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Bageshree Pathak

MKSSS's Cummins College of Engineering for Women, Karvenagar, Pune,
bageshree.pathak@cumminscollge.in

Prachi Mukherji

MKSSS's Cummins College of Engineering for Women, Karvenagar, Pune,
prachi.mukherji@cumminscollge.in

Sandhya Potadar

MKSSS's Cummins College of Engineering for Women, Karvenagar, Pune,
sandhya.potadar@cumminscollge.in

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Implementation of Outcome Based Education for the course 'Digital Image Processing'

Dr. Bageshree Pathak, Sandhya Potadar,
Dr. Prachi Mukherji, Department of
MKSSS's Cummins College of
Engineering for Women, Pune

Abstract—Achieving Outcome Based Education (OBE) in engineering education is a challenging task for the instructor. The cycle starts from the process of curriculum design for the course 'Digital Image Processing' by incorporating the inputs from different stake holders. Program Outcomes (POs) and Program Specific Outcomes (PSOs) are attained through balanced course design and achieving the Course Outcomes by various evaluation methods. The next challenge is to improve the traditional teaching learning methods by implementation of innovative techniques for effective delivery of the course and to increase the engagement of the students. Students should be able to apply, analyze and evaluate a given problem statement and build/simulate an algorithm/system in the course. Continuous assessment is followed in the laboratory sessions and Open-ended assignments are given to the students to stimulate divergent thinking abilities about a given problem. Feedback of theory and laboratory sessions is taken from the students and its analysis is carried out based on assignments, examinations and mini projects.

Keywords: Innovative techniques, Outcome based education, Open ended assignments, Program Outcomes, Program Specific Outcomes,

I. INTRODUCTION

Outcome Based Education is paradigm shift from traditional based education to outcome-based curriculum method. Traditional based education is based on theory of education, a systematic approach of education and specific approach to instructional practices. Whereas OBE also follows traditional way of education system and also focuses on applying basic engineering science and mathematics, design modules, use of latest software technology with professional, intellectual ethics, team work, time management and enhance skills for higher education.

In OBE student are trained by using innovative teaching learning methods such as one minute paper, crosswords, project based learning and open-ended assignments to make them understand the course thoroughly. The students are evaluated and the analysis of course outcome towards program outcome attainment calculation is carried out.

II. LITERATURE SURVEY

K.Pavani et al., [1] summarized OBE for electronic circuits subject. The students build mini/major college sponsored in house projects. The students are evaluated for the projects performed on LC and RC oscillator design, different types of tuned amplifiers and enhance their subject related knowledge, work in team, present the topic related to concepts in detail. They have summarized improvement of CO PO attainment using OBE techniques such as Z to A approach, group discussion and shown calculations for the same activities direct and indirect attainments. Oriah Akir et al., [2] compared students' academic performance of OBE and non-OBE students in terms of grade point average values. They have achieved mean grade point average value of 2.7471, standard deviation of 0.53935 for OBE students and mean value of 2.3998, standard deviation of 0.44009 for non-OBE students. It is observed that the performance of outcome-based education students mean grade point and standard deviation are high as compared to non-OBE students.

K S Ananda Kumar et al., [3] shown calculation of direct attainment of individual course outcome, program outcome for thirty-six students sample data for big data analytics course using excel sheet. The direct attainment with 80 percent weightage is calculated based on internal assignments, quiz and inhouse projects. The indirect attainment with 20 percent weightage is calculated using course exit feedback. Total attainment for each sample student's data is calculated by summing up direct and indirect attainments. They have achieved total attainment in the range 2.53 to 2.76 with average attainment of 2.69 with a scale value of 3. Authors also shown program outcome calculation with PO3 has the highest 2.51 attainment and PO8 has the least 0.90 attainments.

Mohd Sobri et al., [4] elaborated importance of stakeholder's feedback of the chemical engineering course of Malaysian university. The survey of feedback is carried out based on course content delivery, activities conducted by faculty during the entire semester, conduction of laboratory assignments, organizing guest sessions. The exit survey includes syllabus design, learning outcomes, preparing the students for higher studies and future career.

Arun Kumar B.R [5] summarized design of curriculum, framework for value added course, project-based learning activities for IoT and cyber security course. Author has also shown mapping of course out comes to improvement in program outcomes comparison with outcome-based learning and non-outcome-based learning.

Jian Dong [6] elaborated importance of curriculum design of image processing course objectives, content of the syllabus, evaluation process for the online and offline teaching process are discussed. The improvement in the student's performance is shown with the flipped classroom, Z-A approach etc. are reported.

Che Maznah Mat Isa et al., [7] shown outcome-based education for civil engineering of Malaysian university. The authors have analyzed and compared awareness and understanding of outcome-based education by the questionnaire given to randomly selected 1000 students from all the four engineering batches. The results are shown using Likert scale with the value of 54.5% students agree to that with outcome-based education students are transformed to active learners, improve their skills which aid in their life long learning and in higher studies.

III. METHODOLOGY

The new reforms in education field are mainly based on OBE where the outcomes have to be measurable. Novel processes were followed while revising and designing the syllabus of the Digital Image Processing course, defining the Course Objectives and Course Outcomes (COs). Following practices were implemented while designing and teaching the course so as to achieve the goals of OBE.

A. Input from stakeholders: Industry experts in the domain

Different industries related to the field, near Pune and industry experts working in the field were identified. Their expert advice was taken on the COs and the contents of the syllabus. The topics were included considering the need of the industry. Thus, the syllabus was made industry ready.

B. Defining the COs and Curriculum design:

The Course Outcomes were finalized right in the beginning by the faculty by considering the expert advice of the industry experts working in that field. The COs were designed in such a way that different cognitive levels like Apply, Analyse, Select, Develop, Design and Implement are included. After finalization of COs, unit wise curriculum was designed. The syllabus was designed in such a way that students will have to apply their knowledge on a given problem and analyse the result. They will need to design/develop a system/algorithm.

C. Laboratory experiments design:

The laboratory experiments were designed in such a way that, the student will be able to develop a system/algorithm/implement a course project after the conduction of few experiments under the instructor's guidance. The students were exposed to online platforms like Google Collab and Matlab online.

D. Attainment of POs and PSOs through theory and lab sessions:

POs are defined by NBA that describe knowledge or skills that students achieve upon completion of their academic program. The total program is designed in such a way that all the 12 POs are addressed by different courses of the curriculum. For our course PO1 and PO2 are substantially addressed in theory and PO1, 2, 5 and 9 are addressed in the laboratory sessions.

E. Innovative Teaching learning Methods:

The classroom and online lectures are made interesting and two-way communication between the faculty and students is achieved. Some of the techniques used are:

- 1) Attractive PPTs with point wise explanations and examples included in it, are prepared and shared with the students so that they understand the concepts in an easier way.
- 2) Guest lectures from Industry experts are arranged.
- 3) Animated YouTube videos are shown for better understanding of a concept.
- 4) Google classroom is created for theory as well as laboratory sessions for better interaction with the students.
- 5) During the online lectures, 1 minute paper is shared via google classroom for numerical solving. Students solve the numerical and upload their solution, which is presented and discussed.
- 6) Students are exposed to research papers and are guided on paper writing in the domain.
- 7) Flipped classroom is also practiced where the information of a particular topic is shared with the students. On the next day the topic is discussed with the students which helps them to understand the topic in a better way and will also be remembered.
- 8) Google quiz are also shared with the students which enhances their learning capability.
- 9) To make the concept understand in a better way, the students are exposed to the theoretical knowledge of a concept. Further the same concept is verified by solving numericals based on it. The same concept is implemented in the laboratory sessions. Thus, correlation between theory and laboratory sessions is achieved.

F. Teaching based on Revised Blooms Taxonomy:

The topics are first taught in the class. Further students need to apply their knowledge on the given

problem statement. Students analyse the problem and select the best solution. They further design and implement the solution during laboratory sessions. Thus, higher level cognitive levels are achieved as per the Revised Blooms Taxonomy.

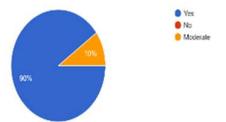
G. Open Ended Assignments:

A group of 3 students choose an open-ended assignment. This is explained with the help of an example. Let the given statement of the open-ended assignment be: “Design and implement a technique to authenticate the entry of a student in the classroom using appropriate image processing techniques”. For the implementation, the students are free to choose any platform like Matlab, Python, Java or C++. They can also select any technique like, finger print recognition system, Face recognition system, Iris recognition system, Palm recognition system etc. By implementing such systems, the students improve their programming skills, develop debugging skills, learn to optimize a given problem, study different papers in the domain, and search for additional information. Thus, this technique helps in skill development of the students which further help them in getting an internship and placement.

IV. RESULTS

The analysis of the course and verification of OBE was carried out from the feedback of students. The respondents are Third Year Engineering students. Responses are collected from 200 students studying the course. A google feedback form was designed based on practices followed during the teaching learning process and questions were designed accordingly. This form was mailed to the students and their feedback was taken. Figures below shows the pie chart representation of the students feedback.

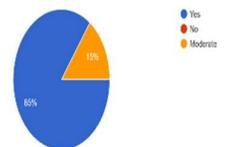
Are the concepts of DIP well explained and the ppt with images included attractive?



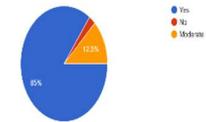
Are the concepts taught in the theory lectures verified by solving numericals.



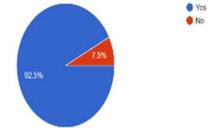
Were the innovative techniques like: one minute assignment, research paper discussion, guest lecture, google quiz etc. useful?



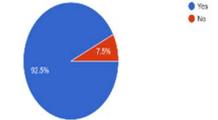
Did the question paper have "Apply and Analyze" type of numericals?



Was there proper correlation between theory concepts and its implementation in the lab?



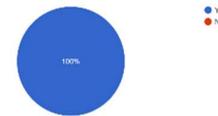
Did the open-ended assignments improve learning, programming and debugging skills?



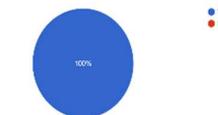
Did the open-ended assignment make you to explore different applications and platforms in image processing?



Were the Course Outcomes (CO) satisfied for the theory and lab?



Were many of the Program Outcomes (POs) defined by AICTE satisfied in the process?



Did you enjoy learning the subject DIP?



VI. CONCLUSION

In the course Digital Image Processing, OBE is implemented and verified. We have defined the COs and then the curriculum by taking input from industry experts. We have made an attempt to attain the POs and PSOs through theory and laboratory sessions. We have designed the question papers in such a way that higher cognitive levels like apply, analyze and select are used. We have also used many innovative techniques in the teaching learning process. The above-mentioned techniques are verified by taking feedback from the students which is put up

in the results section. Thus, Outcome Based Education is implemented for the course.

VII. REFERENCES

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