

# **Attainment of Course Outcomes for Microcontroller Course by using Direct- Indirect Method**

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**ABSTRACT:** Course Outcomes (COs) plays an important role in Outcome-Based Education (OBE). The attainment of Program Outcomes (POs) is depends on the attainment of Course Outcomes (COs). In this paper, we have measured the CO attainment for specific course on the basis of various tools such as direct and indirect method in which students internal and external assessment marks and feedback from Course Exit Survey have been considered as an input data. The attempt is made here to find out accurate attainment of COs so that corrective actions can be taken for the next batch to improve the teaching learning process. We have shown attainment level achievement using both direct and indirect methods.

**KEYWORDS:** Course Outcomes (COs), National Board of Accreditation (NBA), Outcome-Based Education (OBE), Program Outcomes (POs).

## **I. INTRODUCTION**

Outcome based Education (OBE) are already adopted, in engineering education system, from last few years along with National Board of Accreditation (NBA) [1][6][7]. In OBE, individual course outcomes need to be attained up to some minimum level [2].

The attainment level of course outcome may vary with different courses but at least 50% attainment is mandatory for all courses. In our Institute, we have extended that range up to 70%. In this paper we have given detail explanation for evaluation of CO attainment. Here we have selected Microcontroller course of final year diploma students of electronics and telecommunication.

There are ten program outcomes (POs) developed at department level and six course outcomes for each subject [3] [9]. Further we have described attainment of CO using both direct and indirect methods in brief. Six course outcomes specified for microcontroller course i.e. it is expected that after completing this course successfully, students must be able to

CO1: Apply engineering fundamentals to differentiate between microprocessor and microcontroller architectures.

CO2: Identify hardware features internal registers and SFR with their functions.

CO3: Apply knowledge of instruction set and addressing modes for writing program.

CO4: Simulate, Analyse and develop programs using assembly language.

CO5: Interface peripherals and memory to microcontroller.

CO6: Use timers and interrupts through programs.

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## Program Outcomes (POs)

Students of Diploma in Electronics & Telecommunication Engineering should be able to **Basic knowledge:** Apply basic knowledge of mathematics, science and engineering in identifying and analysing routine problems in Electronic and Telecommunication industries such as maintenance and repair, testing, calibration, simulation and PCB designing.

- a. **Discipline knowledge:** Identify, formulate, and solve industrial and systems related electronics and telecommunication engineering problems.
- b. **Experiments and practice:** Conduct experiments on electronics and telecommunication circuits and systems, also and interpret data and prepare report.
- c. **Engineering Tools:** Use modern engineering tools (Eagle, MATLAB, Keil, Xilinx, etc.) and techniques for design and development of circuits and systems.
- d. **The engineer and society:** Demonstrate ability related to social, health, safety, maintenance, etc. related to biomedical instruments, consumer electronics, security services and communication services.
- e. **Environment and sustainability:** Design, evaluate, implement, electronics and telecommunication systems for sustainable development to meet desired needs within realistic constraints such as economic, environmental, social, public health and safety considerations.
- f. **Ethics:** Commit to professional ethics and social responsibilities in dealing with day to day situations in the field of Electronics and Communication Engineering.
- g. **Individual and team work:** Contribute effectively as team member or leader in diverse/ multidisciplinary technical teams to achieve the targets in different areas such as circuit design, testing, troubleshooting, production and operations.
- h. **Communication:** Communicate effectively using orally and written communication techniques such for preparing reports, proposals, drawings, plans, presentations, instructions, feedbacks, etc.
- i. **Life-long learning:** Continuously update through undertaking self-development and life-long learning activities.

The approach in evaluating the attainment of CO is using existing data from students' marks, from the class test results, final board exam, assignment and lab report (term work). Here we have used two methods one is direct and another is indirect to measure the attainment of microcontroller course in academic year 2015-16 [4] [5] [8].

## II. RELATED WORK

### Direct Assessment Methods

1. Assignments
2. Class Test
3. Laboratory performance (Term Work)
4. MSBTE Theory Result

**Direct Method:** In our institute, the assessment methods are divided into 2 categories: Class test, Assignments, Laboratory performance (Term Work) and MSBTE Theory Result. The data used for evaluating CO attainment is obtained from the students mark from these assessments. In this paper CO attainment of Microcontroller (17534) course for academic year 2015-16 is evaluated [12].

### Indirect Assessment Methods:

1. Course Exit Survey
2. Alumni Survey
3. Employer Survey
4. Co-curricular Activities
5. Extracurricular Activities

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**Indirect Method:**

In Indirect method evaluation the Course Outcome (COs) attainment does considered the marks obtained by students directly from class or final term end examinations taking in particular academic year. Instead of that we have used feedback of the students, which is taken at the end of the course and referred it as course end feedback. Course end feedback is taken from all students [10] [11].

Course Exit Surveys (CES) are an excellent means to obtain feedback from students. Questions on subject related Course Outcome (COs) are prepared and uploaded through Google form.

### III. RESULT

Details of CO Attainment through Direct approach:

Course	Assessment Tool	Assess	Average
CO1	Assignment number: 01	80.23	70.38
	Class Test : 01	92.98	
	Experiments : 1	55.67	
	MSBTE Theory Result(>=60% Marks)	52.63	
CO2	Assignment number: 02	81.87	70.79
	Class Test : 01	92.98	
	Experiments : 1	55.67	
	MSBTE Theory Result(>=60% Marks)	52.63	
CO3	Assignment number: 03	79.42	73.66
	Class Test : 01	92.98	
	Experiments (2,3,4)	69.59	
	MSBTE Theory Result(>=60% Marks)	52.63	
CO4	Assignment number: 04	78.6	69.37
	Class Test : 02	76.67	
	Experiments (2,3,4)	69.59	
	MSBTE Theory Result(>=60% Marks)	52.63	
CO5	Assignment number: 05	79.88	73.50
	Class Test : 02	87.71	
	Experiments : ( Experiment	73.79	
	MSBTE Theory Result(>=60% Marks)	52.63	
CO6	Assignment number: 06	81.75	69.44
	Class Test : 02	87.71	
	Experiments : 1	55.67	
	MSBTE Theory Result(>=60% Marks)	52.63	

**Table1: COs Attainment through direct method.**

Table 1 shows different assessment tool are used to attain course outcomes (COs). The attainment of course outcomes (Cos) is the average of mentioned assessment tool percentage. In this way all COs are calculated.

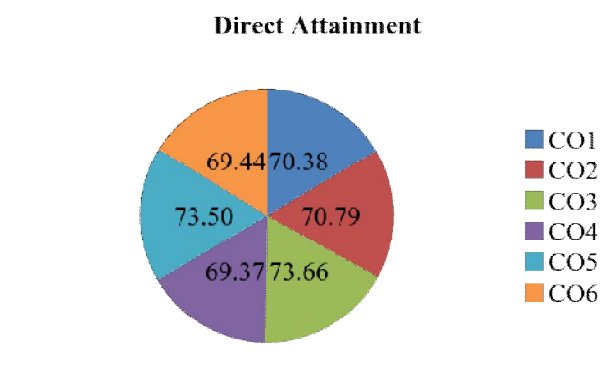


Fig. 1. Graphical representation of attainment of COs using direct method.

Figure 1 indicates direct attainment of COs in terms of percentage.

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Details of CO Attainment through Indirect approach:

Course Outcome	Question in Questionnaire	Assessment in %
CO1	Can you select appropriate Microcontroller for project/ any application?	80.70
CO2	Have you understood the functions of SFR (Special Function Register)?	82.46
CO3	Are you able to use instructions while writing an Assembly Language Program?	81.29
CO4	Can you simulate, analyze and develop programs using SIDE-51 or Keil software?	82.46
CO5	Are you able to interface stepper motor, DAC, LED, keyboard and Memory with 8051?	81.29
CO6	Can you understand the concept of Timer and interrupt?	82.46

**Table 2: Indirect assessment of Course Outcomes through Course Exit Survey**

Table 2 shows course exit survey to check knowledge level of students and based on response achievement level of each CO is evaluated.

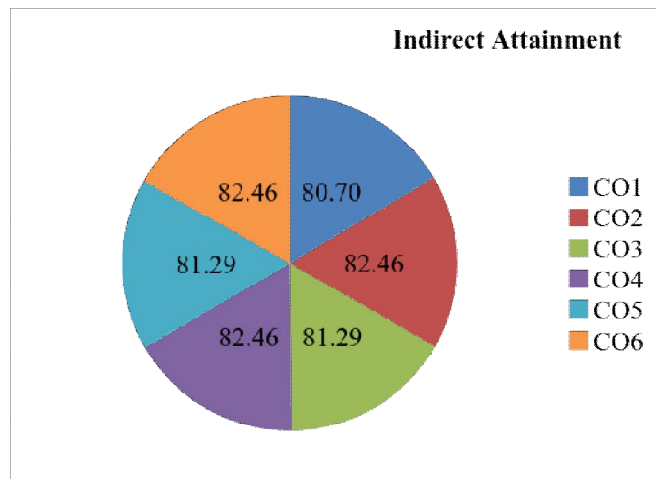


Fig. 2. Graphical representation of attainment of COs using indirect method.

Figure 2 indicates indirect attainment of Course Outcomes in terms of percentage.

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The overall attainment is calculated by considering the separate weight age to each method, i.e. 80% and 20%. Weightages are given to direct and indirect methods respectively shown in table 3.

Course Outcome	Mapping with Program Outcome (PO)	Assessment in %				Target Set	Total Attainment in %
		Indirect 20%		Direct 80%			
CO1	a,b,c,e,f,g,h,j	80.70	16.1	70.38	56.30	70%	72.44
CO2	a,b,c,f,g,h,j	82.46	16.5	70.79	56.63	70%	73.12
CO3	a,b,c,d,e,f,g,h,i,j	81.29	16.3	73.66	58.92	70%	75.18
CO4	a,b,c,d,e,f,g,h,i,j	82.46	16.5	69.37	55.50	70%	71.99
CO5	a,b,c,d,e,g,h,j	81.29	16.3	73.50	58.80	70%	75.06
CO6	a,b,c,d,e,f,g,h,i,j	82.46	16.5	69.44	55.55	70%	72.04

**Table 3: CO Attainment through direct and indirect method**

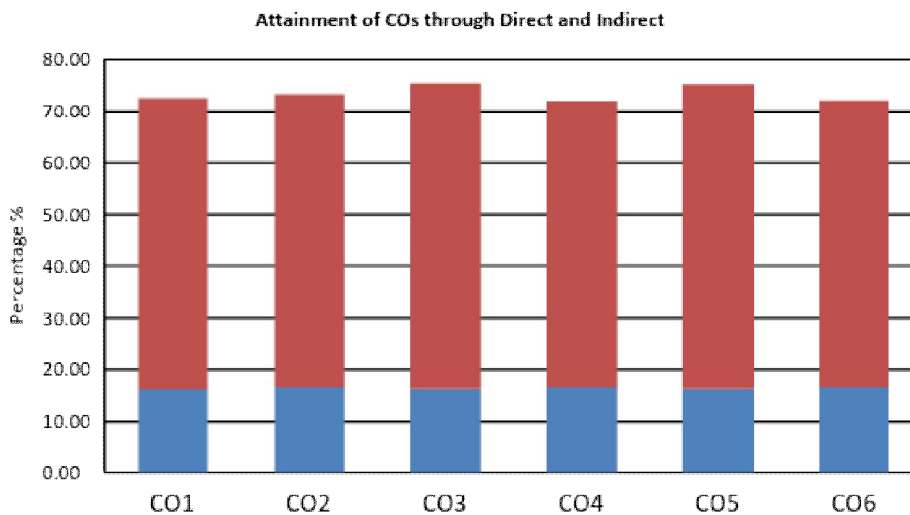


Fig.3. Graphical representation of attainment of COs using direct and indirect method.

Figure 3 indicates attainment of Course Outcomes in terms of percentage using direct and indirect method.

Each CO is responsible for achieving of various Program outcomes. Mapping of COs with respective achieved PO is mentioned in table 3 [7].

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PO	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO	b	c	d	e	f	g	h	i	j
CO1	72.44	72.44	--	72.44	72.44	72.44	72.44	--	72.44
CO2	73.12	73.12	--	--	73.12	73.12	73.12	--	73.12
CO3	75.18	75.18	75.18	75.18	75.18	75.18	75.18	75.18	75.18
CO4	71.99	71.99	71.99	71.99	71.99	71.99	71.99	71.99	71.99
CO5	75.06	75.06	75.06	75.06	--	75.06	75.06	--	75.06
CO6	72.04	72.04	72.04	72.04	72.04	72.04	72.04	72.04	72.04
Avg.	73.31	73.31	73.57	73.34	72.96	73.31	73.31	73.07	73.31

Table 4: Program Outcomes Attainment through course outcomes

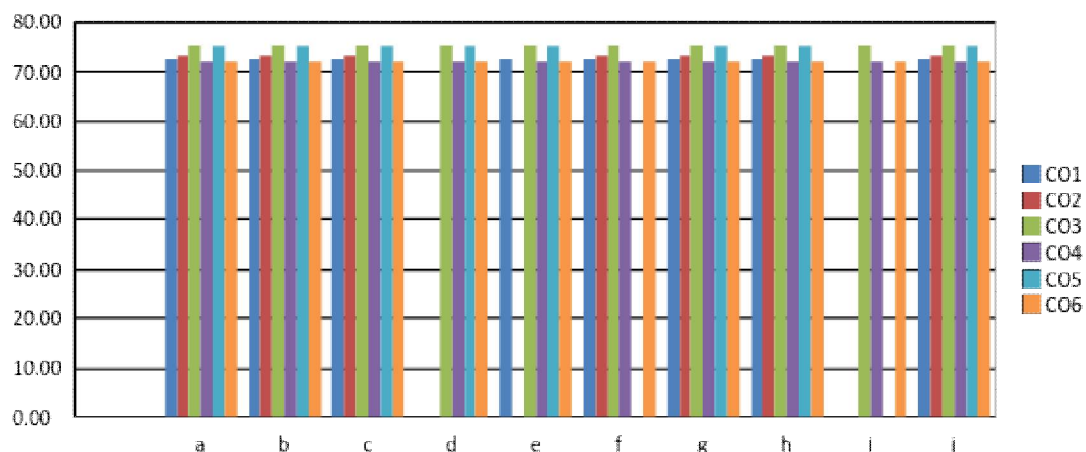


Fig. 4. Graphical representation of attainment of Cos, POs using direct and indirect method.

### III. CONCLUSION

CO attainment level of Microcontroller (17534) is evaluated using direct and indirect methods. The result obtained in academic year 2015-16 has been analyzed. The overall CO attainment is obtained by both direct and indirect methods, whereas different weightages have been considered for each methodology i.e. 80% for direct and 20% for indirect approach. It is observed that all six course outcomes have been satisfied the minimum requirement of 70%. The students are good in understanding the Assembly language programming and microcontroller interfacing with peripherals as CO3 and CO5 attained with 75.18% and 75.06% respectively. Remaining CO's has satisfactory attainments as the level set for attainment was 70%, but need to improve by applying innovative teaching methodologies. It is decided to strengthen the threshold value of CO attainment up to 80% in next academic year 2016-17.

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