

Planning a UG Course in Engineering for Outcome-Based Education

Alok Mathur

Department of Mechanical Engineering

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Email- alokmathur@skit.ac.in

Received 26 May 2015, received in revised form 10 October 2015, accepted 11 October 2015

Abstract: Outcome-based Education is the latest buzz-word in accreditation parlance. Accreditation is important to bestow an international status on a course. India has adopted the Washington Accord and has established the National Board of Accreditation for accreditation of the programs run by Indian universities and their affiliated institutions. The paper discusses the planning of a UG Course in Engineering and developing the course content in the form of a Course File that comprises the teaching, assessment and evaluation material. A Course File is a record of the desired course outcomes, teaching plan to attain the desired COs, teaching material, Lesson Outcomes, the assessment methods and exercises for continuous as well as periodic assessment of attainment of Lesson Outcomes and COs, and the mid-term and end-term examinations leading to a final evaluation of the attainment of the COs. A proper course file will not only facilitate conducting the course effectively and efficiently, but will also prove the extent of attainment of the Course Outcomes that is central to the OBE theme and necessary for NBA Accreditation.

1. INTRODUCTION

It is very essential to properly plan the course that one is going to teach. In the Semester system, a greater proportion of the available time is used up in mid-term tests as compared to the annual system. Apart from this, engineering students are also involved in several extra-curricular activities, Campus Recruitment Training programs, Infosys Campus-Connect program, campus selection exercises, competitive examinations etc., which also put constraints on the available time. A judicious and effective utilization of the available time is therefore essential to impart the required knowledge and competence.

Internationalization of the economy has opened up worldwide opportunities for Indian students. On the other hand, it has also exposed Indian engineers to international competition. Recognition of the Indian degree by other countries has therefore assumed increased significance in the modern scenario. The internet boom of the nineties saw many of the engineering graduates migrating to western countries to reap the benefits of a burgeoning economy. This has resulted in an increased awareness in our students about the opportunities offered by developed economies such as USA, Europe, Australia and New Zealand, as also by the developing economies where the conventional engineering skills of construction, project execution, ship-building, etc. are in great

demand. At the same time, developed economies have been increasing the non-tariff barriers so as to protect the employment opportunities for their local candidates.

One such non-tariff barrier is the recognition or question of equivalence of our degrees with their degrees. The western world has been adopting the system of Accreditation of educational institutions based on their infrastructure, facilities, teaching methods and so on. Washington accord is an international accreditation agreement for professional engineering academic degrees between bodies responsible for accreditation in its signatory countries [1]. The agreement recognizes that there is substantial equivalence of programs accredited by those signatories. Graduates of accredited programs in any of the signatory countries are recognized by the other signatory countries as having met the academic requirements for entry to the practice of engineering. Recognition of accredited programs is not retroactive but takes effect only from the date of admission of the country to signatory status. The Washington Accord covers undergraduate engineering degrees under Outcome-based education approach.

In USA, Accreditation Board for Engineering and Technology (ABET) is the organization that defines the parameters and requirements for accreditation [2]. National Board of Accreditation (NBA) is the agency in India for granting accreditation after following due procedures [3].

The accreditation requirements and procedures are still evolving in India; in fact, they are continuously evolving even in USA [4]. NBA follows ABET guidelines in this respect [4]. Over the years, a lot of changes have been made in the accreditation philosophy and processes by NBA. Banthiya [5] has discussed in detail the changes which were made in accreditation philosophy and processes in recent times. Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur (SKIT) has already secured NBA accreditation for all its UG Programs in Engineering (except the relatively new program in Civil Engineering). We are therefore familiar with the infrastructure and procedure requirements to be met for accreditation. However, as said earlier, the accreditation process itself is evolving, and we need to keep pace with it to secure re-accreditation for our

programs. Outcome-based Education (OBE) is the latest buzz-word in accreditation parlance.

The paper discusses the planning of a UG Course in Engineering and developing the course content in the form of a Course File that contains all the teaching, assessment and evaluation material. A Course File is a record of the desired course outcomes (COs), teaching plan to attain the desired COs, teaching material, Lesson Outcomes (LOs), the assessment methods and exercises for continuous as well as periodic assessment of attainment of Lesson Outcomes and COs, and the mid-term and end-term examinations leading to a final evaluation of the attainment of the COs. A proper course file will not only facilitate conducting the course effectively and efficiently, but will also prove the extent of attainment of the Course Outcomes that is central to the OBE theme and necessary for NBA Accreditation.

2. OUTCOME BASED EDUCATION

Outcome-based education is an educational theory that bases each part of an educational system around goals (outcomes). In a traditional education system, the process paid very little attention to whether or not students learn any of the material presented to them by the teacher except giving grades and rankings to students in comparison to one another. In contrast, in the OBE system, by the end of the educational experience every student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes. NBA had defined certain 'Program Outcomes' (POs) in its earlier version of the accreditation manual. Now it has introduced the concept of Graduate Attributes (GAs) as a result of adopting OBE as India has joined the Washington Accord in 2014. Banthiya (2014) provides the details of the Graduate Attributes and their equivalence to the earlier stated Program Outcomes [6].

An 'outcome' is different from an 'objective'. Most American text books used to have three or four 'learning objectives' at the beginning of each chapter, signifying that the particular chapter contained information which would let the student learn the stated objectives. The word 'objectives' here meant that the objective of the teacher/writer is to teach the chapter with the stated objectives. However, the word 'outcome' signifies that the 'objective' has been achieved. i.e. the chapter/subject/lesson has been learnt by the students. Thus there is a difference – objective signifies a goal, and outcome signifies the attainment of the goal. Outcome-based education therefore requires that the process be modified in such a way that the goal as contained in the 'objective' is attained. Thus outcome-based education requires that the attainment of the goal must be ensured, for which an element of measurement and evaluation is necessary.

An evaluation process is in-built into all systems of education in the form of examinations and tests. The results are declared after the tests as 'Pass' or 'Fail'. A 'Fail' indicates that the teaching process has failed to attain the outcome, or that the

desired objective has not been achieved. While it was the general practice to blame the student for the failure in learning, the modern trend is to treat the onus of teaching on the teaching process so as to result into learning. It is realized that the teaching process should be so structured that it results in the desired learning by the student. Thus a failure of the student in attaining the desired outcome of learning is ascribed to a failure of the process.

It is realized that if a continual assessment of student learning is made, the teacher can tailor the further delivery of education so as to assure learning by the student. This realization that teaching may not always result in learning, and that the teaching may have to be reconfigured to insure learning leads us to another term – assessment. Assessing the amount of transfer of learning may in fact be viewed as a self-assessment by the teacher in order to tailor the teaching method to improve the teaching-learning process.

3. COURSE PLANNING & PREPARATION OF COURSE FILE

Obviously, a course needs to be planned meticulously in order to be effective. This paper deals with Course Planning in Tier-II Institutions as defined in NBA documents; therefore it does not talk of how the course is developed *ab initio* and developing of the course content. Tier-II institutions follow a syllabus prescribed by the affiliating university, and therefore this paper will take up from there. The paper will discuss the development of a course file and what it should generally contain.

Syllabus: The first step for a teacher is to look at the syllabus. The syllabus describes the course content. The Rajasthan Technical University (RTU) syllabus (the syllabus followed by SKIT) generally divides each course into *five* units, with further sub-divisions within each unit. The contact hours required to cover these portions of the syllabus are also indicated. These two things taken together are generally sufficient to indicate the depth in which the topic is to be dealt with. A look at the previous university examination papers also helps to further fine tune this information. A copy of the *syllabus* must therefore be placed by the teacher in the course file.

Text Book: The University syllabus generally prescribes a *text book* for each course. It would be best to adopt the same. However, in some cases the syllabus indicates more than one text book. In such cases, it is possible that none of the books covers the full course. The teacher may then select one of the books indicated in the syllabus that covers most of the course topics, and indicate another book which covers the rest of the topics. Alternatively, if it is possible, the teacher may find a suitable book covering the full course and prescribe the same as *Text Book* even if it is not indicated in the university syllabus. It must be understood that the student is learning this course for the first time, and specifying more than one book is only going to confuse the student. It is therefore essential to restrict the number of books specified as text books, so that both the teacher and student are referring to the same study material for the

duration of the course. Other good books may be indicated as *Reference Books*, only after ensuring that the book is available in the institute library. It does not make sense to suggest a book, howsoever good, which is not easily available in the institute library.

Topic Precedence Chart/ Diagram– The university syllabus details the topics to be covered in one particular order. It is perfectly natural, and even correct, to teach the topics in that particular order. However, a teacher may prefer to teach them in a different order. In many cases there will be several independent topics which do not need the knowledge of those topics that are listed first in the university syllabus. The teacher may therefore prefer to tackle a topic that is easy, scoring or that can arouse the interest of the students in the subject over a topic that is difficult and tedious. In a course that has a lot of numerical problems, the teacher may like to first tackle a topic that allows the teacher to immediately introduce the students to some numerical problems. Such a strategy allows the teacher to utilize the tutorial classes fully, and the students to practice more on the numerical problems and thereby increasing the possibility of scoring better in examinations. For example, starting with transportation model of optimization instead of linear programming in the teaching of Operations Research could be advantageous. Similarly, dealing with inventory models, especially with simple Economic Order Quantity (EOQ) models, and forecasting models in Operations Management (OM) enables the full use of tutorial classes rather than starting with OM theory that could result in poorer utilization of at least a couple of tutorial classes.

Lesson Plan – Once the topic precedence is decided, the teacher is now ready for preparing the lesson plan. A topic may have only one lesson, or it may need more than one lesson. Also, the lesson plan is different than a lecture plan, as a lesson may need more than one lecture to be completed. We may equate a lesson to a chapter in a book. Generally a book will have somewhere about 14 to 20 chapters, whereas a teacher will be taking about 40 lectures and 13 tutorial classes for one subject. The RTU syllabus divides the whole course in five units, which are further identifiable as 10 -12 sub-units. The RTU syllabus is also structured such that the units are allocated about 8 hours each. This also serves as a guide for determining the depth in which a topic is expected to be covered. The teacher can therefore firm up the lesson plan with this data in mind, and identify the chapters/ sections of the *Text Book* that will be taught as part of the course. A table listing the lessons, and the content that will be taught in different lectures to make up these lessons, should be included in the Course File.

Lesson Objectives/ Outcomes–Identify and formulate five to seven lesson objectives/ outcomes for each lesson. Earlier books will be found to contain objectives, whereas some of the latest books are mentioning them as outcomes. The general format would be as following:

After reading this chapter, the students will be able to

1. *Understand the concept of.....*

2. *Analyze the problems involving*
3. *Find solutions to*
4. *Design the parts subject to*
5. *Specify*
6. *Demonstrate the ability*

Assessment Tools- The essence of outcome-based education is ensuring that the desired outcomes of the education process are attained. As such, due stress must be placed on the assessment of attainment of the outcome. It is therefore essential to devise suitable assessment tools for assessing the outcome attainment at every stage of the teaching-learning process. We have advocated that the lesson be treated as the basic unit of the learning process for a course, and therefore it would be advisable to ensure that the lesson outcomes have been attained before proceeding to the next lesson. The teacher may actually devise assessment tools and exercises for assessing the outcome attainment at suitable periods within a lecture class to ensure that the teaching is having the desired effect. It has been discussed in literature that 'engaging' the students is very necessary to successful teaching-learning, and several methods including interactive teaching have been suggested in literature[7]. Use of different types of reinforcement techniques coupled with objective type questions, one word answers, stating definitions, short answer type questions, matching words to statements, multiple choice questions, spot quizzes etc. are some of the time-tested methods that can be conveniently used for this purpose. These assessment tools should form a part of the teaching material, and must be included in the course file.

Assessment of Attainment of Outcome - In addition, the teacher would need to devise a quantitative scale in order to define 'attainment' of the outcome. It is very difficult to expect all the students to have mastered all that is taught in every class; but a teacher can reasonably consider the outcome to be attained if around 80% of correct responses are obtained to the assessment questions on a random basis. The exact percentage of correct responses for considering the outcome as 'attained' would depend, of course, upon the teacher. To start with, the teachers are expected to have some difficulty in grasping and implementing this quantitative aspect of the assessment, and any figure they adopt could be acceptable as far as some implementation is attempted. These quantitative measures must be included in the course file alongwith the relevant assessment questions.

Lecture Notes – Every lecture needs to be planned in minute detail in order to deliver maximum content effectively in a given time. A teacher must select an appropriate teaching method – use of the chalk board, prepared slides or a powerpoint presentation. All the lecture notes must form a part of the course file in an appropriate manner. This learning material should also be made available to all the students via email and/or teacher's webpage in addition to being discussed in class. In addition, the teacher must prepare questions to be asked in the class to promote interactive learning of the

students, as also to be able to assess the learning. According to [8], asking questions in class can have one or more of the following purposes:

- 1) *To provide a model for language or thinking.*
- 2) *To find out something from the learners (facts, ideas, opinions).*
- 3) *To check or test understanding, knowledge or skill.*
- 4) *To get learners to be active in their learning.*
- 5) *To direct attention to the topic being learned.*
- 6) *To inform the class via the answers of the stronger learners rather than through the teacher's input.*
- 7) *To provide weaker learners with an opportunity to participate.*
- 8) *To stimulate thinking (logical, reflective or imaginative); to probe more deeply into issues.*
- 9) *To get learners to review and practise previously learnt material.*
- 10) *To encourage self-expression.*
- 11) *To communicate to learners that the teacher is genuinely interested in what they think.*

Videos - With increasing ease of video presentation, as well as proliferation of videos via the Youtube, explaining engineering concepts, designs, products and processes by showing videos of actual processes to the students is also becoming popular. Links to such videos must be included in the course file. This learning material should also be made available to all the students via email and/or teacher's webpage in addition to being discussed in class.

Result Analysis – The student takes two mid-term tests and a university examination in one semester. The mid-term test paper is evaluated by the teacher in accordance to a pre-decided marking scheme. The result of the term test must be analyzed by the teacher to identify the students who fail to do well. The number and performance level of poor performers is a direct indicator of the extent of attainment of the outcome of the teaching. The teacher must make an effort to determine the reasons of their poor performance. The teacher can then review the teaching methodology based on this feedback, and tailor further teaching to address the needs of such students too. If necessary, the teacher may consult other teachers and the head of the department for devising a proper teaching methodology to improve the outcome. This analysis of results must be placed in the course file, alongwith the details of corrective action planned/ taken. A similar analysis must be done by the teacher of the university examination results to find out whether the course outcomes have been attained, as also to determine whether the interim evaluations and corrective actions produced the desired results. This information about the attainment of the Course Outcome must also be indicated on the page listing the Course Outcomes. If possible, the names of weak students must be passed on to the teachers of the next semester for their information and attention.

Model/ Sample Answers: While it is the general practice to show the term-test answer books to the students, expected answers for the test questions are seldom made available to the students. It is suggested that the weaker students who get a low score in the term-test are not likely to learn the expected answers by themselves. They will not be able to answer that question even in the university examination. The teacher is therefore required to provide the expected model answer to the test questions and explain the marking scheme (scoring scheme from the point of view of the student) in order to help such students to come up to the required level. This is all the more necessary in case of theoretical/ descriptive questions so that the student learns the proper language and the extent of details to be furnished for the particular question. If this practice is followed by all the teachers, even weak students will be able to learn how to interpret and answer questions, otherwise they are never going to learn it. These solutions must not only be discussed in class, but the solutions of the term-test papers must also be posted on the Notice Board, and also made available to all the students via email and/or the teacher's web page.

Further, teachers must also solve the previous university papers, and discuss the questions alongwith teaching of relevant topics, so that students are aware of the important questions, the language in which they are framed, the different ways of framing the same question and the expected answers to such questions. This learning material should also be made available to all the students via email and/or teacher's webpage in addition to being discussed in class.

The necessity of sending these to students via email is discussed later under the heading of email communication.

Email Communication: - It would be good if the teacher could send an email to all the students after every class recapping the topics covered and issues discussed. The teacher must also attach a soft copy of the study material (lecture notes, numerical examples, videos shown in the class, model solutions to term and university papers etc.). This will provide the information to those students also who missed the class for any reason. In addition, it will always remain accessible to the students and they can use it for studying at a place, time and manner of their choosing. Most important, in these times of omnipresent internet, they will have authentic study material with them whenever needed by them, and will not have to run around collecting study material of doubtful quality and wasting precious preparation time during examination time. It is a constant complaint by the teachers that the students do not buy books at the proper time; that they just buy 'one week' series, or help books at the time of the final university examinations and that these sub-standard books contain a lot of erroneous information. Many teachers provide study notes to help the students. Generally these are kept at the nearest photocopy shop, and the students are supposed to buy them. While the system is good in theory, it is tailored only for the good students. The weak students neither buy books, nor the study notes. They are generally in a fix at the time of the examinations. By

placing the entire study material in their email inbox, the teacher can ensure that the student refers to standard study material.

Tutorials – The University syllabi generally allocate one tutorial class for every three lecture classes in some courses. It is therefore fair to say that there will be about 13 tutorial classes in one semester. The tutorial classes provide an excellent opportunity to reinforce the difficult concepts, practice solving numerical problems and to discuss difficulties of individual students. The teacher generally takes up some numerical examples in the lecture classes too, to explain and reinforce some concepts such as computation of stresses for simply supported bars and cantilevers, use of steam tables and similar other tools. Therefore the teacher would do well to prepare about eight to 10 numerical problems similar to the ones already explained, and give them to the students as home assignments. Instead of checking the individual assignment sheets, the teacher could provide the solutions and require the students to grade their own assignment in accordance to the grading (marking) scheme indicated by the teacher before submitting the same. In some cases, the teacher could even invite one of the students to explain the solution to the class. The teacher could then solve three or four typical problems and give them the next tutorial assignment based on the problems solved in class. The tutorial assignments should be filed in the course file along with about five such submissions that cover the full range from the best response to the worst response of student submissions.

Copy of Attendance Register – A copy of the attendance register, relevant pages, must be placed in the course files. A teacher generally records many things in the attendance register apart from the attendance. This will form a good basis for explaining the extra efforts or some unique practice followed by the teacher to any audit team such as RTU audit team or the NBA accreditation audit team.

Examination Papers – A copy of previous university papers must be placed in the course file. A copy of the current internal test papers as well as previous term test papers must also be filed along with model solutions and marking scheme. Other important question papers like GATE and other competitive examinations must also be placed in the course file in order to generate a good question bank pertinent to the specific course. The teacher may also like to include question papers of other universities for the same or similar course in order to find good questions as also to compare the current trend of study in the country. One or two previous papers of the same university must be solved by the teacher and model answers must be framed. These model solutions must be discussed in class, and sent to all students via email to ensure the familiarity of the students with examination and marking pattern in university examinations.

Glossary: - The students are required to learn new words, terms, definitions and usage of new terms in every course. Any course will teach them a lot of new terms like optimization, inventory, lean manufacturing, TDC etc. The student learns these terms

progressively over the complete semester and is quite likely to forget or miss some important terms. It is therefore desirable that the teacher compiles a glossary of such terms relevant to the course, and arranges them in an alphabetical (dictionary) order. The teacher can then introduce the students to all these terms either at the beginning or the end of the course. This glossary will provide a handy reference for the student to look up the term whenever required. Also, the short meaning, definition or the explanation of the term will help the student in answering viva or interview questions. Such a glossary is to be found in many of the good books, and the Glossary placed at the end of 'Production and Operations Management by E.E. Adam and R.J. Ebert' can serve as a good guide for making a glossary.

Other Important Questions: The number of engineering students graduating every year is increasing at a fast rate as more and more engineering institutions are coming up. The job scenario in our country is gradually improving; however, it remains far from satisfactory, particularly in core engineering branches such as mechanical, electrical and civil engineering. Government and public sector jobs hold a special charm for all candidates. Indian Engineering Services (IES), Graduate Aptitude Test in Engineering (GATE) and examinations conducted by PSUs and government organizations such as railways, electricity generation and distribution companies, water treatment and distribution companies like PHED are targeted by a majority of students. The teacher must therefore ensure that questions asked in these examinations from the subject being taught are discussed in class at appropriate learning stages, so that the students are able to compete in these examinations. The teacher must therefore include such questions and their solutions in the course file, as well as provide them to the students via email and/or teacher's website.

Additional Resources: Several additional resources are now available for engineering education. Videos and Lectures are made available online by renowned teachers from different IITs on the platform provided by the National Program on Technology Enhanced Learning (NPTEL). NPTEL has recently started certification courses also, that can be used to enhance qualifications. There are several open courseware (OCW) initiatives where course material is freely available. MIT OCW and Ohio OCW are two leading OCW initiatives. Coursera is a for-profit educational technology company that offers massive open online courses, and provides both free and paid online education in partnership with top universities and organizations. Many professors across the world have their course material on their web sites, and much of it is freely accessible. It may not be possible to use it directly, but it is a valuable source of information and educational content. The teacher must include some references and links to such learning resources in the course file, and encourage the students to use these for supplementing their classroom learning.

Question Bank: A question bank must be included in the course file covering all the topics of the syllabus. Questions can be of several types – multiple choice single correct answer questions,

multiple choice multiple correct answer questions, short answer questions, very short answer questions, long answer questions, numerical questions and so on. It has been long acknowledged that learning by questioning is the best sort of learning, and a teacher must ask questions not only to evaluate the current state of learning of a student, but may also ask questions to stimulate thinking and inquiry to help students think of the possible approaches and answers. However, while it would be good to improvise in class, it would be much better for a teacher to plan ahead and prepare a question bank to include in the course file. The teacher must include both types of questions in the course file. Firstly, the questions which could be used in the class room to steer and strengthen the teaching-learning by engendering the interest of the students and engage them in learning. Secondly, the evaluative questions that the students are likely to face in their examinations. The question bank must be made comprehensive, and must include all types of questions that are necessary to demonstrate all the concepts and their applications to different situations.

Revision and Updating of the Course File: The course file must be continually updated based upon the experience gained by the teacher while teaching the course. The teacher may find it necessary to review and revise the lesson plan, when actual course progress is found to be different than what was envisaged while making the plan. Additions to the course material will be necessary as the teacher refers to more books, journal articles, PPT and Videos available via the internet, changes in curriculum by the university, inclusion of recent developments in the subject like rapid prototyping, non-conventional energy sources, energy conservation and harvesting and so on. Question bank, test papers, university papers will need to be updated to include papers and their solutions from current examinations. Assessment of attainment of outcomes by the teacher in the class will further necessitate a review of the teaching method, and re-planning of the course content to improve the effectiveness of the course. Further iterations of the course will help in making the course file more comprehensive, useful and effective. It is recommended that the teacher review the course file at the end of the semester. The teacher will definitely be able to improve, with the benefit of hindsight, on all sections of the course file and complete those sections which may have remained incomplete in the hurry of completing the course.

Checklist: It is suggested that all the teachers will not be familiar with all the concepts stated above. As in any other job, the novice teacher will need to learn the ropes of the art and science of teaching by following certain stipulated instructions and procedures as also by emulating their seniors. As the concept of OBE is relatively new, it would be advisable to have a checklist of the contents to be included in the course file, so that even a person relatively new to teaching is able to properly prepare the course file.

4. CONCLUSION

Outcome based education focuses on achievement of results – attainment of the desired objectives of teaching a program, a course, a lesson. Bottoms up, a lecture must attain its objectives, which will then enable attainment of the overall attainment of the lesson objectives. Achievement of a majority of objectives of all lessons will result into attaining the course outcome. The attainment of course outcomes of the individual courses will lead to the attainment of the program outcomes, ensuring that the students graduating from the program have the targeted graduate attributes. Tier II institutes follow the syllabus prescribed by the university which is tailored so as to effectively enable the student to attain the graduate attributes. It is however, the duty of the individual teachers to fulfill the role of attaining the individual course outcomes and have the necessary assessment data of regular assessment to support their claim of attainment.

Planning the course in advance and preparing a course file with the necessary teaching content and aids, and updating it as the course progresses, will help the teacher in effective teaching as well as in effective and timely assessments of the outcomes of the teaching-learning process. This paper has discussed the different sections required in a course file in detail, and the necessity of frequently reviewing and revising the course file. The paper has also deliberated on some of the issues involved in outcome based education such as engaging the students in learning, tutorial classes, use of modern tools like email and website for maintaining contact with students and making learning material available to all students, and deployment of assessment tools to ensure attainment of course outcomes that will ultimately help in attainment of the program outcomes.

REFERENCES

- [1] "Washington Accord," Wikipedia, [Online]. Available: http://en.wikipedia.org/wiki/Washington_Accord. [Accessed 25 May 2015].
- [2] "ABET," [Online]. Available: <http://www.abet.org/>. [Accessed 25 May 2015].
- [3] "National Board of Accreditation," [Online]. Available: <http://www.nbaind.org/views/Home.aspx>. [Accessed 25 May 2015].
- [4] N. K. Banthiya, S. Choudhary and A. Agarwal, "Graduate Attributes and Formulation of Programme Outcomes for Undergraduate Degree Programme in Mechanical Engineering," SKIT Research Journal, vol. 5, no. 2, 2015.
- [5] N. K. Banthiya, "Accreditation of Undergraduate Engineering Degree Programmes in India: Changes due to Washington Accord," Journal of Engineering, Science & Management Education, vol. 5, no. II, pp. 445-451, April-June 2012.
- [6] N. K. Banthiya, "Programme Educational Objectives (PEOs) and Programme Outcomes for Undergraduate Degree Programmes in Mechanical Engineering," in Souvenir National Conference on Emerging Trends in Mechanical Engineering: Issues, Challenges & Developments, 23rd & 24th Sept. 2014, Jaipur, 2014.
- [7] N. Zepke and L. Leach, "Improving student engagement: Ten proposals for action," Active Learning in Higher Education, vol. 11, no. 3, pp. 167-177, 2010.
- [8] P. Ur, A Course in Language Teaching: Practice and Theory, Cambridge: Cambridge University Press, 1999, p. 103.

