NOVATEUR PUBLICATIONS
INTERNATIONAL JOURNAL OF INNOVATIONS IN ENGINEERING RESEARCH AND TECHNOLOGY [IJIERT]
ISSN: 2394-3696
VOLUME 3, ISSUE 10, Oct.-2016

ANALYSIS AND IMPLEMENTATION OF VARIOUS TEACHING METHODOLOGIES IN POWER ELECTRONICS FOR ELECTRICAL ENGINEERING STUDENTS AT SPPU, PUNE

MR. P. R. CHOUBE
Assistant Professor, Department of Electrical Engineering, MMCOE, Karvenagar, Pune

MR. T. B. WAGHMARE
Assistant Professor, Department of Electrical Engineering, MMCOE, Karvenagar, Pune

MR. S. S. KATRE

ABSTRACT
Power electronics is considered as one of the tough and important subject in electrical engineering. Authors have observed the university results of various engineering colleges in Pune University and concluded that, there is huge scope for improvement. Authors have decided to carry out experimentation with the students of electrical engineering department by implementation of various teaching methodologies at Marathwada Mitra Mandal's College of Engineering (M.M.C.O.E.) Karvenagar, Savitribai Phule Pune University (SPPU). The experiment was carried out for first two units of power electronics as per the curriculum of SPPU and with 60 students. The authors have tried the best to conclude with the results showing the effective teaching methods in power electronics.

KEYWORDS: Conventional Classroom Teaching, Project based learning, Seminar and Presentations, Numerical Solving Approach Effective Classroom Teaching with various teaching aids and Continuous assessment

INTRODUCTION
Most of electrical engineering students in this era of interdisciplinary word have to work in the field of electronics. The power electronics devices had made the revolution in the field of electronics. The power electronics is rapidly developing technology in electrical engineering [1]. Electrical Engineers must possess the practical knowledge along with the theoretical concepts of power electronics [2]. With growing world the teachers also have to implement the various methods of teaching to make the teaching-learning process more effective. Although the students are surrounded with huge resources for learning, teachers have to play a vital role in guiding the students for better understanding of technical subjects [3]-[5].
In this paper, the experimentation carried out during the teaching learning process is discussed in details. However the results of the students facing the experimentation are compared to conclude with the understanding of the contents by students. After completion of the topic by various methods the students have assessed with the same test examination. The performance of students was really shocking and is challenging the conventional teaching learning methods strongly.

LITERATURE REVIEW
The better understanding of power electronic devices plays a vital role in implementation of the technology for practical applications [4]. E-learning has opened new doors for

IJIERT

understanding and implementation of power electronics technology [5]. The various simulation programs are also available to understand the performance of power electronics devices [6]-[7]. With developing technologies, tutors and teachers also have to implement the best methods for delivering the lecture in order to improve the teaching learning process [8]. Teaching the subject like power electronics is really not a easy work as it involves mathematics, hardware, waveforms, imaginations and conceptual understanding. Power electronics can be made easy to understand for the learners by implementing non conventional methods for the teaching [9]. During the sessions, students must have to develop the skills to learn by themselves and it was proven in research that students can learn better at their own [10]. This paper imparts the various methods to make the teaching learning process more interesting and effective. Most of the times the teachers are teaching the subject but students are not learning it as most of them doesn't find it so interesting. The main challenge to be addressed for the teachers is to make the students learn better in order to implement the knowledge for betterment of society and technology.

METHODS IMPLEMENTED:

In 21st century, we all are surrounded with plenty of resources to study the technologies. The teachers/tutors have to identify the resources to be utilized and to be implemented in order to serve the technology with ease. At the same time tutor has to create students interest in the technical subjects like power electronics, which is really a challenging job. The tutor has a responsibility to motivate the students in order to urge the knowledge in technology. Authors have identified the following methods to be implemented for the teaching-learning of power electronics.

i. Conventional Classroom Teaching
ii. Effective Classroom Teaching with various teaching aids and Continuous assessment
iii. Project based learning
iv. Seminar and Presentations
v. Numerical Solving Approach

Authors have divided the 60 students in to 5 groups with each group having 12 students. The group of the students is selected on the basis of earlier university examination, students overall performance by means of continuous assessment over the period of one semester (i.e. 4 months).The care is taken so that each group should have equal level of students i.e. each group should be balanced and have same talented students.

i) CONVENTIONAL CLASSROOM TEACHING

The group of first 12 students (Group a) was asked to attend the conventional chalk and blackboard, teaching- learning process. The process was carried out over the period of 20 days where a tutor has completed the theoretical part in classroom. The teaching aids used for this method are chalk, blackboard, duster and reference books. It was observed during the sessions that, the students were losing their concentration during the sessions. The sessions were not so interesting for students and hence they were less enthusiastic to attend them. Very few students have asked the queries and in their feedback they have accepted that, the sessions were not so informative. Most of their time was wasted in imagination of, shapes and exact sizes of power electronic devices.

ii) EFFECTIVE CLASSROOM TEACHING WITH VARIOUS TEACHING AIDS AND CONTINUOUS ASSESSMENT

A second group of students (Group b) was asked to attend the lecture and tutorial sessions. During these sessions the various teaching aids like ppts, video resources, animations, surprise tests, tasks and games to motivate and understand the concepts for the students are

used by the tutor. Tutor has prepared and displayed the session plan, at the start of every lecture the tutor has revised what has happened in last session. At the start of session, tutor has explained the students about, learning objectives and outcomes of the session. At the end of every session a quick assessment is carried out by the tutor.

iii) PROJECT BASED LEARNING

In this third approach of teaching learning for second group (group c) of students, initially teacher/ tutor has conducted the test i.e. pretests to check the basic knowledge level of students. From the analysis of the test result, teacher has prepared a plan for two lectures. During these two lectures the weak areas of students are addressed. The prerequisite for the project work are discussed and the students are assigned with the small real time problems to be overcome by means of their projects. The students are assigned with the problem definitions to be addressed and the resources to learn from are not restricted. The students have referred the reference books to understand the theory, the have designed the systems, they also have taken the help of internet. It has observed during this session that students are really eager to learn and complete their projects on priority basis. Students have also developed the team work and with coordination of each other they were trying to solve the difficulties. It has also observed that along with team work, few of them have shown their leadership qualities while few others have utilized their technical knowledge.

iv) SEMINAR AND PRESENTATIONS

Fourth group (Group d) of the students was assigned the technical topics as per the curriculum. The task given to the students is, they have to prepare the seminar on the given topic. The topics are selected such that the students have to study almost all the syllabus assigned. It has observed that the students were searching the resources at their own and they are really prepared well for delivering the seminar. The presentations prepared by the students were really informative and they have used many teaching aides to make their presentations effective.

v) NUMERICAL SOLVING APPROACH

The fifth group of the students (group e) is assigned with the theoretical numerical from the various reference books. The students have to solve and explain the numerical. The students in this group have really found it interesting to solve the numerical. For solving and understanding of numerical, students have referred various reference books. They have prepared for the theoretical concept, derivations and numerical solution. This method was also enthusiastic for the students and they have learns many things at their own.

OBSERVATIONS AND RESULTS

The five methods were implemented on the equally talented group of students with same size. The students have enjoyed the sessions during the sessions the assessment by means of test exams is carried out. It was observed that during first phase of evaluation students have enjoyed the non conventional methods of teaching but they were unable to perform as the adopted techniques are new to them. In later test exams student attending non conventional sessions have improved their performance. The table shown below show the test results for the assessment carried out during the sessions, all the students have attended the same test exam and at the same time the test exams were carried out.

IJIERT

Table 1: Results for the assessment carried out during the sessions

Sr. No.	Group of Students	Method Implemented	Test-I Results in %	Test-II Results in %	Test-III Results in %	Test-IV Results in %
1	Group a	Conventional Classroom Teaching	70	68	65	66
2	Group b	Effective Classroom Teaching with various teaching aids and Continuous assessment	60	70	78	89
3	Group c	Project based learning	58	71	81	91
4	Group d	Seminar and Presentations	57	72	72	92
5	Group e	Numerical Solving Approach	59	71	81	91

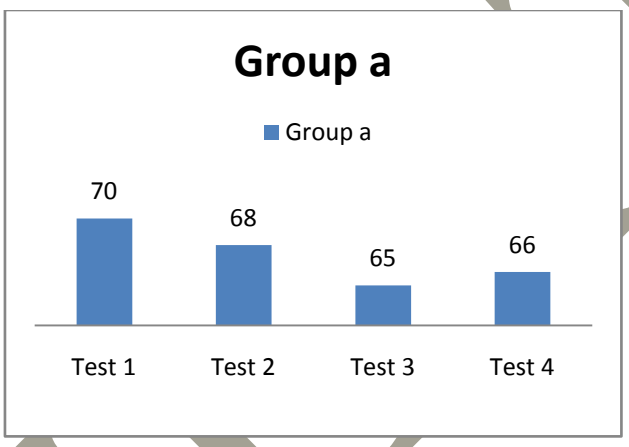

Figure 1: Result comparison of Group a

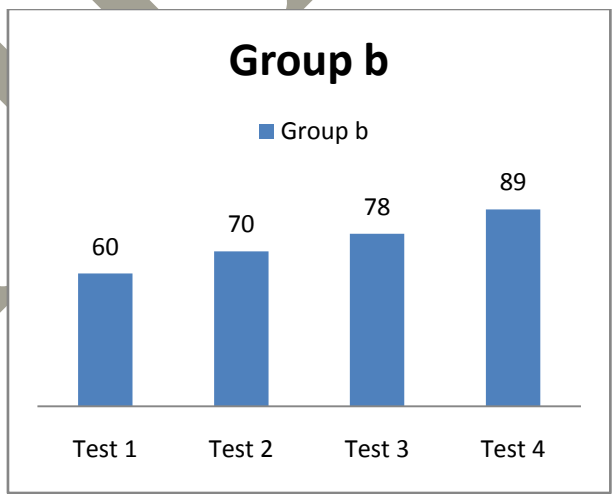

Figure 2: Result comparison of Group b

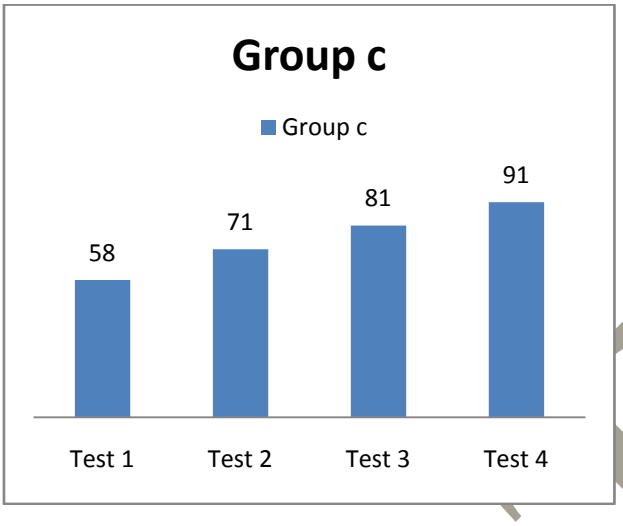

Figure 3: Result comparison of Group c

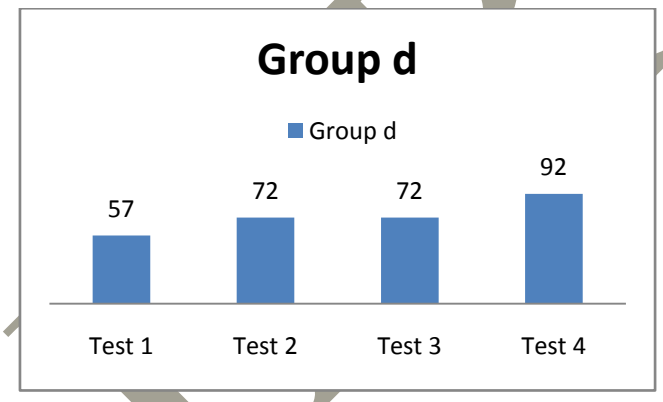

Figure 4: Result comparison of Group d

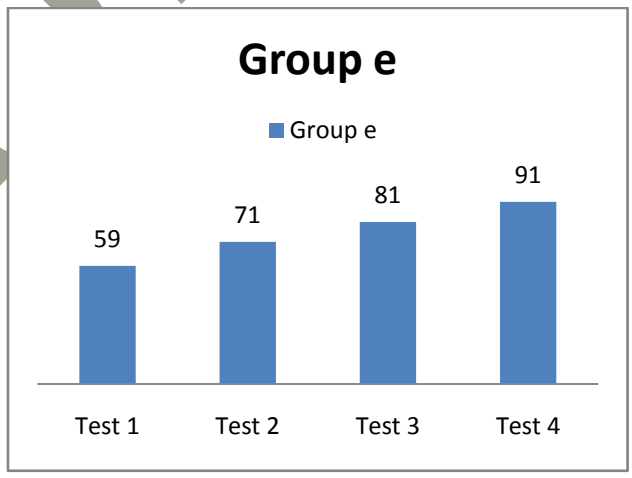

Figure 5: Result comparison of Group e

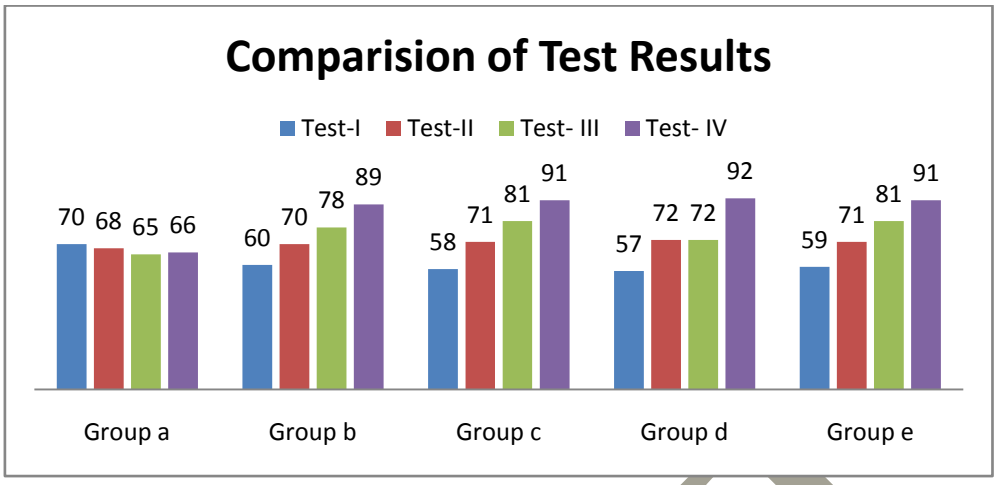

Figure 6: Comparison of Results for group a to e for all four tests conducted

The figures drawn above shows the performance analysis of students for all four test exams carried out as a part of assessment during the various methods implemented for studying power electronics. It has observed that, the various methods implemented have given the better results in examinations. Initially students were happy with the conventional methods, later they have liked the new methods.

CONCLUSION

In this paper, authors have addressed the general problem to make teaching learning process more effective. For the subject like power electronics, apart from the conventional classroom teaching, it's really the need of time to add few better techniques of effective teaching learning. The brief study is carried out and experimentation is performed with teaching learning process. From the results of experimentation, authors concluded the following points.

1. Conventional classroom teaching is effective for small contents of curriculum.
2. Use of various teaching aids is really makes the course more effective. Students will understand the concept in better way and the results are continuously improving.
3. Although the above mentioned methods are effective, project based learning is useful to develop practical approach and hands on practice for the students. The students will learn to identify the leadership qualities and it also develops the team work amongst them.
4. Seminar and presentation method, improves the presentation skills of students. In this method, students learned to carry out literature survey there by identifying the effective resources to be used for making the presentations more effective.
5. Solving the numerical, needs to understand the theoretical concepts and vice versa. In this method, student learned deeply and they try to understand the concepts as they have to implement it in solving the numerical.

All the above mentioned methods are effective; teachers have to decide the percentage of implementation for the methods during conduction of the course.

IJIERT

REFERENCES

1) Zhe Zhang, Member, IEEE, Claus Thorp Hansen and Michael A. E. Andersen, Member, IEEE Technical University of Denmark Kgs. Lyngby 2800, DENMARK "*Teaching Power Electronics with a Design-Oriented and Project-Based Learning Method at the Technical University of Denmark"*

2) P. Bauer and J. W. Kolar, *"Teaching power electronics in the 21st century"* EPE Journal, vol. 13, no.4, pp.43-50. Nov. 2003.

3) J. Holtz, "*Power electronics—a continuing challenge",* IEEE Ind. Electron. Mag., vol. 5, no. 2, pp.6 -15, 2011.

4) Jaroslav Dudrik, "*New Methods in Teaching of Power Electronics Devices"* IRANIAN JOURNAL OF ELECTRICAL AND COMPUTER ENGINEERING, VOL. 4, NO. 2, SUMMER-FALL 2005

5) D. A. Torrey, *"A project oriented power electronics laboratory,"* IEEE Trans. on Power Electronics, vol. 9, no 3, pp. 250-255, May 1994.

6) V. Fedák and P. Bauer, *"E-learning for Power Electronics and Electrical Drives,"* in Proc. of Int. EDPE 2003 Conf., The High Tatras, pp. 567 - 572, ISBN 80-89061-77-X.

7) B. Dobrucký and P. Špánik, *"Modelling and Simulation of Power Electronics Structures"*, Scientific Monograph. EDIS, Žilina. Dec. 1999.

8) Cheng K.W.E., Cheung T.K., "*Development of a multilingual web-based teaching and learning software for engineering students",* Special issue of Call Asia/Information Technology and Universities in Asia (ITUA), 2002,

9) CHENG K.W.E. and LU Y., *"Development of an electronic book for Power Electronics, Machine and Drives based on the multilingual and Problem-Based Learning Techniques"*, EPE-PEMC, 2002.

10) K.W.E. Cheng and S.C. Cheung , "*Examination of PBL and Web-based Exercises in English Language Improvement for Engineering Students"*. Asia-Pacific Conference on PBL2001, Dec 2001., pp. 49-56. (www.newcastle.edu.au/centre/problarc/conference)

IJIERT