

JSPM's Bhivarabai Sawant Institute of Technology and Research, Wagholi, Pune

Attainment of Program Outcomes, Program Specific Outcomes and Course Outcomes are evaluated by the institution

The method of measuring attainment of POs, PSOs and COs and the level of attainment of POs, PSOs and COs for a course/subject in the Electrical Engineering is described below as an example.

Program Outcomes (POs) as identified by National Board of Accreditation (NBA), India are what the graduates of an undergraduate engineering program should be able to do at the time of graduation. The POs are discipline non-specific. A total of twelve Program Outcomes have been prescribed in the NBA/affiliating university as

Students are expected to know and be able -

1. To apply knowledge of mathematics, science, engineering fundamentals, problem solving skills, algorithmic analysis to solve complex engineering problems.
2. To analyze the problem by finding its domain and applying domain specific skills
3. To understand the design issues of the product/software and develop effective solutions with appropriate consideration of public health and safety, cultural, societal, and environmental issues.
4. To find solutions of complex problems by conducting investigations applying suitable techniques.
5. To adapt the usage of modern tools and recent software.
6. To contribute towards the society by understanding the impact of Engineering on global aspect.
7. To understand environment issues and design a sustainable system.
8. To understand and follow professional ethics.
9. To function effectively as an individual and as member or leader in diverse teams and interdisciplinary settings.
10. To demonstrate effective communication at various levels.

11. To apply the knowledge of Computer Engineering for development of projects, and its finance and management.
12. To keep in touch with current technologies and inculcate the practices of lifelong learning.

Program Specific Outcomes (PSOs) are what the graduates of a specific undergraduate engineering program should be able to do at the time of graduation. The PSOs are program specific. PSOs are written by the Department offering the program.

PSO 1.

Analytical Ability: Perform engineering calculations and other electrical oriented components and parameters as needed for the analysis of complex engineering problems in the respective fields.

PSO 2.

Design of Electrical Systems: Analyze the working principles and operation of various electrical systems and design a system to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability, in accordance with standards.

PSO 3.

Modern tool usage: Practice the ability to visualize and work on industrial-quality laboratory equipment and apply modern tools and methodologies to electrical engineering problems for analysis, testing, design and decision making.

PSO 4.

Communication and Ethics: Demonstrate effective communication, leadership, and teamwork skills that contribute to the success of their organizations and exhibit a commitment to professional and ethical practices, continuous improvement, and lifelong learning.

COURSE OUTCOME ASSESSMENT METHODOLOGY

The institute is affiliated to Savitribai Phule Pune University which has provided the syllabus for various engineering courses where all courses/subjects have its own objectives and methodology to achieve the course outcomes. To attain the course outcomes for the course/subject, the faculty members use various Direct or Indirect tools as assessment methods. Faculty has to assess the CO and PO attainment using some direct and indirect methods, where a lot of clerical actions get involved.

The process of attainment of COs, POs and PSOs starts from writing appropriate COs for each course in the four-year engineering degree program. The course outcomes are written by the respective faculty member using action verbs of learning levels as suggested by Bloom Taxonomy. Then, a correlation is established between COs and POs and COs and PSOs on the scale of 0 to 3, 0 being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation. A 6x12 mapping matrix of COs-POs and 6x4 mapping matrix of COs-PSOs is prepared in this regard for all courses in the program. Course Outcomes and the CO-PO & CO-PSO mapping matrix for a sample course are discussed below. Table 1 shows “CO-PO” mapping matrix and Table 2 shows “CO-PSO” mapping matrix.

203149: Fundamentals Of Microcontroller And Applications

Course outcomes (CO'S)

At the end of the course, a student will be able to-

1. Differentiate Between Microprocessor And Microcontroller. Describe The Architecture And Different Features Of Various Types Of Microcontroller. State The Internal Organization Of Microcontroller 8051.
2. Demonstrate Programming Proficiency Using The Various Addressing Modes And All Types Of Instructions Of The Target Microcontroller. Impart The Knowledge About The Instruction Set
3. Program Using The Capabilities Of The Stack, The Program Counter The Internal And External Memory, Timer And Interrupts And Show How These Are Used To Execute A Programme.
4. Develop Skill In Simple Program Writing For 8051 & And Applications. Develop Algorithm/Program Of The Advanced Microcontrollers For A Particular Task.
5. Interface Advanced Microcontrollers With External Peripherals. Design Electrical Circuitry To The Microcontroller I/O Ports In Order To Interface With External Device
6. Write Assembly Language Programs And Download The Machine Code That Will Provide Solutions Real-World Control Problems Such As Fluid Level Control, Temperature Control, And Batch Processes.

Table 1 CO – PO Matrix for 203149:Fundamentals Of Microcontroller And Applications

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO149.1	3	2	3	1	3	3	3	1	2	1	3	2
CO149.2	NA	3	NA	NA	2	1	1	2	3	NA	1	2
CO149.3	NA	1	1	3	NA	3	1	2	1	1	1	NA
CO149.4	NA	1	3	2	NA	1	NA	2	2	NA	3	2
CO149.5	1	2	1	1	1	NA	2	3	NA	2	NA	1
CO149.6	1	NA	1	NA	1	1	1	2	2	1	1	3
SUM	5	9	9	7	7	9	8	12	10	5	9	10
Average	1.67	1.80	1.80	1.75	1.75	1.80	1.60	2.00	2.00	1.25	1.80	2.00

Table 2 CO – PSO Matrix for for 203149:Fundamentals Of Microcontroller And Applications

	PSO1	PSO2	PSO3	PSO4
CO149.1	3	NA	2	1
CO149.2	2	2	1	3
CO149.3	NA	1	1	3
CO149.4	2	NA	NA	NA
CO149.5	1	1	3	NA
CO149.6	NA	3	3	3
SUM	8	7	10	10
Average	2.00	1.75	2.00	2.50

ATTAINMENT OF CO's

Thus, mapping matrix of COs – POs and COs - PSOs are prepared for all the courses to attain the CO level of the class as shown in Table 3. In this assignments, Tests are conducted along with end semester exam. The different weights are assigned to each of above. INSEM exams are conducted is purely based upon CO1, CO2 and CO3 whereas ENDSEM is based upon all Cos. Similarly each student is given six assignments based upon Cos and marks awarded for each assignment to the student are out of 10 in same manner after every two units test is conducted based upon particular Cos. In below matrix marks of END SEM is fed as soon as result are declared for the semester and attainment is calculated for the students as per below pattern.

1. Attainment level 1: 60% of students scored more than 55% marks
2. Attainment level 2: 70 % of students scored more than 55% marks
3. Attainment level 3: 80% of students scored more than 55% marks

Assessment Method -->			ASSIGNMENT						TEST1		TEST2		TEST3		Total	EXTERNAL ASSESSMENT	TOTAL MARKS OF CO 220 (INT+EXT)	PERCENT AGE %
CO->			CO 1	CO 2	CO 3	CO 4	CO 5	CO 6	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6		TOTAL MARKS INSEM+END SEM OUT OF 100		
Assignment-->			1	2	3	4	5	6	Q1, 2	Q3, 4	Q1, 2	Q3, 4	Q1, 2	Q3, 4				
Marks->			10	10	10	10	10	10	10	10	10	10	10	10	120			
Sr No.	Roll No	Name of Students																
1	2201	LOKHANDE SHWETA RAMKRISHAN A	7	7	5	8	7	7	6	6	7	5	7	4	76	60	136	61.8
2	2202	MAHAJAN PRANALI VIKAS	7	5	7	5	7	5	5	5	5	5	6	2	64	63	127	57.7
3	2203	MAHESH UMESH ASALKAR	2	2	2	1	2	1	5	5	7	6	6	4	43	69	112	50.9
4	2204	MALI AKASH SUDHAKAR	7	5	7	7	7	5	6	5	5	7	5	5	71	57	128	58.2
5	2205	MALI AKSHAY SOMNATH	8	7	6	7	6	6	6	5	2	5	4	5	67	58	125	56.8
6	2206	MALVADKAR KALPANA RAMLAL	7	7	7	6	7	7	6	4	6	2	7	7	73	42	115	52.3
7	2207	MALVE OMKAR BHAGWAN	8	6	5	6	8	8	5	7	4	7	6	4	74	59	133	60.5
8	2208	MANE ABHIJEET SATAYAWAN	4	5	8	5	4	4	4	5	5	8	7	4	63	61	124	56.4
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67	2213	NANDE SHRIDEVI NAVANATH	2	2	3	2	1	4	5	3	7	5	6	4	44	52	96	43.6
68	2214	NIKAM MAHESH ASHOK	8	6	7	8	8	8	7	5	4	6	6	7	80	53	133	60.5
69	2215	NIVAGIRE MINAJI MAHADEV	5	5	5	5	5	5	8	5	4	5	5	5	62	59	121	55

Total Marks of CO	220
No of Student in range	69
0 to 121marks	20
122 to 220 marks	49
Total students attempted CO1	69

% CO1 attainment	
0 to 55%	29%
56% to 100%	71%
CO Attained	Level 2

MAPPING OF COS AND POS:

		Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability:	Ethics	Individual and team work	Communication	Management	Life-long learning:	Analytical ability	Design of electrical system	Modern tool usage	communicationa and ethics		
THIRD SEMESTER	Sub Code	Subject	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4	
	2031 41	Power Generation Technologies	1.7	3.0	1.8	1.8	2.5	2.6	1.7	2.3	3.0	1.5	3.0	2.4	2.0	2.4	2.8	2.2	5
	2031 42	Material Science	2.5	1.7	2.7	1.2	2.0	2.7	1.8	0.0	0.0	0.0	1.2	1.7	2.5	1.8	2.0	0	0
	2031 44	ELECTRICAL MEASUREMENT AND INSTRUMENTATION	2.8	2.8	2.5	2.7	1.7	0.0	0.0	2.0	0.0	0.0	0.0	3.0	2.8	2.5	1.7	2	5
	2031 46	Electrical Machines I	1.9	1.7	1.6	1.5	1.7	2.7	2.1	1.6	3.0	1.5	1.3	1.8	1.5	2.5	1.8	1.4	0
	2031 47	Network Analysis	2.0	2.7	2.0	1.7	2.0	0.0	0.0	1.0	2.0	2.0	0.0	0.0	2.6	2.0	2.0	1.5	7
	2031 48	Numerical Methods and Computer Programming	2.8	2.6	1.6	1.6	1.2	1.5	1.3	1.0	1.0	0.0	0.0	2.0	2.6	0.0	1.1	1	7
	2031 49	Fundamentals of Microcontroller and Applications	1.3	1.4	1.6	1.8	1.8	1.8	1.6	2.0	2.0	1.3	1.8	2.0	2	1.7	2	2.5	5
	3031 41	Advance Microcontroller and its Applications	1.8	2.2	1.7	1.4	1.6	1.6	1.7	1.8	1.8	1.5	1.6	1.6	1.6	2.6	2.8	2	2
	3031 42	Electrical Machines II	2.4	2.2	2.5	2.3	1.9	2.8	2.3	1.7	3.0	1.7	1.8	2.3	2.1	3	1.7	1.8	5
	3031 44	Electrical Installation, Maintenance	2.5	1.3	2.0	1.8	2.3	2.8	1.8	1.0	1.0	0.0	1.2	2.0	2.5	1.8	2.3	0	3

		and Testing																
SIXTH SEMESTER	3031 46	Power System II	2.5	2.0	2.5	0.0	1.0	0.0	1.7	0.0	0.0	2.0	0.0	0.0	0	3	1	0
	3031 47	Control System I	1.8	1.7	2.0	2.8	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	2	0	0	1.2
	3031 48	Utilization of Electrical Energy	2	3.0	2.5	2.5	1.5	2.0	2.5	2.0	0.0	0.0	0.0	3.0	2	2.5	1.5	2
	3031 49	Design of Electrical Machines	3.0	3.0	2.5	3.0	3.0	2.3	6.0	1.0	1.5	1.0	3.0	3.0	2.3 3	2	3	1
	3031 50	Energy Audit and Management																
SEVENTH SEMESTER	4031 41	Power System Operation and Control	2.7	2.8	2.5	1.8	3.0	1.8	1.2	1.3	1.7	1.4	1.5	2.2	2	2	2.8	2.5
	4031 42	PLC and SCADA Applications	2.3 3	2.2	2.5	2.5	3	2	1.6 7	0	2	2	3	2.5	2.3 3	2	3	1
	4031 43	Renewable Energy Resources	2.2	1.8 3	2.25	1.4	1.5	1.6	1.6 7	1	1.5	0	3	1.5	1.8 3	2	1	1.2
	4031 45	Control System II	3.0 0	2.6 7	2.6 7	2.1 7	2.1 7	1.1 7	1.0 0	1.0 0	1.0 0	1.0 0	1.0 0	1.5 0	3.0 0	2.6 7	2.1 7	1
EIGHTH SEMESTER	4031 47	Switchgear and Protection	3	3	2.6 7	2	2	2	3	NA	NA	NA	NA	3	3.0	2.7	2.0	0
	4031 49	High Voltage Engineering	2.6 7	2.8 3	2.5 0	1.8 3	3.0 0	1.8 3	1.2 0	1.2 5	1.6 7	1.4 0	1.5 0	2.1 6	2.0 0	2.0 0	2.4 0	2