies or take up jobs in the signatory countries. At present full members of the accord are; Australia, Canada, Taipei, Hong Kong, Ireland, Japan, Korea, Malaysia, New Zealand, Singapore, South Africa, United Kingdom and United States. India became a provisional member of Washington Accord countries in 2007. With NBA changing its accreditation norms to bring them at par with global standards, India’s chances to become a full-fledged member of the Washington Accord has brightened.

NBA has completely changed its guideline documents so that accreditation process is in tune with the Washington Accord. The new documents made available are [8]:

1. Evaluation Guidelines: This gives various criteria of evaluation and the maximum points for each criterion. Table II summarizes this information. It also gives guidelines for evaluation for each of the sub-criterion. Some of these will be discussed later. Appendix I of this document is a very critical input related to Program Educational
Objectives (PEOs) and Outcomes. These are new concepts for degree awarding institutions, though these concepts in some form or other existed in polytechnic system in India. Also some sample Assessment Plans have been included.

2. Evaluation Report: It gives in a very comprehensive manner criteria for which evaluators have to award points. Criteria here are same as in Table II of this paper.

3. Self Assessment Report: It has two sections; one related to the Institution and other related to the program. These proformas have to be filled and sent to the NBA before the visit. Proformas have been developed in such a way that all the information is collected objectively, so that giving points by evaluators becomes easy. List of documents to be made available to the accreditation team has also been specified clearly.

IV – COMPARISON OF NEW AND OLD ACCREDITATION SYSTEMS

Comparing earlier and new accreditation systems it can be seen that in the new system, some completely new aspects have been included,

Table II: Criteria in New System of Accreditation and Maximum and Minimum Qualifying Points [8]

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Points Max</th>
<th>Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Organization and Governance, Resources, Institutional Support, Development and Planning</td>
<td>I-I.1 Campus Infrastructure and facility</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>I-I.2 Organization, governance and transparency</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I-I.3 Budget allocation and utilization</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I-I.4 Library</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I-I.5 Academic support units and common facilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I-I.6 Internet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I-I.7 Co-curricular and extra-curricular activities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I-I.8 Career guidance, Training placement and Entrepreneurship cell</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I-I.9 Safety norms and checks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I-I.10 Emergency medical care and first-aid</td>
<td></td>
</tr>
<tr>
<td>II. Evaluation and Teaching-Learning Process</td>
<td>II-I.1 Evaluation system</td>
<td>175</td>
</tr>
<tr>
<td></td>
<td>II-I.2 Tutorial classes/ remedial classes/ mentoring</td>
<td></td>
</tr>
<tr>
<td>III. Students’ Entry and Outputs</td>
<td>III-P.1 Students admission</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>III-P.2 Success Rate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>III-P.3 Academic performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>III-P.4 Placement and higher studies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>III-P.5 Professional activities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>III-P.6 Students’ Project Quality</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV-P.1 Faculty in position (Teacher-student ratio)</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>IV-P.2 Faculty in position: Cadre Ratio</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV-P.3 Faculty qualifications</td>
<td></td>
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<tr>
<td></td>
<td>IV-P.4 Faculty retention</td>
<td></td>
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<tr>
<td></td>
<td>IV-P.5 Research publications and IPR</td>
<td></td>
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<tr>
<td></td>
<td>IV-P.6 Externally funded R &amp; D projects and consultancy work</td>
<td></td>
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<tr>
<td></td>
<td>IV-P.7 Interaction of faculty members with outside world</td>
<td></td>
</tr>
<tr>
<td></td>
<td>V-P.1 Class rooms</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>V-P.2 Faculty rooms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>V-P.3 Laboratories including computing facility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>V-P.4 Technical</td>
<td></td>
</tr>
</tbody>
</table>

(447)
manpower support

VI. Continuous Improvement

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Description</th>
<th>Improvement in Success Index of students</th>
<th>Improvement in academic performance of students</th>
<th>Enhancement of faculty qualification and retention</th>
<th>Improvement in Faculty Activities in research, publications, R&amp;D work and consultancy, interaction</th>
<th>Continuing education</th>
<th>New facility created</th>
<th>Overall improvement since last accreditation, if, any, otherwise since</th>
</tr>
</thead>
<tbody>
<tr>
<td>VI-P.1</td>
<td></td>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>VI-P.2</td>
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<td>VI-P.3</td>
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<td>VI-P.4</td>
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<td>VI-P.5</td>
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<td>VI-P.6</td>
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</tbody>
</table>

VII. Curriculum

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VII-P.1</td>
<td>Contents of basic sciences, HSS, professional core, and electives, and breadth</td>
</tr>
<tr>
<td>VII-P.2</td>
<td>Emphasis on laboratory and project work</td>
</tr>
<tr>
<td>VII-P.3</td>
<td>Curriculum updates and PEO reviews</td>
</tr>
<tr>
<td>VII-P.4</td>
<td>Additional contents to bridge the gap</td>
</tr>
</tbody>
</table>

VII-P.1  | Contents of basic sciences, HSS, professional core, and electives, and breadth |

VIII. Program Educational Objectives (PEOs)- their compliance and Outcomes

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIII-P.1</td>
<td>Course objectives and mapping</td>
</tr>
<tr>
<td>VIII-P.2</td>
<td>Assessment outcomes</td>
</tr>
<tr>
<td>VIII-P.3</td>
<td>Mapping with faculty expertise</td>
</tr>
</tbody>
</table>

VI-P.4 Mapping with outcomes

VIII-P.5 Significant achievements

Total 1000 600*

750**

* Provisionally accredited for next 2 years
** Accredited for 5 years.

(a) Concepts of Program Educational Objectives (PEOs), Outcomes and Objectives have been introduced. Figure 1 explains these concepts. Each course in a program will have its objectives i.e. what a student would be able to do at the end of the course. All these objectives must lead to Program Outcomes i.e. what a student would be able to do after the total program. PEOs are the expected achievements of graduates within first few years of their graduation from the program.

Figure 1: Relationship between Individual Course Objectives, Program Outcomes and PEOs

As seen in Table II, Criterion VIII, mapping of PEOs with Program Outcomes, Course Objectives, Assessment and Faculty Expertise are required. Although affiliating universities are expected to develop course objectives, program outcomes and PEOs, it does not seem that the Universities will be able to undertake this task in near future, thus institutions themselves will have to undertake this work.

(b) Continuous Improvement in various aspects is expected as can be seen in Criterion VI. In this case, points are to be awarded on the basis of rate of improvement over three years. Points are zero for negative gradient as well as for a zero gradient. This aspect of continuous improvement has been introduced from concepts of Total Quality Management.

(c) Aspect of Curriculum has to be considered as seen in Criterion VII. Although institutions under an affiliating university do not have much control on the syllabus content and they have to see that syllabus content is delivered in classrooms and laboratories, institutions will have to undertake PEO reviews and make provision for additional contents to bridge the gap, if there is any.

(d) To make the evaluation transparent, and objective, assessment points have been clearly specified for each sub-criteria. Some indexes and measures have been defined and introduced. Although some of these aspects were there in the earlier accreditation instruments also, ambiguities were noticeable. A few of these are discussed below Numbering...
system corresponds to what is given in [8].

(i) II-1.5 & IV-P.3 Assessment of faculty qualifications = C * FQI / N, where

FQI = Faculty qualification index
   = (10x + 6y + 3z) / N, where
x = No. of faculty members with Ph.D.
y = No. of faculty members with M.E. / M.Tech.
z = No. of faculty members with B.E. / B.Tech. Also M.Sc. / M.A. for I year
N = Total no. of faculty members
C = A constant equal to 1 when First year classes are considered, and equal to 4 when program related second, third and fourth year classes are considered.

If all the faculty members are Ph.D., x = N, y and z = 0, and FQI = 10, and points = 10 for the first year and 40 for the program evaluation.
If all the faculty members are M.E. / M.Tech., y = N, x and z = 0. In this case FQI = 6, and points = 6 for the first year and 24 for the program.
If all the faculty members are B.E., B.Tech., or M.Sc. / M.A. (for I year); z = N, and x and y = 0. In this case FQI = 3, and points = 3 for the first year and points = 12 for the program.

It can thus be seen that faculty qualifications are going to be a very important factor for the first year as well as for the program assessment.

(ii) II-1.6 Academic performance in First Year Common Courses
Assessment points = 40 * FYSI
FYSI = First year success index = (No. of students clearing all subjects in first attempt / Total no. of students admitted)

This index can be considered as a good measure of success of students in the First Year.

(iii) III- P.2 Success Rate
Assessment points for Success Rate = 30 * Mean of Success Index (SI) for past 3 batches
SI = (No. of students who cleared the program in the minimum period of course duration) / (No. of students admitted in the first year of the batch)

This measure assumes that in the best case all the students must pass during minimum period of course duration.

(iv) III- P.3 Academic Performance
Assessment points = 3 * API
API = Assessment Performance Index = (Mean of % marks of all students/10) or (Mean of CGPA average of all the points on a 10 point scale)

This measure judges how close the total population is about 100% marks or CGPA of ten (10).

(v) III-P.4 Assessment points for placement and higher studies = 40* (x + 1.25y)/100,
where x = % of students placed, and y = % of students admitted for higher studies, subject to maximum assessment points = 30

It can be observed that a lot of emphasis has been put on higher studies, as it has more weight. In the earlier accreditation criteria, higher studies by students were not included.

(vi) IV-P.1 Faculty in position: Teacher-student ratio (TSR)
Assessment points for TSR = 20* TSR/ 15, subject to maximum TSR = 15, where

TSR = (x + y + z) / N
x = No. of students in 2nd year of the program
y = No. of students in 3rd year of program
z = No. of students in 4th year of program
N = Total no. of faculty members in the program

According to the above formula, it can be observed that if a program has more students and fewer teachers, it would get more assessment points as compared to the program which has more number of teachers for the same number of students. Formula as given will have to be looked into and modified.

TSR as defined is not Teacher-student ratio; it is Student-teacher ratio (STR). If it is assumed that desirable student-teacher ratio (STR) is 15 or less; the formula could be modified as

Assessment points for STR = 20 * 15/ STR, with maximum points = 20.

In this case, if STR is greater than 15, points will be less than 20, and if STR is 15 or less, points would be twenty (20).

(vii) IV-P.2 Faculty in position: Cadre Ratio
Assessment points = 20 * CRI, where
CRI = Cadre Ratio Index
= 2.25 (2x + y) / N, subject to maximum CRI = 1.0

In the above formula; x = No. of professors in the program
y = No. of readers in the program
N = Total no. of faculty members in the program

It can be seen that, if the desirable ratio of (Professors: Readers: Lecturers) = (1:2:4), is maintained, CRI would work out to be 1.26, which would be taken as one, and assessment points would be 20.

(viii) IV-P.4 Faculty Retention
Assessment points = 4 * RPI / N,
where RPI = Retention Point index = Points assigned to all faculty

Points assigned to a faculty = 1 point for each year of experience at the institute but not exceeding 5 points

(449)
Faculty retention is becoming a real problem these days, though it is an important factor for ensuring continuity and creating a culture of their own in various engineering departments.

Another interesting point which has been introduced in the documentation relate to removing ambiguities about year of reporting. Academic related data have to be given for Academic years and Finance related data have to be given for financial years. Also term ‘Latest Year of Graduation (LYG)’ has been introduced to remove ambiguity.

In the earlier proformas, there was confusion about the years. Usually, academic year will be from July to June, financial year from April to March. Latest Year of Graduation for Academic year (2011-12) would be (2010-11).

N = Total no. of faculty members
One of the most critical criteria is Criterion IV: Faculty Contributions. For this criterion, 150 points have been specified, and a department has to obtain minimum 100 points, based on the record of past 3 years. Departments will usually be able to meet norms for faculty in position (teacher-student ratio & cadre ratio), but it will be almost impossible for them to score reasonable points under other heads. To satisfy criterion of ‘Faculty qualifications’ is difficult. Availability of suitable M.Tech. and Ph.D. faculty is a nightmare, even when institutions are prepared to pay them reasonably well. Institutions like IITs and NITs which have to provide this manpower are unable to cater to this need. Quality of M.Tech. passouts from private universities is questionable. A serious thought will have to be given by AICTE and NBA to this issue. Where from these suitable M.Tech. & Ph.D. candidates come? M.Tech. programs in self-financed institutions, where a candidate is expected to study full-time and also pay heavy fees seems to be unworkable. Alternative methodology, including distance or open mode may have to be worked out. But this will require serious thought by affiliating universities and AICTE, which do not seem to be in favour of this mode. It may be a much better option than what is possibly happening at present in most of the institutions.

Faculty retention is a phenomenon for which there does not seem to be any solution in sight for most of even good performing institutions. Many fresh graduates take to teaching as a stop gap arrangement. There is no alternative for institutions but to take fresh graduates every year for running their academic programs, as many recruited previously usually find some other avenue, including higher studies.

A culture of ‘Research publications and IPR’, Externally funded R&D projects and consultancy work, and ‘Interaction of faculty members with outside world’ are distant dreams even in most of the good performing institutions. With usually 50% new faculty every year, these are difficult propositions.

It seems to the author that very few programs in the country will be able to score minimum points under this head. for the present.

Alternative methodology, including distance or open mode may have to be worked out. But this will require serious thought by affiliating universities and AICTE, which do not seem to be in favour of this mode. It may be a much better option than what is possibly happening at present in most of the institutions.

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be done jointly by AICTE and NBA, so that institutions become
aware of what they have to do in the near future at all level.
A thorough staff development activity will have to be undertaken
by NBA to make their pool of visiting tram members aware
about the changes made, and how valid and reliable data would
be obtained by visiting teams. NITTTRs could become resource
institutions for this purpose also.

CONCLUSIONS

New documents for Accreditation of Engineering (UG)
programs in India containing instruments developed by various
committees and expert groups of NBA have been discussed in
this paper, in the context of old Accreditation Manual and
emerging scenario of India opting to become member of
Washington Accord. The instruments developed make the
process of accreditation more objective and transparent. The
effort by different committees for developing these instruments
is highly commendable. In the paper, some modifications have
been suggested, and some issues have been raised which may
influence the proper implementation of the new Accreditation
Guidelines.

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