

Assessment of Attainment of Student Outcome

PO-01

An ability to apply knowledge of mathematics, science, and engineering
(2015-16)

for the
Bachelor of Engineering
in
Electrical Engineering



THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

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Attainment of Program outcome 'PO-01'

The attainment of program outcome PO-01: *An ability to apply knowledge of mathematics, science, and engineering* has been measured using a standard procedure for the BE Electrical Engineering program. The program outcome 'PO-01' has been classified into following performance criteria:

PO-01(A): *Apply mathematics (partial differentiation, vector calculus, linear algebra, complex variables, Laplace transform, probability, discrete mathematics etc.) to obtain analytical, numerical and statistical solutions*

PO-01(B): *Demonstrate and apply knowledge of fundamentals, scientific and/or engineering principles towards solving engineering problems*

PO-01(C): *Apply numerical and statistical methods in analysing data*

The program assessment committee identified the following courses for the assessment of program outcome 'PO-01':

- UEE001: Electrical Engineering
- UEE301: Direct Current Machines and Transformers
- **UEE302: Electro Magnetic Field Theory**
- UEI303: Techniques on Signals and Systems
- UEE401: Alternating Current Machines
- UEE402: Transmission and Distribution of Power
- UEE403: Measurement and Transducers
- UMA032: Numerical and Statistical Methods
- UEI501: Control Systems
- **UEE501: Generalized Theory of Electrical Machine**
- **UEI503: Digital Signal Processing and Applications**
- **UEE503: Network Analysis and Synthesis**
- UEE504: Power Electronics
- UEE505: Analog and Digital Systems
- UEE602: Power System Analysis and Stability
- UEE603: Switchgear and Protection
- **UEI841: Advance Control Systems**
- UEE801: Electric Drives
- UEE802: Intelligent Algorithms in Power Systems
- UEE804: Operation and Control of Power Systems

- **UEE843: Power System Planning**

Outcome PO-01 has been assessed through three performance criteria PO-01(A), PO-01(B) and PO-01(C). The following courses have been considered by the program assessment committee for the assessment of performance criteria ‘PO-01(A)’, ‘PO-01(B)’ and ‘PO-01(C)’ in the academic year 2015-16.

Performance Criteria	Course -1	Course-2
PO-01(A)	UEE501:Generalized Theory of Electrical machines	UEI841:Advanced Control systems
PO-01(B)	UEE302: Electromagnetic Field Theory	UEE503: Network Analysis and Synthesis
PO-01(C)	UEI503: Digital Signal processing and Applications	UEE843:Power System planning

The step by step methodology used to measure the attainment of program outcome ‘PO-01’ is shown in Fig. PO-01.1. The similar procedure is followed to measure the attainment of program outcome ‘PO-01’ for all three academic years under consideration.

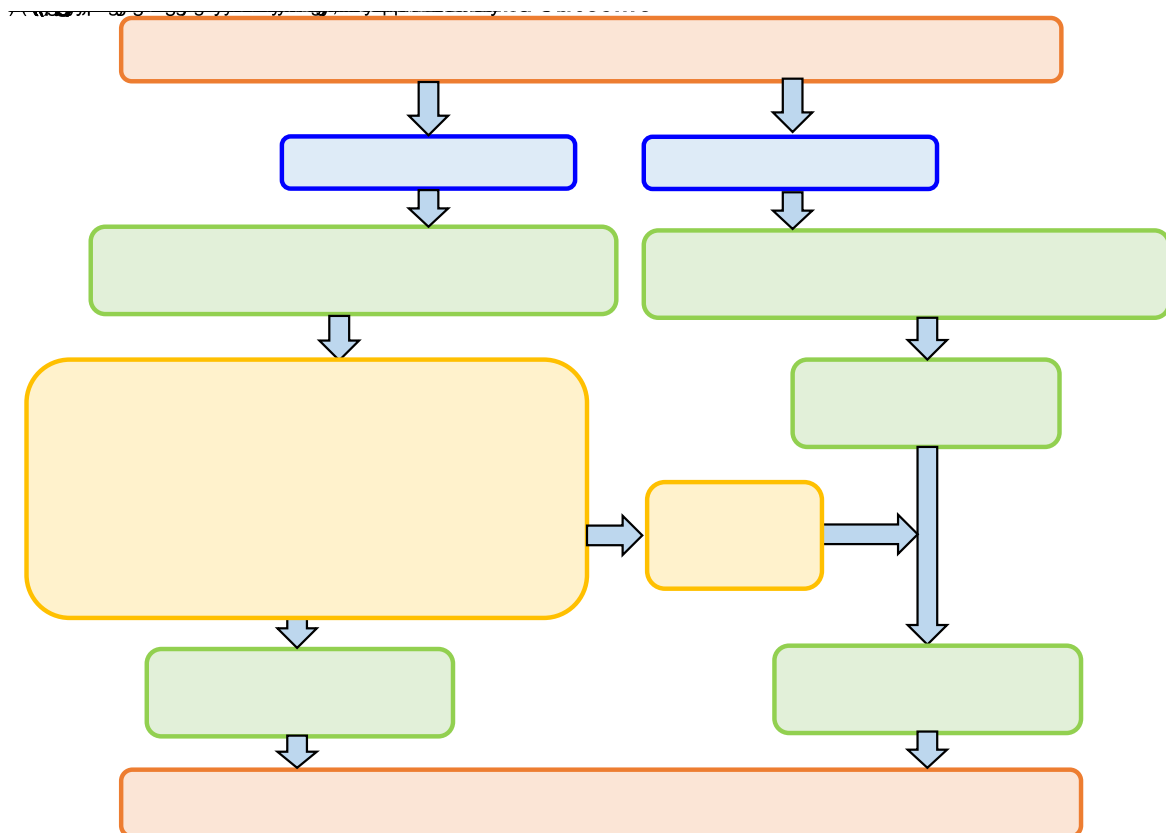


Fig. PO-01.1: Process for measurement of attainment of outcome ‘PO-01’ for the year 2015-16

The following Rubric has been used to convert marks obtained by the students to a scale in the range of 1 to 5 and is described in Table PO-01.1 in most cases unless specifically mentioned.

Table PO-01.1: Rubric for Outcome Measurement

S. No.	Range of Marks (%)	Score (1-5)
1	$75 \leq \text{Marks} \leq 100$	5
2	$60 \leq \text{Marks} < 75$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

The following sections summarize separate assessments for each of the performance criteria using the courses mentioned.

Assessment of Outcome ‘PO-01’ using performance criterion ‘PO-01(A)’

PO-01(A): Apply mathematics (partial differentiation, vector calculus, linear algebra, complex variables, Laplace transform, probability, discrete mathematics etc.) to obtain analytical, numerical and statistical solutions

The performance criterion ‘PO-01(A)’ has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a.) Direct Measures:

(i) Assessment Tool: Students’ performance using Course Portfolio

Two courses namely *UEE501: Generalized Theory of Electrical Machines* and *UEI841: Advanced Control Systems* are used to assess performance criteria PO-01(A) as a direct measure. The analysis for each of these courses is provided below:

UEE 501: Generalized Theory of Electrical Machines

The performance of course *UEE501: Generalized Theory of Electrical Machines* is used to measure the attainment of outcome ‘PO-01(A)’ through End Semester Examination (Question 2(b and c) , July-Dec 2016, 25 Marks).

Question:

2.	(b) Explain with mathematical expressions in Kron’s primitive machine that electrical power input is equivalent to summation of power lost, power stored and mechanical power output	(10)
	(c) Obtain the identical transformations for currents and voltages from a	(15

	rotating balanced 3-phase (a,b,c) winding to stationary 2-phase(d,q) winding.	)
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The performance of the students in the above question is summarized as given below in Table PO-01(A). Using rubrics defined in Table PO-01.1.

Table PO-01(A).1: Students' performance in question targeting ' PO-01(A)'; Course UEE501

S. No	Roll No.	Name of Student	Marks (25)	Score (1-5)
1	101304001	Aarushi Bajaj	10.5	3
2	101304002	Abhey Arora	3.5	1
3	101304003	Abhishek Taksali	16.5	4
4	101304005	Aditi Narang	10	3
5	101304006	Aditya	19	5
6	101304007	Akshat	16	4
7	101304008	Akshay Kapoor	16.5	4
8	101304009	Akshay Kumar	8	2
9	101304011	Akshay Sharma	8.5	2
10	101304012	Amandeep Kaur	3	1
11	101304014	Amaninder Singh Randhawa	2.5	1
12	101304015	Angad Kapoor	3	1
13	101304016	Ankita Garg	15	4
14	101304018	Anmol Jawa	8	2
15	101304019	Anmolpreet Singh	4	1
16	101304020	Anyuti Tiwary	10	3
17	101304021	Arpit Sharma	19	5
18	101304023	Arshbir Kaur	16	4
19	101304024	Arshdeep Singh Bagga	4	1
20	101304026	Ashish Rajpal	14.5	3
21	101304028	Berry Lubana	9.5	2
22	101304029	Bhanu Duggal	21.5	5
23	101304030	Bhanu Marwaha	9	2
24	101304031	Chirag Gaba	14	3
25	101304033	Dishant Vanvari	9	2
26	101304034	Divyesh Pratap Singh	12.5	3
27	101304035	Elham Anwar	12.5	3
28	101304036	Gurseerat Singh Meen	0	1
29	101304037	Gursewak Singh	12	3
30	101304040	Hariansh Sehgal	11	3
31	101304042	Himanshu Goyal	14.5	3
32	101304044	Jasjit Singh	0	1
33	101304046	Jessica Dhaliwal	19	5
34	101304048	Karan Kumar	9	2
35	101304049	Karanjot Singh Kochar	15	4
36	101304050	Kashish Aggarwal	13	3

37	101304052	Love Gaba	5.5	2
38	101304056	Mayank Singla	1	1
39	101304057	Mridul Bhutani	5.5	2
40	101304058	Naman Garg	20.5	5
41	101304060	Navdeep Singh	14.5	3
42	101304062	Nishant Garg	19	5
43	101304094	Satripleen Kaur	8	2
44	101484001	Amandeep Singh	5	2
45	101484002	Amrinder Singh	18.5	4
46	101484004	Azad Singh	9	2
47	101484007	Deepak Singla	7	2
48	101484008	Diljeet Singh	13	3
49	101304051	Kritika Singla	8	2
50	101304061	Nazuk Aggarwal	5	2
51	101304064	Paras Bawa	0	1
52	101304065	Parth Ahuja	17	4
53	101304066	Parushi	7.5	2
54	101304068	Piyush Jindal	10	3
55	101304069	Piyush Tripathi	1	1
56	101304070	Prachi Garg	7	2
57	101304072	Preeti Garg	1	1
58	101304073	Priyank Arora	10.5	3
59	101304074	Priyanka	0	1
60	101304075	Priyanka Singh	6	2
61	101304076	Priyansh Mahajan	0	1
62	101304078	Rajan	0	1
63	101304079	Rajat Sharma	9	2
64	101304080	Ratul Goyal	16.5	4
65	101304081	Ravinder Singh	9.5	2
66	101304082	Rishabh Juneja	6.5	2
67	101304083	Robin Manktala	16	4
68	101304084	Rohan Ghai	21	5
69	101304085	Rohan Singla	18.5	4
70	101304086	Rohan Wadhawan	15	4
71	101304087	Rohit Goyal	10.5	3
72	101304088	Rubina Bamba	11.5	3
73	101304089	Sagar Pulani	12.5	3
74	101304090	Sahil Kataria	6.5	2
75	101304091	Sakshi	21.5	5
76	101304092	Sandal Singh Sidhu	14.5	3
77	101304095	Saurabh Mohan	11	3
78	101304097	Shailly Gupta	10	3
79	101304098	Shaina	3.5	1

80	101304099	Shivika Gupta	11	3
81	101304100	Shresth Rai	5	2
82	101304101	Shubham Goyal	4	1
83	101304102	Shubham Gupta	17	4
84	101304104	Shubham Sharma	17.5	4
85	101304105	Shubham Soin	13.5	3
86	101304106	Siddharth Goyal	0	1
87	101304107	Sidharth Garg	2.5	1
88	101304108	Simran Kaur	7	2
89	101304111	Sumit Dhingra	5.5	2
90	101304112	Sumit Kaushik	14	3
91	101304113	Tushar Dheer	4.5	1
92	101304114	Tushar Sharma	12	3
93	101304116	Utsav Chhabra	3	1
94	101304117	Vaibhav Gupta	21	5
95	101304118	Vaishali	15.5	4
96	101304119	Varun Bansal	12.5	3
97	101304120	Veni Jindal	8	2
98	101304121	Vishal Arora	17.5	4
99	101304122	Yugesh Goyal	2	1
100	101484009	Jyoti Kaushal	2	1
101	101484011	Pawan Kumar	13.5	3
102	101484012	Rajat Singla	1	1
103	101484013	Satveer Kaur	20	5
104	101484014	Saurabh Kumar Wadhawan	2.5	1
105	101484015	Shweta Sharma	0	1
106	101484016	Sukhjeet Singh	13.5	3

The performance of students through the course UEE501 for criteria PO-01(A) is summarized in Table PO-01(A).2.

Table PO-01(A).2: Average score of student performance in the course UEE501 for criteria PO-01(A)

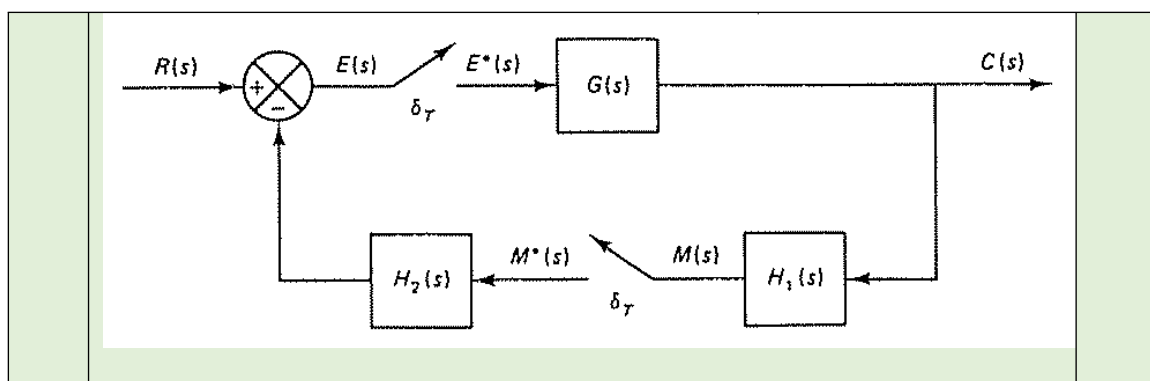
Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE501	9.4	15.09	26.42	24.53	24.53	2.60

UEI841: Advanced Control Systems

The performance of course *UEI841: Advanced Control Systems* is used to measure the attainment of outcome 'PO-01(A)' through the End Sem. Examination (Question8, Jan-June 2016,10 Marks).

Question:

Q.8	Find the closed-loop pulse transfer function of the block diagram shown in Fig. 3.	(10)
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The performance of the students in the above question is summarized in Table PO-01(A).3 using rubrics defined in Table PO-01.1.

Table PO-01(A).3: Students' performance in question targeting ' PO-01(A)'; Course UEI841

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
1	101304001	Aarushi Bajaj	10	5
2	101304002	Abhey Arora	10	5
3	101304003	Abhishek Taksali	8	5
4	101304004	Adhikaansh Tayal	0	1
5	101304005	Aditi Narang	10	5
6	101304006	Aditya	6	4
7	101304007	Akshat	8	5
8	101304008	Akshay Kapoor	10	5
9	101304009	Akshay Kumar	4	3
10	101304010	Akshay Kumar Chaudhary	4	3
11	101304011	Akshay Sharma	10	5
12	101304012	Amandeep Kaur	6	4
13	101304013	Amandeep Singh	10	5
14	101304015	Angad Kapoor	8	5
15	101304016	Ankita Garg	10	5
16	101304018	Anmol Jawa	8	5
17	101304019	Anmolpreet Singh	10	5
18	101304020	Anyuti Tiwary	10	5
19	101304021	Arpit Sharma	8	5
20	101304022	Arsh Kundal	4	3
21	101304023	Arshbir Kaur	8	5
22	101304024	Arshdeep Singh Bagga	6	4
23	101304025	Ashish	8	5
24	101304026	Ashish Rajpal	10	5
25	101304028	Berry Lubana	8	5
26	101304029	Bhanu Duggal	10	5
27	101304030	Bhanu Marwaha	8	5
28	101304031	Chirag Gaba	8	5
29	101304032	Dipin Garg	10	5

30	101304033	Dishant Vanvari	6	4
31	101304034	Divyesh Pratap Singh	8	5
32	101304035	Elham Anwar	10	5
33	101304036	Gurseerat Singh Meen	6	4
34	101304037	Gursewak Singh	8	5
35	101304040	Hariansh Sehgal	9	5
36	101304041	Hartejdeep Singh	8	5
37	101304042	Himanshu Goyal	6	4
38	101304044	Jasjit Singh	6	4
39	101304045	Jassimran Singh Julka	8	5
40	101304046	Jessica Dhaliwal	10	5
41	101304048	Karan Kumar	6	4
42	101304049	Karanjot Singh Kochar	8	5
43	101304050	Kashish Aggarwal	8	5
44	101304052	Love Gaba	6	4
45	101304054	Manik Mittal	10	5
46	101304056	Mayank Singla	8	5
47	101304057	Mridul Bhutani	10	5
48	101304058	Naman Garg	10	5
49	101304059	Navdeep Singh	10	5
50	101304060	Navdeep Singh	10	5
51	101304062	Nishant Garg	10	5
52	101304094	Satripleen Kaur	6	4
53	101484001	Amandeep Singh	10	5
54	101484002	Amrinder Singh	10	5
55	101484003	Ashmeen Singh	6	4
56	101484004	Azad Singh	4	3
57	101484005	Chandan Garg	10	5
58	101484007	Deepak Singla	8	5
59	101484008	Diljeet Singh	5	3
60	101304051	Kritika Singla	10	5
61	101304061	Nazuk Aggarwal	10	5
62	101304063	Nishtha Raheja	4	3
63	101304064	Paras Bawa	4	3
64	101304065	Parth Ahuja	4	3
65	101304066	Parushi	3	2
66	101304067	Pency Goyal	6	4
67	101304068	Piyush Jindal	4	3
68	101304069	Piyush Tripathi	4	3
69	101304070	Prachi Garg	10	5
70	101304071	Prashant Kataria	0	1
71	101304072	Preeti Garg	2	2
72	101304073	Priyank Arora	4	3

73	101304074	Priyanka	0	1
74	101304075	Priyanka Singh	4	3
75	101304076	Priyansh Mahajan	1	1
76	101304077	Rahul Meena	2	2
77	101304078	Rajan	4	3
78	101304079	Rajat Sharma	4	3
79	101304080	Ratul Goyal	2	2
80	101304081	Ravinder Singh	10	5
81	101304082	Rishabh Juneja	4	3
82	101304083	Robin Manktala	6	4
83	101304084	Rohan Ghai	4	3
84	101304085	Rohan Singla	2	2
85	101304086	Rohan Wadhawan	6	4
86	101304087	Rohit Goyal	4	3
87	101304088	Rubina Bamba	4	3
88	101304089	Sagar Pulani	4	3
89	101304090	Sahil Kataria	10	5
90	101304091	Sakshi	8	5
91	101304092	Sandal Singh Sidhu	0	1
92	101304093	Sandeep Kaur	0	1
93	101304095	Saurabh Mohan	3	2
94	101304096	Shagundeep Singh	1	1
95	101304097	Shailly Gupta	4	3
96	101304098	Shaina	2	2
97	101304099	Shivika Gupta	4	3
98	101304100	Shresth Rai	0	1
99	101304101	Shubham Goyal	4	3
100	101304102	Shubham Gupta	6	4
101	101304103	Shubham Sharma	0	1
102	101304104	Shubham Sharma	0	1
103	101304105	Shubham Soin	4	3
104	101304106	Siddharth Goyal	4	3
105	101304107	Sidharth Garg	4	3
106	101304108	Simran Kaur	4	3
107	101304109	Simranjit Singh	0	1
108	101304111	Sumit Dhingra	0	1
109	101304112	Sumit Kaushik	4	3
110	101304113	Tushar Dheer	2	2
111	101304114	Tushar Sharma	10	5
112	101304116	Utsav Chhabra	4	3
113	101304117	Vaibhav Gupta	10	5
114	101304118	Vaishali	4	3
115	101304119	Varun Bansal	0	1

116	101304120	Veni Jindal	10	5
117	101304121	Vishal Arora	4	3
118	101304122	Yugesh Goyal	4	3
119	101484009	Jyoti Kaushal	2	2
120	101484011	Pawan Kumar	4	3
121	101484012	Rajat Singla	2	2
122	101484013	Satveer Kaur	8	5
123	101484014	Saurabh Kumar Wadhawan	4	3
124	101484015	Shweta Sharma	3	2
125	101484016	Sukhjeet Singh	4	3

The performance of students through the course UEI841 for criteria PO-01(A) is summarized in Table PO-01(A).4.

Table PO-01(A).4: Average score of student performance in the course UEI841 for criteria PO-01(A)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEI841	41.60	12.00	27.20	8.80	10.40	3.66

The data from Table PO-01(A).2 and Table PO-01(A).4 is used to evaluate weighted average of direct measure through course portfolio for criteria 'PO-01(A)', and is summarised in Table PO-01(A).5.

Table PO-01(A).5: Weighted Average Student class performance (Course Portfolio) for criteria 'PO-01(A)'

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE501	9.4	15.09	26.42	24.53	24.53	2.60
UEI841	41.60	12.00	27.20	8.80	10.40	3.66
Student class performance score	25.52	13.55	26.81	16.66	17.46	3.13

b) Indirect Measures:

The indirect measurement of performance criteria 'PO-01(A)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarized in Table PO-01(A).6 and Table PO-01(A).7.

(i) Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-01(A)'.

UEE501	Develop the Kron's primitive model for rotating machines Express the revolving field and reference frame theory
UEI841	Derive discrete-time mathematical models in both time domain (difference equations, state equations) and z-domain (transfer function using z-transform)

Table PO-01(A).6: Weighted average score of performance criterion 'PO-01(A)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE501	10.13	22.13	33.25	25.05	9.45	2.99
UEI841	28.09	30.58	23.97	8.27	9.09	3.60
Course survey score	19.11	26.36	28.61	16.66	9.27	3.30

- (ii) **Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-01' through indirect measurement using following question in the respective surveys.

Graduating Survey	An ability to apply knowledge of mathematics, science, and engineering
Alumni Survey	
Employer Survey	Do our students have an ability to apply knowledge of mathematics, science, and engineering?

Table PO-01(A).7: Weighted average score of performance criterion 'PO-01(A)' based on other surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating student survey	15.56	40.00	26.67	11.11	6.67	3.47
Employer survey	40.00	46.67	13.33	0.00	0.00	4.27
Alumni survey	25.60	34.78	30.92	6.76	1.93	3.75
Other surveys score	27.05	40.08	23.64	5.96	2.87	3.83

c) Overall weighted average score of performance criterion 'PO-01(A)'

The overall weighted average score of performance criterion 'PO-01(A)' is summarised in Table PO-01(A).8 from the data given in Tables PO-01(A).5, Table PO-01(A).6 and Table PO-01(A).7.

Table PO-01(A).8: Overall weighted average score of performance criterion 'PO-01(A)'

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	25.52	13.55	26.81	16.66	17.46	3.13	5
Course surveys	19.11	26.36	28.61	16.66	9.27	3.30	4

Other surveys	27.05	40.08	23.64	5.96	2.87	3.83	3
Overall weighted score	23.77	24.45	26.62	13.99	11.08	3.36	

Assessment of Outcome 'PO-01' using performance criterion PO-01(B)

PO-01(B): Demonstrate knowledge of fundamentals, scientific and/or engineering principles towards solving engineering problems

The performance criterion 'PO-01(B)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE302: Electromagnetic Field Theory* and *UEE503: Network Analysis and Synthesis* are used to assess performance criteria PO-01(B) as a direct measure. The analysis for each of these courses is provided below:

UEE302: Electromagnetic Field Theory

The performance of course *UEE302: Electromagnetic Field Theory* is used to measure the attainment of outcome 'PO-01(B)' through the End Semester Examination (Question 4(c) and 5(a), July-Dec 2016, 16 Marks).

Question:

Q.4 (c)	Utilize the analogy between EM wave and transmission line to establish the relation: $LC = \mu\epsilon$.	(4)
Q.5 (a)	A $100 + j150\Omega$ load is connected to a 75Ω loss less line. Find using smith chart I. Reflection coefficient II. SWR III. The load admittance Y_L. IV. Z_{in} at 0.4λ from the load V. The locations of V_{max} and V_{min} with respect to load if the line is 0.6λ long VI. Z_{in} at the generator.	(12)

The performance of the students in the above question is summarized in Table PO-01(B).1 using rubrics defined in Table PO-01.1.

Table PO-01(B).1: Students' performance in question targeting 'PO-01(B)'; Course UEE302

S. No	Roll No.	Name of Student	Marks (16)	Score (1-5)
1	101404001	Abhay Mahipal	14	5
2	101404002	Abhijeet Singh Sankhla	6.5	3

3	101404004	Abhinav Arora	15	5
4	101404006	Abhishek Sharma	12	5
5	101404007	Ajay Singh	7	3
6	101404009	Alka Thakur	16	5
7	101404012	Ankush Goyal	7	3
8	101404014	Anmol Goyat	9	3
9	101404015	Anmol Rattan Kaur	6	2
10	101404017	Anubhav Kumar	8	3
11	101404018	Apeksha Goel	7	3
12	101404019	Arnish Jain	16	5
13	101404020	Arshiya	12	5
14	101404021	Arshjot Kaur	15	5
15	101404023	Ayush Jain	14	5
16	101404024	Bhawani Singh	9	3
17	101404025	Chirag Jain	8	3
18	101404026	Davileen Garg	16	5
19	101404027	Dilpreet Kaur	1	1
20	101404028	Divesh Kamdar	8	3
21	101404029	Divyam Aggarwal	11	4
22	101404031	Divyanshu Sidhartha	7	3
23	101404032	Garima	3	1
24	101404033	Garv Chahar	3	1
25	101404035	Gaurav Rathore	2	1
26	101404036	Gurpreet Singh	10	4
27	101404037	Gursagar Singh	12	5
28	101404038	Gurupinder Pal Singh	7	3
29	101404039	Harmanpreet Singh	6	2
30	101404041	Harshit Kaushik	8	3
31	101404042	Harshvir Singh	12	5
32	101404043	Harsimarjot Kaur	4	2
33	101404044	Harsimran Singh	10	4
34	101404045	Hartej Singh Bains	10	4
35	101404046	Heema Gupta	11	4
36	101404047	Hitesh Kumar	5	2
37	101404048	Ishita Mahindru	0	1
38	101404050	Jagnoor Kaur	7	3
39	101404051	Jashanpreet Singh	7	3
40	101404052	Jatin Bansal	13	5
41	101404053	Jatin Raheja	10	4
42	101404054	Kanishak Sharma	9	3
43	101404055	Karan Sanjeev Bajaj	13	5
44	101404056	Kirtish Madaan	10	4
45	101404057	Mahitosh Sharma	15	5

46	101404058	Manan Mittal	10	4
47	101404059	Mandeep Singh Panesar	8	3
48	101404060	Manisha Gupta	5	2
49	101404061	Manit Gupta	9	3
50	101404062	Manjosh Singh Dhillon	8	3
51	101404063	Manpreet Singh Brar	15	5
52	101404064	Manvir Kaur	8	3
53	101404065	Mehak Bhatia	8	3
54	101404066	Mithilesh Kumar	6	2
55	101404067	Mohit Goyal	16	5
56	101404068	Mridul Marwaha	13	5
57	101404069	Mudit Arora	14	5
58	101404070	Naveen Parashar	6	2
59	101404072	Nigam Wadhwa	7	3
60	101404073	Nikhil Danodia	8	3
61	101404074	Nishita Kumari	4	2
62	101404075	Nitin Gupta	10	4
63	101404076	Nitish Arora	15	5
64	101404077	Nitish Bhardwaj	8	3
65	101404078	Omandeep Kaur	12	5
66	101404079	Pankaj Garg	4	2
67	101404080	Paramjot Singh	10	4
68	101404081	Parmar Adhiraj Singh	5	2
69	101584009	Prince Kalia	7.5	3
70	101584010	Rohit Gupta	0	1
71	101584012	Sharandeep Singh	7	3
72	101584013	Shashi Sharma	14	5

The performance of students through the course UEE302 for criteria PO-01(B) is summarized in Table PO-01(B).2

Table PO-01(B).2: Average score of student performance in the course UEE302 for criteria PO-01(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE302	29.17	13.89	34.72	13.89	8.33	3.42

UEE503: Network Analysis and Synthesis

The performance of course *UEE503: Network Analysis and Synthesis* is used to measure the attainment of outcome 'PO-01(B)' through the End Semester. Examination (Question 3, July-Dec 2015, 20 Marks).

Question:

Q3 a)	What is a 'Two-Port Network'?	(2)
b)	Write the condition of symmetry and that of reciprocity for a two-port network in terms of ABCD parameters.	(2)
c)	Derive the relationship to convert Y-parameters of the given two port network to Z-parameters.	(6)
d)	Given 2 networks N_a and N_b such that Y parameters of N_a are given by $Y_{11a} = 1 \text{ S}$, $Y_{12a} = -2 \text{ S}$, $Y_{22a} = 5 \text{ S}$, $Y_{21a} = 2 \text{ S}$ and that of N_b are given by $Y_{11b} = -1.5 \text{ S}$, $Y_{12b} = -1 \text{ S}$, $Y_{22b} = 2 \text{ S}$, $Y_{21b} = 2 \text{ S}$. Find out the h-parameters of the resultant network N which is the result of the series-series connection of N_a and N_b .	(10)

The performance of the students in the above question is summarized in Table PO-01(B).3 using rubrics defined in Table PO-01.1.

Table PO-01(B).3: Student's performance in question targeting 'PO-01(B)'; Course UEE503

S. No	Roll No.	Name of Student	Marks (20)	Score (1-5)
1	101304001	Aarushi Bajaj	8	3
2	101304002	Abhey Arora	18	5
3	101304003	Abhishek Taksali	12	4
4	101304004	Adhikaansh Tayal	0	1
5	101304005	Aditi Narang	18	5
6	101304006	Aditya	0	1
7	101304007	Akshat	20	5
8	101304008	Akshay Kapoor	18	5
9	101304009	Akshay Kumar	5	2
10	101304010	Akshay Kumar Chaudhary	2	1
11	101304011	Akshay Sharma	8	3
12	101304012	Amandeep Kaur	6	2
13	101304013	Amandeep Singh	10	3
14	101304014	Amaninder Singh Randhawa	18	5
15	101304015	Angad Kapoor	14	4
16	101304016	Ankita Garg	20	5
17	101304018	Anmol Jawa	10	3
18	101304019	Anmolpreet Singh	17	5
19	101304020	Anyuti Tiwary	8	3
20	101304021	Arpit Sharma	12	4
21	101304022	Arsh Kundal	0	1
22	101304023	Arshbir Kaur	13	4
23	101304024	Arshdeep Singh Bagga	10	3
24	101304025	Ashish	16	5
25	101304026	Ashish Rajpal	15	5
26	101304028	Berry Lubana	8	3

27	101304029	Bhanu Duggal	18	5
28	101304030	Bhanu Marwaha	15	5
29	101304031	Chirag Gaba	18	5
30	101304032	Dipin Garg	12	4
31	101304033	Dishant Vanvari	10	3
32	101304034	Divyesh Pratap Singh	9	3
33	101304035	Elham Anwar	15	5
34	101304036	Gurseerat Singh Meen	0	1
35	101304037	Gursewak Singh	0	1
36	101304040	Hariansh Sehgal	9	3
37	101304041	Hartejdeep Singh	0	1
38	101304042	Himanshu Goyal	19	5
39	101304044	Jasjit Singh	2	1
40	101304045	Jassimran Singh Julka	2	1
41	101304046	Jessica Dhaliwal	17	5
42	101304047	Kanwarpal Singh	0	1
43	101304048	Karan Kumar	6	2
44	101304049	Karanjot Singh Kochar	12	4
45	101304050	Kashish Aggarwal	8	3
46	101304051	Kritika Singla	6	2
47	101304052	Love Gaba	8	3
48	101304054	Manik Mittal	10	3
49	101304055	Maninderjit Singh	0	1
50	101304056	Mayank Singla	15	5
51	101304057	Mridul Bhutani	10	3
52	101304058	Naman Garg	19	5
53	101304059	Navdeep Singh	11	3
54	101304060	Navdeep Singh	8	3
55	101304061	Nazuk Aggarwal	14	4
56	101304062	Nishant Garg	14	4
57	101304063	Nishtha Raheja	15	5
58	101304064	Paras Bawa	1	1
59	101304065	Parth Ahuja	13	4
60	101304066	Parushi	14	4
61	101304067	Pency Goyal	9	3
62	101304068	Piyush Jindal	10	3
63	101304069	Piyush Tripathi	8	3
64	101304070	Prachi Garg	14	4
65	101304071	Prashant Kataria	0	1
66	101304072	Preeti Garg	12	4
67	101304073	Priyank Arora	9	3
68	101304074	Priyanka	9	3
69	101304075	Priyanka Singh	9	3

70	101304076	Priyansh Mahajan	4	2
71	101304077	Rahul Meena	0	1
72	101304078	Rajan	1	1
73	101304079	Rajat Sharma	0	1
74	101304080	Ratul Goyal	14	4
75	101304081	Ravinder Singh	17	5
76	101304082	Rishabh Juneja	8	3
77	101304083	Robin Manktala	12	4
78	101304084	Rohan Ghai	18	5
79	101304085	Rohan Singla	20	5
80	101304086	Rohan Wadhawan	12	4
81	101304087	Rohit Goyal	2	1
82	101304088	Rubina Bamba	7	2
83	101304089	Sagar Pulani	12	4
84	101304090	Sahil Kataria	18	5
85	101304091	Sakshi	20	5
86	101304092	Sandal Singh Sidhu	14	4
87	101304093	Sandeep Kaur	1	1
88	101304094	Satripleen Kaur	4	2
89	101304095	Saurabh Mohan	4	2
90	101304096	Shagundeep Singh	0	1
91	101304097	Shailly Gupta	13	4
92	101304098	Shaina	10	3
93	101304099	Shivika Gupta	18	5
94	101304100	Shresth Rai	0	1
95	101304101	Shubham Goyal	8	3
96	101304102	Shubham Gupta	10	3
97	101304103	Shubham Sharma	7	2
98	101304104	Shubham Sharma	20	5
99	101304105	Shubham Soin	18	5
100	101304106	Siddharth Goyal	12	4
101	101304107	Sidharth Garg	8	3
102	101304108	Simran Kaur	11	3
103	101304109	Simranjit Singh	2	1
104	101304111	Sumit Dhingra	0	1
105	101304112	Sumit Kaushik	18	5
106	101304113	Tushar Dheer	14	4
107	101304114	Tushar Sharma	20	5
108	101304116	Utsav Chhabra	0	1
109	101304117	Vaibhav Gupta	12	4
110	101304118	Vaishali	10	3
111	101304119	Varun Bansal	6	2
112	101304120	Veni Jindal	20	5

113	101304121	Vishal Arora	11	3
114	101304122	Yugesh Goyal	14	4
115	101484001	Amandeep Singh	17	5
116	101484002	Amrinder Singh	19	5
117	101484003	Ashmeen Singh	1	1
118	101484004	Azad Singh	0	1
119	101484005	Chandan Garg	10	3
120	101484007	Deepak Singla	10	3
121	101484008	Diljeet Singh	10	3
122	101484009	Jyoti Kaushal	2	1
123	101484011	Pawan Kumar	13	4
124	101484012	Rajat Singla	11	3
125	101484013	Satveer Kaur	16	5
126	101484014	Saurabh Kumar Wadhawan	8	3
127	101484015	Shweta Sharma	4	2
128	101484016	Sukhjeet Singh	7	2

The performance of students through the course UEE503 for criteria PO-01(B) is summarized in Table PO-01(B).4.

Table PO-01(B).4: Average score of student performance in the course UEE503 for criteria PO-01(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE503	25.00	17.97	27.34	9.38	20.31	3.18

The data from Table PO-01(B).2 and Table PO-01(B).4 is used to evaluate weighted average of direct measure through course portfolio for criteria 'PO-01(B)', and is summarised in Table PO-01(B).5.

Table PO-01(B).5: Weighted Average Student class performance (Course Portfolio) for criteria PO-01(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE302	29.2	13.9	34.7	13.9	8.3	3.42
UEE503	25.0	17.97	27.34	9.38	20.31	3.18
Student class performance Score	27.08	15.93	31.03	11.63	14.32	3.30

b) Indirect Measures:

The indirect measurement of performance criteria 'PO-01(B)' has been assessed through Student Course Surveys and other surveys(Graduating Student Survey, Alumni Survey and Employer

Survey). The weighted average score in respective surveys is summarised in Table PO-01(B).6 and Table PO-01(A).7.

(i) **Assessment Tool:** Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of ‘ PO-01(B)’.

UEE302	Realize the analogy of wave with transmission line and determine the transmission line performance
UEE503	Apply two port network theory in electrical circuits

Table PO-01(B).6: Weighted average score of performance criterion ‘ PO-01(B)’ based on student course surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE302	5.4	21.6	27.0	35.1	10.8	2.76
UEE503	31.1	29.5	26.2	11.5	1.6	3.77
Course survey score	18.25	25.55	26.60	23.30	6.20	3.27

(ii) **Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey
(Other surveys) are used to assess the attainment of program outcome ‘PO-01’ through indirect measurement and is summarized in Table PO-01(A).7

c) Overall weighted average score of performance criterion ‘ PO-01(B)’

The overall weighted average score of performance criterion ‘ PO-01(B)’ is summarised in Table PO-01(B).7 from the data given in Tables PO-01(B).5, PO-01(B).6 and PO-01(A).7.

Table PO-01(B).7: Overall weighted average score of performance criterion ‘ PO-01(B)’

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	27.08	15.93	31.03	11.63	14.32	3.30	5
Course surveys	18.25	25.55	26.60	23.30	6.20	3.27	4
Other surveys	27.05	40.08	23.64	5.96	2.87	3.83	3
Overall weighted score	24.13	25.17	27.71	14.10	8.75	3.42	

Assessment of Outcome ‘PO-01’ using performance criterion PO-01(C)

PO-01(C): Apply numerical and statistical methods in analysing data

a.) Assessment Tool: Students’ performance using Course Portfolio

Two courses namely *UEE503: Digital Signal Processing and Applications* and *UEE843: Power System Planning* are used to assess performance criteria PO-01(C) as a direct measure. The analysis for each of these courses is provided below:

UEI503: Digital Signal Processing and Applications

The performance of course *UEI503: Digital Signal Processing and Applications* is used to measure the attainment of outcome ‘PO-01(C)’ through the End Sem. Examination (Question 2(b and c), Jan-June 2016, 15 Marks).

Question:

Q2 (b)	Find the Inverse Discrete Fourier Transform of $X(k) = \{1, 0, 1, 0\}$.	(5)
(c)	Find the 8-point DFT of the sequence $x(n) = \{1, 1, 1, 1, 1, 0, 0, 0\}$ using DIT-FFT algorithm.	(10)

The performance of the students in the above question is then summarized as given below in Table PO-01(C).1 using rubrics defined in Table PO-01.1.

Table PO-01(C).1: Students’ performance in question targeting ‘PO-01(C)’; Course UEI503

S. No	Roll No.	Name of Student	Marks (15)	Score (1-5)
1	101304001	Aarushi Bajaj	13	5
2	101304002	Abhey Arora	8	3
3	101304004	Adhikaansh Tayal	0	1
4	101304005	Aditi Narang	10	4
5	101304006	Aditya	14	5
6	101304007	Akshat	5	2
7	101304008	Akshay Kapoor	14	5
8	101304009	Akshay Kumar	15	5
9	101304011	Akshay Sharma	10	4
10	101304012	Amandeep Kaur	11	4
11	101304013	Amandeep Singh	6	3
12	101304014	Amaninder Singh Randhawa	6	3
13	101304015	Angad Kapoor	10	4
14	101304016	Ankita Garg	15	5
15	101304018	Anmol Jawa	11	4
16	101304019	Anmolpreet Singh	6	3
17	101304020	Anyuti Tiwary	15	5
18	101304023	Arshbir Kaur	15	5
19	101304024	Arshdeep Singh Bagga	12	5
20	101304025	Ashish	6	3
21	101304026	Ashish Rajpal	8	3
22	101304028	Berry Lubana	12	5
23	101304029	Bhanu Duggal	11	4
24	101304031	Chirag Gaba	13	5
25	101304032	Dipin Garg	15	5
26	101304033	Dishant Vanvari	9	4
27	101304034	Divyesh Pratap Singh	9	4
28	101304035	Elham Anwar	10	4
29	101304037	Gursewak Singh	5	2
30	101304040	Hariansh Sehgal	12	5
31	101304041	Hartejdeep Singh	2	1
32	101304042	Himanshu Goyal	9	4

33	101304044	Jasjit Singh	8	3
34	101304045	Jassimran Singh Julka	15	5
35	101304046	Jessica Dhaliwal	15	5
36	101304048	Karan Kumar	10	4
37	101304049	Karanjot Singh Kochar	11	4
38	101304050	Kashish Aggarwal	15	5
39	101304052	Love Gaba	15	5
40	101304054	Manik Mittal	15	5
41	101304055	Maninderjit Singh	4	2
42	101304056	Mayank Singla	5	2
43	101304057	Mridul Bhutani	7	3
44	101304058	Naman Garg	15	5
45	101304059	Navdeep Singh	12	5
46	101304060	Navdeep Singh	12	5
47	101304062	Nishant Garg	15	5
48	101304094	Satripleen Kaur	11	4
49	101484001	Amandeep Singh	8	3
50	101484002	Amrinder Singh	15	5
51	101484003	Ashmeen Singh	5	2
52	101484004	Azad Singh	6	3
53	101484005	Chandan Garg	12	5
54	101484007	Deepak Singla	11	4
55	101484008	Diljeet Singh	15	5

The overall performance of students for the above criterion is summarized in Table PO-01(C).2

Table PO-01(C).2: Average score of student performance in the course UEI503 for criteria PO-01(C)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEI503	43.64	25.45	18.18	9.09	3.64	3.96

UEE843: Power System Planning

The performance of course *UEE843: Power System Planning* is used to measure the attainment of outcome ‘ PO-01(C)’ through the End Semester. Examination (Question 2(b), July-Dec 2015, 10 Marks).

Question:

Q2(b)	What is the purpose of capacity model in the probabilistic analysis of generation capacity? A generating system consists of four identical units each of 110 MW capacity. The maximum load is 300 MW. The load duration curve may be assumed straight line with load factor of 55 %. F.O.R. for each unit is 0.04. Prepare a capacity outage probability table showing individual and cumulative probabilities. Continue this table with the load duration curve	(10)
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	and determine the loss of load probability.	
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The performance of the students in the above question is then summarized as given below in Table PO-01(C).2 using rubrics defined in Table PO-01.1.

Table PO-01(C).2: Students' performance in question targeting ' PO-01(C)'; Course UEE843

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
1	101204001	Aashna	6.5	4
2	101204002	Abhinav Sharma	8	5
3	101204003	Abhishek Jain	6	4
4	101204004	Aditya Jain	5.5	3
5	101204005	Akash Deep	6	4
6	101204006	Akash Ratna	7	4
7	101204009	Akshu Gupta	6.5	4
8	101204010	Aman Goyal	7.5	5
9	101204012	Amit Bansal	7.5	5
10	101204013	Anshul Kumar	6	4
11	101204014	Anukriti Dwivedi	7.5	5
12	101204015	Arushi Nagpal	7	4
13	101204016	Ayush Vaid	5	3
14	101204018	Chahat Singla	7	4
15	101204019	Deeksha Goyal	7	4
16	101204020	Dhruv Sharma	6	4
17	101204021	Gaurav Arora	6	4
18	101204022	Gursharan Kaur	8.5	5
19	101204023	Gursimran Singh	9	5
20	101204024	Harjot Singh	8	5
21	101204025	Harsh Kothari	9	5
22	101204026	Hemanshu Garg	8	5
23	101204027	Himanshu Takkar	8	5
24	101204028	Iqbal Singh Garcha	8.5	5
25	101204030	Ishtjot Singh	8	5
26	101204031	Jasdeep Garg	8.5	5
27	101204033	Jasleen Kaur	8	5
28	101204035	Kapil Kinger	6	4
29	101204037	Karanbir Singh Kahlon	2.5	2
30	101204038	Karanveer Singh Bhangoo	7.5	5
31	101204039	Kartik Arora	5.5	3
32	101204040	Kashish Sethi	6	4
33	101204041	Kaustubh Singh	8.5	5
34	101204042	Krishnank Atrey	7.5	5
35	101204043	Lovely Goyal	6	4
36	101204045	Manik Mittal	0	1
37	101204046	Marshall	1.5	1
38	101204048	Mohit Kukkar	1	1
39	101204049	Mohit Manhas	7.5	5
40	101204051	Nalin Kaushik	5	3

41	101204053	Nishant Arora	5.5	3
42	101204054	P Siddharth	8	5
43	101204057	Rahul Kamboj	4.5	3
44	101204059	Rajat Sahore	7	4
45	101204060	Rajatdeep Singh	6	4
46	101204061	Ramanpreet Kaur	6	4
47	101204063	Sahil Arora	8	5
48	101204064	Sahil Mittal	8	5
49	101204065	Sanchit Goel	6.5	4
50	101204066	Sewak Ram	7.5	5
51	101204067	Sheenu	6.5	4
52	101204069	Shubham Bhatia	8.5	5
53	101204070	Shubham Goel	7.5	5
54	101204071	Shubham Kansal	6.5	4
55	101204074	Sukhdarshanpal Singh	8.5	5
56	101204075	Sultan Singh	8	5
57	101204076	Tejasvi Anand	6.5	4
58	101254001	Sahilpreet Singh	8	5
59	101254002	Naman Kumar	6	4
60	101254003	Sachin Pathak	8.5	5
61	101254004	Srijan Aditya	2.5	2
62	101254005	Navjot Kaur	5	3
63	101254006	Milan Jain	7.5	5
64	101254008	Gaurav	7.5	5
65	101254009	Varun Khanna	5.5	3
66	101254010	Swati Srivastava	7	4
67	101254012	Shubham Singla	8.5	5
68	101254013	Sorabh Devgun	7.5	5
69	101254014	Paras Ghai	7	4
70	101254016	Sachin Gupta	8.5	5
71	101254017	Nakul Kumar	7.5	5
72	101384001	Ankur Singla	7.5	5
73	101384002	Gagandeep Singh	6	4
74	101384004	Himanshu Bansal	5	3
75	101384005	Navdeep Singh	7	4
76	101384006	Parampreet Singh	8	5
77	101384007	Saurav Goyal	9	5
78	101384008	Surjeet Singh	6	4

The overall performance of students for the above criterion is summarized in Table PO-01(C).4:

Table PO-01(C).4: Average score of student performance in the course UEE843 for criteria PO-01(C)

Course	% of students in each score					Average Score
	5	4	3	2	1	

UEE843	47.44	34.62	11.54	2.56	3.85	4.19
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The above data is used to evaluate weighted average student class performance (Course Portfolio) for criteria PO-01(C) is given in Table PO-01(C).5.

Table PO-01(C).5: Weighted Average Student class performance (Course Portfolio) for criteria PO-01(C)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEI503	43.64	25.45	18.18	9.09	3.64	3.96
UEE843	47.44	34.62	11.54	2.56	3.85	4.19
Student class performance Score	45.54	30.03	14.86	5.83	3.74	4.08

b) Indirect measures for Performance criteria PO-01(C) (Surveys)

(i) Assessment Tools: Student Course Surveys

Student Course Surveys are used to assess the attainment of program outcome 'PO-01(C)' through indirect measurement using following course learning objectives in the respective courses.

UEI503	Analyse discrete time signals and systems performing DFT & FFT
UEE843	Have a broad view of generation system planning and reliability

Table PO-01(C).6: Weighted average score of performance criterion 'PO-01(C)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEI503	16.95	30.50	23.73	16.95	11.87	3.23
UEE843	40.00	28.57	20.00	8.57	2.81	3.95
Course surveys score	28.48	29.54	21.87	12.76	7.34	3.59

(ii) Assessment Tool: Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-01' through indirect measurement and is summarized in Table PO-01(A).7.

c) Overall weighted average score of performance criterion 'PO-01(C)'

The overall weighted average score of performance criterion 'PO-01(C)' is summarised in Table PO-01(C).7 from the data given in Tables PO-01(C).5, PO-01(C).6 and PO-01(A).7.

Table PO-01(C).7: Overall weighted average score of performance criterion 'PO-01(C)'

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class	45.54	30.03	14.86	5.83	3.74	4.08	5

performance							
course surveys	28.48	29.54	21.87	12.7 6	7.34	3.59	4
Other surveys	27.0 5	40.0 8	23.64	5.96	2.87	3.83	3
Overall weighted score	35.2 3	32.3 8	19.39	8.17	4.72	3.85	

Overall assessment of program outcome PO-01 using scores of PO-01(A), PO-01(B) and PO-01(C)

In the previous sections, each of the individual performance criteria PO-01(A), PO-01(B) and PO-01(C) have been assessed. The performance for attainment of outcome PO-01 has been completed using the attainment values for PO-01(A), PO-01(B) and PO-01(C) and is given below:

Table PO-01.2 summarizes the scores of each of the three performance criteria and these scores have been used to assess an overall score for outcome PO-01.

Table PO-01.2: Overall score for outcome PO-01 at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
PO-01(A)	23.77	24.45	26.62	13.99	11.0 8	3.36	5
PO-01(B)	24.13	25.17	27.71	14.10	8.75	3.42	5
PO-01(C)	35.23	32.38	19.39	8.17	4.72	3.85	5
Overall score	27.71	27.33	24.57	12.09	8.18	3.54	

The performance criteria wise assessment score distribution of outcome 'PO-01' is shown in Figure PO-01.2 .

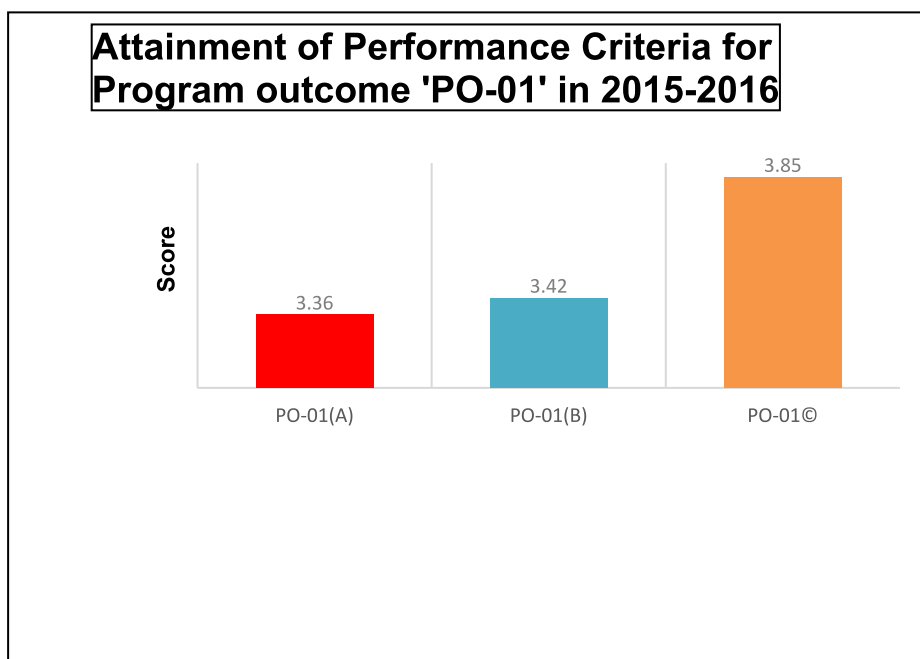


Figure PO-01.2: Performance criteria-wise assessment score distribution of outcome 'PO-01'

The data presented above pertains to the courses offered during academic year 2015-16. The attainment of the program outcome 'PO-01' through assessment of PO-01(A), PO-01(B) and PO-01(C) in the selected courses is achieved as "Good" .

Assessment of Attainment of Program outcome

PO-02

An ability to design and conduct experiments, as well as to analyze and interpret data

(2015-16)

for the
Bachelor of Engineering
in
Electrical Engineering



THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Electrical & Instrumentation Engineering Department
Thapar Institute of Engineering & Technology, Patiala
(Punjab) -INDIA

Attainment of Program outcome 'PO-02'

The attainment of program outcome **PO-02: An ability to design and conduct experiments, as well as to analyze and interpret data** has been measured using a standard procedure explained for the BE Electrical Engineering program. The program outcome 'PO-02' has been classified into following performance criteria:

PO-02(A): *Identify the constraints, assumptions and models for the experiments*

PO-02(B): *Utilize suitable hardware equipment for data collection*

PO-02(C): *Analyze and validate experimental results using appropriate techniques*

The program assessment committee identified the following courses for the assessment of program outcome 'PO-02':

- **UEE301: DC Machines and Transformers**
- **UEE401: Alternating Current Machines**
- UEI501 : Control Systems
- UEE502: High Voltage Engineering
- **UEI503: Digital Signal Processing and Applications**
- **UEE504:Power Electronics**
- UEE505: Analog and Digital Systems
- **UEE603:Switchgear and Protection**
- UEE801: Electric Drives
- UEE802: Intelligent Algorithms in Power Systems
- UEE804: Operation and Control of Power Systems

Outcome PO-02 has been assessed through three performance criteria PO-02(A), PO-02(B) and PO-02(C). The following courses have been considered by the program assessment committee for the assessment of performance criteria 'PO-02(A)', 'PO-02(B)' and 'PO-02(C)' for the academic year 2015-16.

Performance Criteria	Course -1	Course-2
PO-02(A)	UEE401: Alternating Current Machines	UEI503: Digital Signal Processing and Applications
PO-02(B)	UEE504 Power Electronics	UEE603: Switchgear & Protection
PO-02(C)	UEE301: DC Machines & Transformers	UEE401: Alternating Current Machines

The step by step methodology used to measure the attainment of program outcome 'PO-02' is shown in Fig. PO-02.1 for academic year (AY) 2015-16. The similar procedure is followed to measure the attainment of program outcome 'PO-02' for all three academic years under consideration.

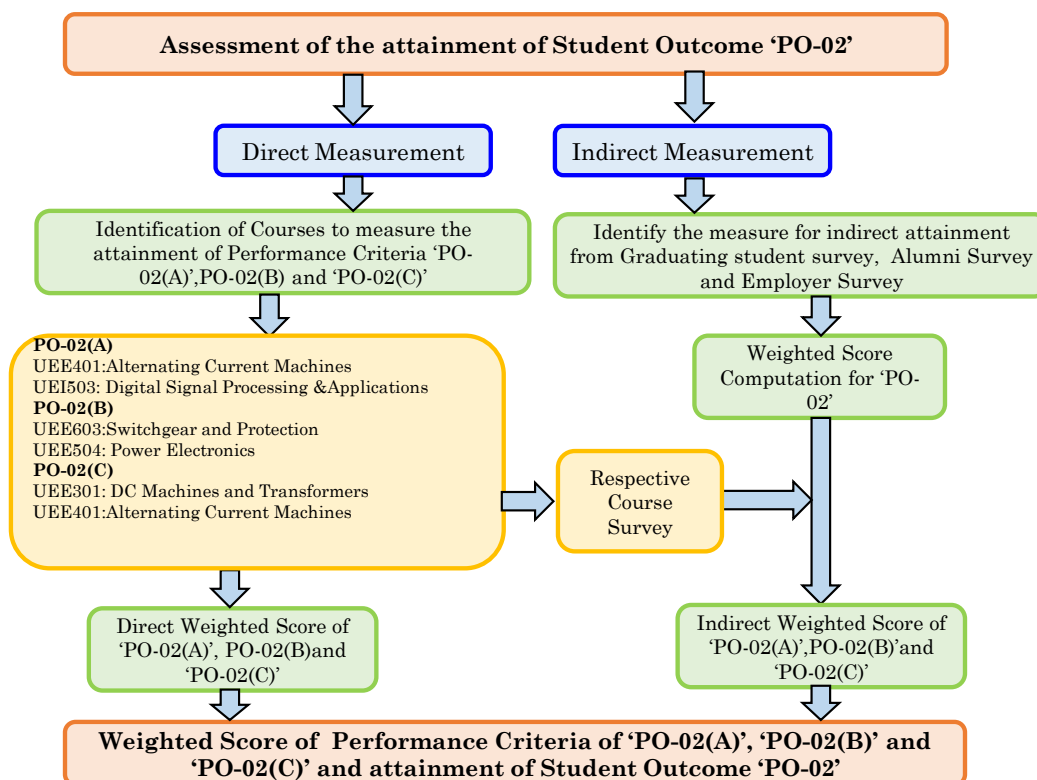


Fig. PO-02.1: Process for measurement of attainment of outcome 'PO-02' for the year 2015-16

The following Rubric has been used to convert marks obtained by students to a scale in the range of 1 to 5 is described in Table PO-02.1 (a) and Table PO-02.1(b) in most cases unless specifically mentioned.

Table PO-02.1 (a): Rubric for Outcome Measurement

S. No.	Range of Marks for Theory Examination (%)	Score (1-5)
1	$75 \leq \text{Marks} \leq 100$	5
2	$60 \leq \text{Marks} < 75$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

Table PO-02.1 (b): Rubric for Outcome Measurement

S. No.	Range of Marks for Laboratory Examination (%)	Score (1-5)
1	$80 \leq \text{Marks} \leq 100$	5
2	$60 \leq \text{Marks} < 80$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

The following sections summarize separate assessments for each of the performance criteria using the courses mentioned.

Assessment of Outcome 'PO-02' using performance criterion 'PO-02(A)'

PO-02(A): Identify the constraints, assumptions and models for the experiments.

The performance criteria 'PO-02(A)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE 401: Alternating Current Machines* and *UEI503: Digital Signal Processing and Applications* are used to assess performance criteria B1 as a direct measure. The analysis for each of these courses is provided below:

UEE 401: Alternating Current Machines

The performance of course *UEE 401: Alternating Current Machines* is used to measure the attainment of outcome 'PO-02(A)' through the End Semester Examination (Question No. 3(a), Jan- June 2016, 10 marks).

Question:

Q3(a).	A 230 V, 380 W, 50 Hz, 4-pole, single phase induction motor gave the following test results: No-load test: 230 V, 84 W, 2.8 A Blocked-rotor test: 110 V, 460 W, 6.2 A The stator winding resistance is 4.6 ohms and during the blocked rotor test, the auxiliary winding is open. Determine the equivalent circuit parameters and draw the equivalent circuit.	(8)
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The performance of the students in the above question is summarized in Table PO-02(A).1 using rubrics defined in Table PO-02.1(a).

Table PO-02(A).1: Student's performance in question targeting 'PO-02(A)'; course: UEE401

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
1	101404001	Abhay Mahipal	8	5
2	101404002	Abhijeet Singh Sankhla	0	1
3	101404004	Abhinav Arora	3.5	3
4	101404006	Abhishek Sharma	2	2
5	101404007	Ajay Singh	0	1
6	101404009	Alka Thakur	7	5
7	101404012	Ankush Goyal	6.5	5
8	101404013	Anmol Arjun Bharaj	1	1
9	101404014	Anmol Goyat	3	2
10	101404015	Anmol Rattan Kaur	6.5	5
11	101404017	Anubhav Kumar	3.5	3
12	101404018	Apeksha Goel	3	2
13	101404019	Arnish Jain	3.5	3
14	101404020	Arshiya	7.5	5
15	101404021	Arshjot Kaur	8	5
16	101404023	Ayush Jain	1.5	1
17	101404024	Bhawani Singh	0	1
18	101404025	Chirag Jain	3.5	3
19	101404026	Davileen Garg	7	5
20	101404027	Dilpreet Kaur	1	1
21	101404028	Divesh Kamdar	1.5	1
22	101404029	Divyam Aggarwal	5	4
23	101404031	Divyanshu Siddharth	7	5
24	101404032	Garima	0.5	1
25	101404033	Garv Chahar	0	1
26	101404035	Gaurav Rathore	1	1
27	101404036	Gurpreet Singh	6	5
28	101404037	Gursagar Singh	6	5
29	101404038	Gurupinder Pal Singh	7.5	5
30	101404039	Harmanpreet Singh	3	2
31	101404041	Harshit Kaushik	0	1
32	101404042	Harshvir Singh	8	5
33	101404043	Harsimarjot Kaur	6.5	5
34	101404044	Harsimran Singh	5	4
35	101404045	Hartej Singh Bains	1	1
36	101404046	Heema Gupta	4.5	3
37	101404047	Hitesh Kumar	1.5	1
38	101404048	Ishita Mahindru	1.5	1
39	101404049	Jagmeet Singh Bawa	3	2

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
40	101404050	Jagnoor Kaur	7	5
41	101404051	Jashanpreet Singh	7	5
42	101404052	Jatin Bansal	6	5
43	101404053	Jatin Raheja	7	5
44	101404054	Kanishak Sharma	7	5
45	101404055	Karan Sanjeev Bajaj	8	5
46	101404056	Kirtish Madaan	7	5
47	101404057	Mahitosh Sharma	7	5
48	101404058	Manan Mittal	8	5
49	101404059	Mandeep Singh Panesar	6.5	5
50	101404060	Manisha Gupta	8	5
51	101404061	Manit Gupta	0	1
52	101404062	Manjosh Singh Dhillon	3.5	3
53	101404063	Manpreet Singh Brar	2	2
54	101404064	Manvir Kaur	6	5
55	101404065	Mehak Bhatia	7	5
56	101404066	Mithilesh Kumar	0	1
57	101404067	Mohit Goyal	7	5
58	101404068	Mridul Marwaha	8	5
59	101404069	Mudit Arora	8	5
60	101404070	Naveen Parashar	2	2
61	101404072	Nigam Wadhwa	6	5
62	101404073	Nikhil Danodia	2.5	2
63	101404074	Nishita Kumari	7.5	5
64	101404075	Nitin Gupta	6.5	5
65	101404076	Nitish Arora	8	5
66	101404077	Nitish Bhardwaj	0.5	1
67	101404078	Omandeep Kaur	1	1
68	101404079	Pankaj Garg	6	5
69	101404080	Paramjot Singh	5	4
70	101404081	Parmar Adhiraj Singh	7	5
71	101404083	Prabhdeep Kaur	5	4
72	101404084	Prachur Maharwal	7.5	5
73	101404087	Prashant Khare	6.5	5
74	101404089	Pulkit Bansal	8	5
75	101404090	Pushpinder Singh	6	5
76	101404091	Rachit Verma	0.5	1
77	101404092	Rahul Gautam	6	5
78	101404093	Rahul Goyal	6	5
79	101404094	Rajshree Vaidya	0	1
80	101404096	Rishabh Gupta	7	5
81	101404099	Sagar Bansal	8	5
82	101404100	Sahajdeep Kaur	8	5

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
83	101404102	Sahil Singla	7	5
84	101404103	Samarth Gupta	7	5
85	101404104	Sambhav Jain	7	5
86	101404105	Samrat Kumar Gupta	4	3
87	101404106	Sanamdeep Singh	7.5	5
88	101404107	Sanket Gupta	0.5	1
89	101404108	Saurabh Kumar	0	1
90	101404109	Shailesh Verma	0	1
91	101404110	Shaivya Thapliyal	5	4
92	101404111	Sher Mohammed	4	3
93	101404112	Shivam Dochania	0	1
94	101404113	Shivam Gera	3.5	3
95	101404114	Shivam Kumar Kedia	5	4
96	101404115	Shubham Bhardwaj	0	1
97	101404116	Shubham Chaturvedi	5.5	4
98	101404117	Shubham Garg	3.5	3
99	101404118	Shubham Kumar	7	5
100	101404119	Shubham Verma	4	3
101	101404120	Shubhdeep Singh	5	4
102	101404121	Siddharth Singh	0	1
103	101404122	Simran Mehra	6	5
104	101404123	Sukhman	1	1
105	101404124	Swapnil Singla	0	1
106	101404125	Tanish Gupta	6	5
107	101404126	Taranjot Singh	4.5	3
108	101404127	Tarun Garg	6	5
109	101404128	Tarun Gupta	4	3
110	101404129	Tarun Kumar	2	2
111	101404130	Tushar Goel	0	1
112	101404131	Utkarsh Apoorva	0	1
113	101404132	Utkarsh Atri	3	2
114	101404133	Vandana Gora	3	2
115	101404135	Vasu Mittal	0	1
116	101404136	Yashika Chopra	5.5	4
117	101404137	Yatin Gudwani	1.5	1
118	101404138	Yogesh Garg	8	5
119	101454001	Yatendra Agrawal	4	3
120	101454002	Yash Motwani	3.5	3
121	101454003	Harshwardhan Soni	6	5
122	101454004	Simardeep Kaur	5.5	4
123	101454005	Tejas Kapila	4	3
124	101454006	Nitish Dewan	0	1
125	101454007	Abhishek Nigam	4.5	3

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
126	101454008	Tarun Puri	4.5	3
127	101454009	Lariza Bansal	1	1
128	101454010	Tanish Goyal	6.5	5
129	101454011	Aditi	6.5	5
130	101584001	Amanjit Singh	1.5	1
131	101584002	Chetan Garg	8	5
132	101584003	Devinder Kumar	2	2
133	101584004	Gurpreet Singh	0	1
134	101584005	Gurpreet Singh	5.5	4
135	101584006	Harman Preet Singh	0	1
136	101584007	Karamjeet Singh	5	4
137	101584008	Lakshay Garg	2.5	2
138	101584009	Prince Kalia	0	1
139	101584010	Rohit	0	1
140	101584011	Satvir Singh	0	1
141	101584012	Sharandeep Singh	7.5	5
142	101584013	Shashi Sharma	5	4
143	101584014	Sunnypreet Singh	6.5	5
144	101584015	Rajat Chandra	0	1
145	101584016	Gursimran Singh	0	1

The performance of students through the course UEE401 for criteria PO-02(A) is summarized in Table PO-02(A).2

Table PO-02(A).2: Average score of student performance in the course UEE401 for criteria PO-02(A)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE401	40.69	8.97	12.41	8.97	28.97	3.23

UEI503: Digital Signal Processing and Applications

The performance of course *UEI503: Digital Signal Processing and Applications* is used to measure the attainment of outcome 'PO-02(A)' through the End Semester Examination (Question No. 3(a) & 4(a), Jan-June 2016, 22 marks).

Question:

Q.3(a)	Design a low pass FIR filter with a cut-off frequency of 5 kHz and a sampling frequency of 20 kHz using Hanning window. Assume a filter length $N=11$. Find its windowed causal impulse response sequence and transfer function $H(z)$ of the causal filter.	(10)
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Q.4(a)	Design a digital Butterworth filter that satisfies the following constraints using bilinear transformations. The sampling frequency is given as 1Hz.			(12)
	$0.8 \leq H(e^{jw}) \leq 1 \qquad 0 \leq w \leq 0.2\pi$			
	$ H(e^{jw}) \leq 0.2 \qquad 0.5\pi \leq w \leq \pi$			
	Denominator of H(s)			
	1	$s + 1$		
	2	$s^2 + \sqrt{2}s + 1$		
	3	$(s + 1)(s^2 + s + 1)$		
	4	$(s^2 + 0.76537s + 1)(s^2 + 1.8477s + 1)$		
	5	$(s + 1)(s^2 + 0.61803s + 1)(s^2 + 1.61803s + 1)$		
	6	$(s^2 + 1.931855s + 1)(s^2 + \sqrt{2}s + 1)(s^2 + 0.51764s + 1)$		
	7	$(s + 1)(s^2 + 1.80194s + 1)(s^2 + 1.247s + 1)(s^2 + 0.445s + 1)$		

The performance of the students in the above question is summarized in Table PO-02(A).3 using rubrics defined in Table PO-02.1(a).

Table PO-02(A).3: Students' performance in question targeting 'PO-02(A)'; Course UEI503

S. No	Roll No.	Name of Student	Marks (22)	Score (1-5)
1	101304001	Aarushi Bajaj	20	5
2	101304002	Abhey Arora	6	2
3	101304004	AdhikaanshTayal	6	2
4	101304005	Aditi Narang	22	5
5	101304006	Aditya	13	3
6	101304007	Akshat	9	3
7	101304008	Akshay Kapoor	18	5
8	101304009	Akshay Kumar	18	5
9	101304011	Akshay Sharma	10	3
10	101304012	Amandeep Kaur	10	3
11	101304013	Amandeep Singh	15	4
12	101304014	Amaninder Singh Randhawa	5	2
13	101304015	Angad Kapoor	12	3
14	101304016	Ankita Garg	22	5
15	101304018	Anmol Jawa	10	3
16	101304019	Anmolpreet Singh	6	2
17	101304020	AnyutiTiwary	12	3
18	101304021	Arpit Sharma	12	3
19	101304023	Arshbir Kaur	19	5
20	101304024	Arshdeep Singh Bagga	6	2
21	101304025	Ashish	9	3

S. No	Roll No.	Name of Student	Marks (22)	Score (1-5)
22	101304026	Ashish Rajpal	10	3
23	101304028	Berry Lubana	12	3
24	101304029	Bhanu Duggal	21	5
25	101304030	BhanuMarwaha	6	2
26	101304031	Chirag Gaba	17	5
27	101304032	Dipin Garg	8	2
28	101304033	DishantVanvari	6	2
29	101304034	DivyeshPratap Singh	9	3
30	101304035	Elham Anwar	3	1
31	101304036	Gurseerat Singh Meen	2	1
32	101304037	Gursewak Singh	4.5	2
33	101304040	Hariansh Sehgal	9	3
34	101304041	Hartejdeep Singh	1	1
35	101304042	Himanshu Goyal	1	1
36	101304044	Jasjit Singh	2	1
37	101304045	Jassimran Singh Julka	9	3
38	101304046	Jessica Dhaliwal	22	5
39	101304049	Karanjot Singh Kochar	14	4
40	101304050	Kashish Aggarwal	16	4
41	101304052	Love Gaba	19	5
42	101304054	Manik Mittal	5	2
43	101304056	Mayank Singla	8	2
44	101304057	Mridul Bhutani	13	3
45	101304058	Naman Garg	22	5
46	101304059	Navdeep Singh	15	4
47	101304060	Navdeep Singh	8	2
48	101304062	Nishant Garg	16	4
49	101304094	Satripleen Kaur	12	3
50	101484001	Amandeep Singh	18	5
51	101484002	Amrinder Singh	13	3
52	101484003	Ashmeen Singh	6	2
53	101484004	Azad Singh	7	2
54	101484007	Deepak Singla	8	2
55	101484008	Diljeet Singh	10	3

The performance of students through the course UEI503 for criteria PO-02(A) is summarized in Table PO-02(A).4

Table PO-02(A).4: Average score of student performance in the course UEI503 for criteria PO-02(A)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEI503	21.82	9.09	32.73	27.27	9.09	3.07

The data from Table PO-02(A).2 and Table PO-02(A).4 is used to evaluate the weighted average of direct measure through course portfolio for criteria ‘PO-02(A)’ and is summarized in Table PO-02(A).5.

Table PO-02(A).5: Weighted Average Student class performance (Course Portfolio) for criteria ‘PO-02(A)’

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE401	40.69	8.97	12.41	8.97	28.97	3.23
UEI503	21.82	9.09	32.73	27.27	9.09	3.07
Student class performance score	31.25	9.03	22.57	18.12	19.03	3.15

b) Indirect Measures

The indirect measurement of performance criteria ‘PO-02(A)’ has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-02(A).6 and Table PO-02(A).7.

(i) Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of ‘PO-02(A)’.

UEE401	Determine the equivalent circuit parameters of three-phase Induction motor and single-phase Induction motor
UEI503	- Design digital filters for FIR using different techniques - Design digital filters for IIR using different techniques

Table PO-02(A).6: Weighted average score of performance criterion ‘PO-02(A)’ based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE401	49.2	22.15	13.55	5	10	3.9
UEI503	13.39	26.7	24.1	24.95	16.07	3.11
Course survey score	31.30	24.43	18.83	14.98	13.04	3.51

- (ii) **Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-02' through indirect measurement using following question in the respective surveys.

Graduating Survey	An ability to design and conduct experiments, as well as to analyze and interpret data.
Alumni Survey	
Employer Survey	Do our students have an ability to design and conduct experiments, as well as to analyze and interpret data?

Table PO-02(A).7: Weighted average score of performance criterion 'PO-02(A)' based on Other Surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating Student Survey	22.22	31.11	37.78	8.89	0.00	3.68
Employer Survey	28.02	43.48	20.77	4.83	1.93	3.87
Alumni Survey	33.33	60.00	6.67	0.00	0.00	4.27
Other surveys score	27.86	44.86	21.74	4.57	0.64	3.94

c) Overall weighted average score of performance criterion 'PO-02(A)'

The overall weighted average score of performance criterion 'PO-02(A)' is summarized in Table PO-02(A).8 from the data given in Tables PO-02(A).5, PO-02(A).6 and PO-02(A).7.

Table PO-02(A).8: Overall weighted average score of performance criterion 'PO-02(A)'

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	31.25	9.03	22.57	18.12	19.03	3.15	5
Course surveys	31.30	24.43	18.83	14.98	13.04	3.51	4
Other surveys	27.86	44.86	21.74	4.57	0.64	3.94	3
Overall weighted score	30.42	23.12	21.11	13.68	12.43	3.47	

Assessment of Outcome 'PO-02' using performance criterion PO-02(B)

PO-02(B): Utilize suitable hardware equipment for data collection

The performance criteria 'PO-02(B)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE504: Power Electronics* and *UEE603: Switchgear & Protection* are used to assess performance criteria PO-02(B) as a direct measure. The analysis for each of these courses is provided below:

UEE504: Power Electronics

The performance of course *UEE504: Power Electronics* is used to measure the attainment of outcome 'PO-02(B)' through the End Semester Lab performance (July-Dec 2016, 5 marks). The students were asked to perform any one experiment out of the following:

Control & V.I characteristics of SCR ; firing circuits.; Single Phase half and fully controlled AC to DC Power Converter; Three Phase half controlled AC to DC Power Converter; Mc-Murray Bridge Inverter with Resistive load and AC motor load; Single Phase AC to AC phase control; Voltage commutated DC chopper;

The performance of the students in the above criteria is summarized in Table PO-02(B).1 using rubrics defined in Table PO-02.1(b).

Table PO-02(B).1: Student's performance in question targeting 'PO-02(B)'; course: UEE504

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101304051	Kritika Singla	4.5	5
2	101304061	Nazuk Aggarwal	4	5
3	101304063	Nishtha Raheja	3.5	4
4	101304064	Paras Bawa	4	5
5	101304065	Parth Ahuja	4	5
6	101304066	Parushi	4.5	5
7	101304067	Pency Goyal	4	5
8	101304068	Piyush Jindal	3.5	4
9	101304069	Piyush Tripathi	3	4
10	101304070	Prachi Garg	4	5
11	101304071	Prashant Kataria	4	5
12	101304072	Preeti Garg	3.5	4
13	101304073	Priyank Arora	4.5	5
14	101304074	Priyanka	4	5
15	101304075	Priyanka Singh	4	5
16	101304076	Priyansh Mahajan	4.5	5
17	101304077	Rahul Meena	2.5	3
18	101304078	Rajan	4.5	5
19	101304079	Rajat Sharma	2.5	3
20	101304080	Ratul Goyal	3.5	4
21	101304081	Ravinder Singh	4.5	5
22	101304082	Rishabh Juneja	4.5	5
23	101304083	Robin Manktala	3	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
24	101304084	Rohan Ghai	3.5	4
25	101304085	Rohan Singla	4.5	5
26	101304086	Rohan Wadhawan	4.5	5
27	101304087	Rohit Goyal	3	4
28	101304088	Rubina Bamba	4.5	5
29	101304089	Sagar Pulani	4.5	5
30	101304090	Sahil Kataria	4.5	5
31	101304091	Sakshi	4	5
32	101304092	Sandal Singh Sidhu	4.5	5
33	101304093	Sandeep Kaur	4	5
34	101304095	Saurabh Mohan	3.5	4
35	101304096	Shagundeep Singh	3	4
36	101304097	Shailly Gupta	4	5
37	101304098	Shaina	4	5
38	101304099	Shivika Gupta	4	5
39	101304100	Shresth Rai	4.5	5
40	101304101	Shubham Goyal	3.5	4
41	101304102	Shubham Gupta	3	4
42	101304103	Shubham Sharma	2	3
43	101304104	Shubham Sharma	3.5	4
44	101304105	Shubham Soin	5	5
45	101304106	Siddharth Goyal	4	5
46	101304107	Sidharth Garg	4	5
47	101304108	Simran Kaur	5	5
48	101304109	Simranjit Singh	2.5	3
49	101304111	Sumit Dhingra	4.5	5
50	101304112	Sumit Kaushik	3.5	4
51	101304113	tushar dhir	4.5	5
52	101304114	Tushar Sharma	4	5
53	101304116	Utsav Chhabra	2	3
54	101304117	Vaibhav Gupta	4.5	5
55	101304118	Vaishali	4	5
56	101304119	Varun Bansal	4.5	5
57	101304120	Veni Jindal	5	5
58	101304121	Vishal Arora	3.5	4
59	101304122	Yugesh Goyal	4.5	5
60	101484009	Jyoti Kaushal	4.5	5
61	101484011	Pawan Kumar	4.5	5
62	101484012	Rajat Singla	3	4
63	101484013	Satveer Kaur	5	5
64	101484014	Saurabh Kumar Wadhawan	4.5	5
65	101484015	Shweta Sharma	4	5
66	101484016	Sukhjeet Singh	4.5	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
67	101304001	Aarushi Bajaj	4.5	5
78	101304002	Abhey Arora	4	5
79	101304003	Abhishek Taksali	3	4
70	101304004	Adhikaansh Tayal	2.5	3
71	101304005	Aditi Narang	4	5
72	101304006	Aditya	5	5
73	101304007	Akshat	4	5
74	101304008	Akshay Kapoor	5	5
75	101304009	Akshay Kumar	4	5
76	101304010	Akshay Kumar Chaudhary	3	4
77	101304011	Akshay Sharma	4	5
78	101304012	Amandeep Kaur	4.5	5
79	101304013	Amandeep Singh	4.5	5
80	101304014	Amaninder Singh Randhawa	4	5
81	101304015	Angad Kapoor	4	5
82	101304016	Ankita Garg	5	5
83	101304017	Ankur Malik	3	4
84	101304018	Anmol Jawa	3	4
85	101304019	Anmolpreet Singh	4.5	5
86	101304020	Anyuti Tiwary	5	5
87	101304021	Arpit Sharma	4.5	5
88	101304022	Arsh Kundal	3	4
89	101304023	Arshbir Kaur	4.5	5
90	101304024	Arshdeep Singh Bagga	4	5
91	101304025	Ashish	4	5
92	101304026	Ashish Rajpal	5	5
93	101304028	Berry Lubana	4	5
94	101304029	Bhanu Duggal	5	5
95	101304030	Bhanu Marwaha	4.5	5
96	101304031	Chirag Gaba	4	5
97	101304032	Dipin Garg	4	5
98	101304033	Dishant Vanvari	4	5
99	101304034	Divyesh Pratap Singh	4	5
100	101304035	Elham Anwar	4	5
101	101304036	Gurseerat Singh Meen	2	3
102	101304037	Gursewak Singh	3	4
103	101304040	Hariansh Sehgal	3	4
104	101304041	Hartejdeep Singh	3	4
105	101304042	Himanshu Goyal	4.5	5
106	101304044	Jasjit Singh	3.5	4
107	101304045	Jassimran Singh Julka	4	5
108	101304046	Jessica Dhaliwal	4.5	5
109	101304047	Kanwarpal Singh	3.5	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
110	101304048	Karan Kumar	4.5	5
111	101304049	Karanjot Singh Kochar	5	5
112	101304050	Kashish Aggarwal	4.5	5
113	101304052	Love Gaba	4	5
114	101304054	Manik Mittal	4	5
115	101304055	Maninderjit Singh	3	4
116	101304056	Mayank Singla	3	4
117	101304058	Naman Garg	4	5
118	101304057	Mridul Bhutani	5	5
119	101304059	Navdeep Singh	5	5
120	101304060	Navdeep Singh	4.5	5
121	101304062	Nishant Garg	4.5	5
122	101304094	Satripleen Kaur	5	5
123	101484001	Amandeep Singh	5	5
124	101484002	Amrinder Singh	4.5	5
125	101484003	Ashmeen Singh	3	4
126	101484004	Azad Singh	4	5
127	101484005	Chandan Garg	3	4
128	101484007	Deepak Singla	4	5
129	101484008	Diljeet Singh	4	5

The performance of students through the course UEE504 for criteria PO-02(B) is summarized in Table PO-02(B).2

Table PO-02(B).2: Average score of student performance in the course UEE504 for criteria PO-02(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE504	71.32	23.26	5.43	0.00	0.00	4.66

UEE603: Switchgear & Protection

The performance of course *UEE603: Switchgear & Protection* is used to measure the attainment of outcome 'PO-02(B)' through the End Semester Lab performance (Jan-June 2016, 5 marks). The students were asked to perform any one experiment out of the following: Computing efficiency of Voltage distribution in String Insulator, A, B, C, D and Hybrid parameters of transmission line, Operation and characterization of Percentage Differential Relay, Negative Sequence Relay, Static type Over Current Relay and Static Type Differential Relay, IDMT Relay, Performance evaluation of long Transmission line under different loads, Verification of operation of Thermal Relay and fuse characteristics and Earth Fault Relay

The performance of the students in the above criteria is summarized in Table PO-02(B).3 using rubrics defined in Table PO-02.1(b).

Table PO-02(B).3: Students' performance in question targeting 'PO-02(B)'; Course UEE603

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101304001	Aarushi Bajaj	4.5	5
2	101304002	Abhey Arora	2	3
3	101304003	Abhishek Taksali	2.5	3
4	101304004	Adhikaansh Tayal	3	4
5	101304005	Aditi Narang	4.5	5
6	101304006	Aditya	4	5
7	101304007	Akshat	3.5	4
8	101304008	Akshay Kapoor	3.5	4
9	101304009	Akshay Kumar	3	4
10	101304010	Akshay Kumar Chaudhary	4	5
11	101304011	Akshay Sharma	3	4
12	101304012	Amandeep Kaur	4	5
13	101304013	Amandeep Singh	3.5	4
14	101304014	Amaninder Singh Randhawa	2.5	3
15	101304015	Angad Kapoor	3.5	4
16	101304016	Ankita Garg	4	5
18	101304018	Anmol Jawa	3.5	4
19	101304019	Anmolpreet Singh	4	5
20	101304020	Anyuti Tiwary	3.5	4
21	101304021	Arpit Sharma	4	5
22	101304022	Arsh Kundal	3.5	4
23	101304023	Arshbir Kaur	3.5	4
24	101304024	Arshdeep Singh Bagga	4.5	5
25	101304025	Ashish	4	5
26	101304026	Ashish Rajpal	4	5
27	101304028	Berry Lubana	4	5
28	101304029	Bhanu Duggal	4.5	5
29	101304030	Bhanu Marwaha	3.5	4
30	101304031	Chirag Gaba	4	5
31	101304032	Dipin Garg	4.5	5
32	101304033	Dishant Vanvari	4	5
33	101304034	Divyesh Pratap Singh	4.5	5
34	101304035	Elham Anwar	4	5
35	101304036	Gurseerat Singh Meen	4.5	5
36	101304037	Gursewak Singh	4	5
38	101304040	Hariansh Sehgal	3.5	4
39	101304041	Hartejdeep Singh	1	2
40	101304042	Himanshu Goyal	4.5	5
41	101304044	Jasjit Singh	2	3
42	101304045	Jassimran Singh Julka	2	3
43	101304046	Jessica Dhaliwal	4	5
44	101304047	Kanwarpal Singh	2	3

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
45	101304048	Karan Kumar	2	3
46	101304049	Karanjot Singh Kochar	4	5
47	101304050	Kashish Aggarwal	4.5	5
48	101304052	Love Gaba	2.5	3
49	101304054	Manik Mittal	2.5	3
50	101304055	Maninderjit Singh	2	3
51	101304056	Mayank Singla	2	3
52	101304057	Mridul Bhutani	2	3
53	101304058	Naman Garg	4	5
54	101304059	Navdeep Singh	3	4
55	101304060	Navdeep Singh	2.5	3
56	101304062	Nishant Garg	3	4
57	101304094	Satripleen Kaur	4.5	5
58	101484001	Amandeep Singh	4	5
59	101484002	Amrinder Singh	3.5	4
60	101484003	Ashmeen Singh	2.5	3
61	101484004	Azad Singh	4	5
62	101484005	Chandan Garg	3.5	4
63	101484007	Deepak Singla	3.5	4
64	101484008	Diljeet Singh	2.5	3

The performance of students through the course UEE603 for criteria PO-02(B) is summarized in Table PO-02(B).4.

Table PO-02(B).4: Average score of student performance in the course UEE603 for criteria PO-02(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE603	45.16	29.03	24.19	1.61	0.00	4.18

The data from Table PO-02(B).2 and Table PO-02(B).4 is used to evaluate weighted average of direct measure through course portfolio for criteria 'PO-02', and is summarised in Table PO-02(B).5.

Table PO-02(B).5: Weighted Average Student class performance (course portfolio) for criteria PO-02(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE504	71.32	23.26	5.43	0.00	0.00	4.66
UEE603	45.16	29.03	24.19	1.61	0.00	4.18
Student class performance score	58.24	26.14	14.81	0.81	0.00	4.42

b) Indirect Measures

The indirect measurement of performance criteria 'PO-02(B)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer

Survey). The weighted average score in respective surveys is summarised in Table PO-02(B).6 and Table PO-02(A).7.

(i) Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-02(B)'.

UEE504	- Exhibit the designing of firing and commutation circuits for different converter configurations - Analyse various converter configuration/topology with different types of loads
UEE603	- Select the protection elements such as fuse, circuit breakers and relays etc. for a given configuration. - Design scheme for protection of generators and transformers using differential relay.

Table PO-02(B).6: Weighted average score of performance criterion 'PO-02(B)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE504	8.6	16.38	30.83	27.22	16.94	2.72
UEE603	10	36.65	29.95	13.3	10	3.22
Course survey score	9.3	26.52	30.39	20.26	13.47	2.97

(ii) Assessment Tool: Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-02' through indirect measurement is summarized in Table PO-02(A).7.

c) Overall weighted average score of performance criterion 'PO-02(B)'

The overall weighted average score of performance criterion 'PO-02(B)' is summarized in Table PO-02(B).7 from the data given in Tables PO-02(B).5, PO-02(B).6 and PO-02(A).7.

Table PO-02(B).7: Overall weighted average score of performance criterion 'PO-02(B)'

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	58.24	26.14	14.81	0.81	0.00	4.42	5
Course surveys	9.30	26.52	30.39	20.26	13.47	2.97	4
Other surveys	27.86	44.86	21.74	4.57	0.64	3.94	3
Overall weighted score	34.33	30.95	21.74	8.23	4.65	3.82	

Assessment of Outcome 'PO-02' using performance criterion PO-02(C)

PO-02(C): Analyze and validate experimental results using appropriate techniques

The performance criteria 'PO-02(C)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE401: Alternating Current Machines* and *UEE301: DC Machines and Transformers* are used to assess performance criteria PO-02(C) as a direct measure. The analysis for each of these courses is provided below:

UEE401: Alternating Current Machines

The performance of course *UEE401: Alternating Current Machines* is used to measure the attainment of outcome 'PO-02(C)' by evaluating the day to day performance through lab reports (Jan-June 2016, 5 marks)

The performance of the students in the above criteria is summarized in Table PO-02(C).1 using rubrics defined in Table PO-02.1(b).

Table PO-02(C).1: Student's performance in question targeting 'PO-02(C)'; course: UEE401

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101404001	Abhay Mahipal	4	5
2	101404002	Abhijeet Singh Sankhla	3.5	4
3	101404004	Abhinav Arora	3.5	4
4	101404006	Abhishek Sharma	3.5	4
5	101404007	Ajay Singh	3	4
6	101404009	Alka Thakur	4	5
7	101404012	Ankush Goyal	4.5	5
8	101404013	Anmol Arjun Bharaj	4	5
9	101404014	Anmol Goyat	3.5	4
10	101404015	Anmol Rattan Kaur	4.5	5
11	101404017	Anubhav Kumar	3.5	4
12	101404018	Apeksha Goel	4	5
13	101404019	Arnish Jain	4.5	5
14	101404020	Arshiya	4.5	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
15	101404021	Arshjot Kaur	5	5
16	101404023	Ayush Jain	3	4
17	101404024	Bhawani Singh	3.5	4
18	101404025	Chirag Jain	3.5	4
19	101404026	Davileen Garg	5	5
20	101404027	Dilpreet Kaur	4	5
21	101404028	Divesh Kamdar	5	5
22	101404029	Divyam Aggarwal	3.5	4
23	101404031	Divyanshu Siddharth	3	4
24	101404032	Garima	4.5	5
25	101404033	Garv Chahar	3	4
26	101404035	Gaurav Rathore	3	4
27	101404036	Gurpreet Singh	3	4
28	101404037	Gursagar Singh	5	5
29	101404038	Gurupinder Pal Singh	4	5
30	101404039	Harmanpreet Singh	3	4
31	101404041	Harshit Kaushik	3	4
32	101404042	Harshvir Singh	4.5	5
33	101404043	Harsimarjot Kaur	4.5	5
34	101404044	Harsimran Singh	4	5
35	101404045	Hartej Singh Bains	3	4
36	101404046	Heema Gupta	4	5
37	101404047	Hitesh Kumar	3	4
38	101404048	Ishita Mahindru	4	5
39	101404049	Jagmeet Singh Bawa	3	4
40	101404050	Jagnoor Kaur	4.5	5
41	101404051	Jashanpreet Singh	4.5	5
42	101404052	Jatin Bansal	4	5
43	101404053	Jatin Raheja	4	5
44	101404054	Kanishak Sharma	4	5
45	101404055	Karan Sanjeev Bajaj	4	5
46	101404056	Kirtish Madaan	4.5	5
47	101404057	Mahitosh Sharma	4.5	5
48	101404058	Manan Mittal	4	5
49	101404059	Mandeep Singh Panesar	5	5
50	101404060	Manisha Gupta	3.5	4
51	101404061	Manit Gupta	3.5	4
52	101404062	Manjosh Singh Dhillon	4.5	5
53	101404063	Manpreet Singh Brar	4.5	5
54	101404064	Manvir Kaur	4.5	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
55	101404065	Mehak Bhatia	4.5	5
56	101404066	Mithilesh Kumar	4	5
57	101404067	Mohit Goyal	4.5	5
58	101404068	Mridul Marwaha	4.5	5
59	101404069	Mudit Arora	5	5
60	101404070	Naveen Parashar	3	4
61	101404072	Nigam Wadhwa	3	4
62	101404073	Nikhil Danodia	3.5	4
63	101404074	Nishita Kumari	4.5	5
64	101404075	Nitin Gupta	3.5	4
65	101404076	Nitish Arora	4.5	5
66	101404077	Nitish Bhardwaj	4.5	5
67	101404078	Omandeep Kaur	4	5
68	101404079	Pankaj Garg	4	5
69	101404080	Paramjot Singh	1.5	2
70	101404081	Parmar Adhiraj Singh	2.5	3
71	101404083	Prabhdeep Kaur	3	4
72	101404084	Prachur Maharwal	3	4
73	101404087	Prashant Khare	3	4
74	101404089	Pulkit Bansal	4	5
75	101404090	Pushpinder Singh	4	5
76	101404091	Rachit Verma	3	4
77	101404092	Rahul Gautam	3	4
78	101404093	Rahul Goyal	4	5
79	101404094	Rajshree Vaidya	3	4
80	101404096	Rishabh Gupta	4	5
81	101404099	Sagar Bansal	3	4
82	101404100	Sahajdeep Kaur	4	5
83	101404102	Sahil Singla	4	5
84	101404103	Samarth Gupta	3	4
85	101404104	Sambhav Jain	3	4
86	101404105	Samrat Kumar Gupta	3	4
87	101404106	Sanamdeep Singh	4	5
88	101404107	Sanket Gupta	3	4
89	101404108	Saurabh Kumar	4	5
90	101404109	Shailesh Verma	4	5
91	101404110	Shaivya Thapliyal	3	4
92	101404111	Sher Mohammed	4	5
93	101404112	Shivam Dochania	3	4
94	101404113	Shivam Gera	1	2

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
95	101404114	Shivam Kumar Kedia	3	4
96	101404115	Shubham Bhardwaj	4	5
97	101404116	Shubham Chaturvedi	4	5
98	101404117	Shubham Garg	4	5
99	101404118	Shubham Kumar	3	4
100	101404119	Shubham Verma	3	4
101	101404120	Shubhdeep Singh	2	3
102	101404121	Siddharth Singh	4.5	5
103	101404122	Simran Mehra	4	5
104	101404123	Sukhman	4	5
105	101404124	Swapnil Singla	3	4
106	101404125	Tanish Gupta	4	5
107	101404126	Taranjot Singh	3	4
108	101404127	Tarun Garg	4	5
109	101404128	Tarun Gupta	4	5
110	101404129	Tarun Kumar	4.5	5
111	101404130	Tushar Goel	4	5
112	101404131	Utkarsh Apoorva	3	4
113	101404132	Utkarsh Atri	3	4
114	101404133	Vandana Gora	5	5
115	101404135	Vasu Mittal	5	5
116	101404136	Yashika Chopra	5	5
117	101404137	Yatin Gudwani	2.5	3
118	101404138	Yogesh Garg	3.5	4
119	101454001	Yatendra Agrawal	4.5	5
120	101454002	Yash Motwani	3.5	4
121	101454003	Harshwardhan Soni	3.5	4
122	101454004	Simardeep Kaur	4.5	5
123	101454005	Tejas Kapila	5	5
124	101454006	Nitish Dewan	3.5	4
125	101454007	Abhishek Nigam	0	1
126	101454008	Tarun Puri	4	5
127	101454009	Lariza Bansal	4.5	5
128	101454010	Tanish Goyal	4	5
129	101454011	Aditi	4	5
130	101584001	Amanjit Singh	4.5	5
131	101584002	Chetan Garg	5	5
132	101584003	Devinder Kumar	3.5	4
133	101584004	Gurpreet Singh	4.5	5
134	101584005	Gurpreet Singh	4.5	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
135	101584006	Harman Preet Singh	4	5
136	101584007	Karamjeet Singh	2	3
137	101584008	Lakshay Garg	4	5
138	101584009	Prince Kalia	4.5	5
139	101584010	Rohit	3	4
140	101584011	Satvir Singh	4	5
141	101584012	Sharandeep Singh	5	5
142	101584013	Shashi Sharma	4.5	5
143	101584014	Sunnypreet Singh	4	5
144	101584015	Rajat Chandra	4	5
145	101584016	Gursimran Singh	4	5

The performance of students through the course UEE401 for criteria PO-02(C) is summarized in Table PO-02(C).2.

Table PO-02(C).2: Average score of student performance in the course UEE401 for criteria PO-02(C)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE401	60.00	35.17	2.76	1.38	0.69	4.52

UEE301: DC Machines and Transformers

The performance of course *UEE301: DC Machines and Transformers* is used to measure the attainment of outcome 'PO-02(C)' by evaluating day to day performance through Laboratory Reports (July-Dec, 2015, 5 marks).

The performance of the students in the above criteria is summarized in Table PO-02(C).3 using rubrics defined in Table PO-02.1(b).

Table PO-02(C).3: Students' performance in question targeting 'PO-02(C)'; Course UEE301

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101404001	Abhay Mahipal	3	4
2	101404002	Abhijeet Singh	1.5	2
3	101404004	Abhinav Arora	2	3
4	101404006	Abhishek Sharma	3.5	4
5	101404007	Ajay Singh	2.5	3
6	101404009	Alka Thakur	3.5	4
7	101404012	Ankush Goyal	4.5	5
8	101404013	Anmol Arjun	1.5	2
9	101404014	Anmol Goyat	4	5
10	101404015	Anmol Rattan Kaur	4	5
11	101404017	Anubhav Kumar	3.5	4
12	101404018	Apeksha Goel	3	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
13	101404019	Arnish Jain	3.5	4
14	101404020	Arshiya	2.5	3
15	101404021	Arshjot Kaur	4.5	5
16	101404023	Ayush Jain	4	5
17	101404024	Bhawani Singh	3.5	4
18	101404025	Chirag Jain	2.5	3
19	101404026	Davileen Garg	4.5	5
20	101404027	Dilpreet Kaur	4	5
21	101404028	Divesh Kamdar	2.5	3
22	101404029	Divyam Aggarwal	4	5
23	101404031	Divyanshu Siddharth	1.5	2
24	101404032	Garima	4	5
25	101404033	Garv Chahar	2.5	3
26	101404035	Gaurav Rathore	1.5	2
27	101404036	Gurpreet Singh	0.5	1
28	101404037	Gursagar Singh	4.5	5
29	101404038	Gurupinder Pal Singh	4.5	5
30	101404039	Harmanpreet Singh	0.5	1
31	101404041	Harshit Kaushik	3.5	4
32	101404042	Harshvir Singh	4	5
33	101404043	Harsimarjot Kaur	4	5
34	101404044	Harsimran Singh	4.5	5
35	101404045	Hartej Singh Bains	4	5
36	101404046	Heema Gupta	3.5	4
37	101404047	Hitesh Kumar	3.5	4
38	101404048	Ishita Mahindru	4	5
39	101404049	Jagmeet Singh	2	3
40	101404050	JagnoorKaur	4.5	5
41	101404051	Jashanpreet Singh	4.5	5
42	101404052	Jatin Bansal	4	5
43	101404053	Jatin Raheja	4	5
44	101404054	Kanishak Sharma	4	5
45	101404055	Karan Sanjeev Bajaj	4	5
46	101404056	Kirtish Madaan	3.5	4
47	101404057	Mahitosh Sharma	4.5	5
48	101404058	Manan Mittal	4	5
49	101404059	Mandeep Singh	4	5
50	101404060	Manisha Gupta	4	5
51	101404061	Manit Gupta	2.5	3
52	101404062	Manjosh Dhillon	4	5
53	101404063	Manpreet Singh Brar	4	5
54	101404064	Manvir Kaur	3.5	4
55	101404065	Mehak Bhatia	3.5	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
56	101404066	Mithilesh Kumar	3	4
57	101404067	Mohit Goyal	4.5	5
58	101404068	Mridul Marwaha	3	4
59	101404069	Mudit Arora	3.5	4
60	101404070	Naveen Parashar	2.5	3
61	101404072	Nigam Wadhwa	4.5	5
62	101404073	Nikhil Danodia	3.5	4
63	101404074	Nishita Kumari	3	4
64	101404075	Nitin Gupta	4	5
65	101404076	Nitish Arora	4	5
66	101404077	Nitish Bhardwaj	1.5	2
67	101404078	Omandeep Kaur	3.5	4
68	101404079	Pankaj Garg	3.5	4
69	101404080	Paramjot Singh	4.5	5
70	101404081	Parmar Adhiraj S	3.5	4
71	101584001	Amanjit Singh	4	5
72	101584002	Chetan Garg	4.5	5
73	101584004	Gurpreet Singh	4.5	5
74	101584005	Gurpreet Singh	4	5
75	101584006	Harman Preet Singh	4.5	5
76	101584007	Karamjeet Singh	4	5
77	101584008	Lakshay Garg	4.5	5
78	101584009	Prince Kalia	4.5	5
79	101584010	Rohit	3	4
80	101584012	Sharandeep Singh	4.5	5
81	101584013	Shashi Sharma	3	4

The performance of students through the course UEE301 for criteria PO-02(C) is summarized in Table PO-02(C).4.

Table PO-02(C).4: Average score of student performance in the course UEE301 for criteria PO-02(C)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE301	51.85	28.40	11.11	6.17	2.47	4.21

The data from Table PO-02(C).2 and Table PO-02(C).4 is used to evaluate weighted average of direct measure through course portfolio for criteria 'PO-02(C)', and is summarised in Table PO-02(C).5.

Table PO-02(C).5: Weighted Average Student class performance (course portfolio) for criteria PO-02(C)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE401	60.00	35.17	2.76	1.38	0.69	4.52
UEE301	51.85	28.40	11.11	6.17	2.47	4.21

Student class performance score	55.93	31.78	6.93	3.78	1.58	4.37
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b) Indirect Measures

The indirect measurement of performance criteria 'PO-02(C)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-02(C).6 and Table PO-02(A).7.

(i) Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-02(C)'

UEE401	- Analyze the performance characteristics of three phase induction motor, single phase induction motor, three phase synchronous generator and synchronous motor - Determine the equivalent circuit parameters of three phase induction motor and single phase induction motor.
UEE301	- Compute the performance with DC generators and can supply increasing load with parallel operation - Thoughtfully select the speed control and starting method of DC motors - Test the single phase transformer and estimate the efficiency and voltage regulation - Compute the load sharing among parallel connected transformers - Transform three phase to six phase connections, three phase to two phase connections and open delta connections, demonstrate their analysis under load sharing

Table PO-02(C).6: Weighted average score of performance criterion 'PO-02(C)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE401	52.29	22.91	12.98	4.58	7.26	4.08
UEE301	7.4	25.15	30.72	27.27	7.57	2.96
Course survey score	29.85	24.03	21.85	15.93	7.42	3.52

(ii) **Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-02' through indirect measurement is summarized in Table PO-02(A).7.

c) Overall weighted average score of performance criterion 'PO-02(C)'

The overall weighted average score of performance criterion ‘PO-02(C)’ is summarized in Table PO-02(C).7 from the data given in Tables PO-02(C).5, PO-02(C).6 and PO-02(A).7.

Table PO-02(C).7: Overall weighted average score of performance criterion ‘PO-02(C)’

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	55.93	31.78	6.93	3.78	1.58	4.37	5
Course surveys	29.85	24.03	21.85	15.93	7.42	3.52	4
Other surveys	27.86	44.86	21.74	4.57	0.64	3.94	3
Overall weighted score	40.22	32.47	15.61	8.02	3.29	3.98	-

Overall assessment of program outcome PO-02 using scores of PO-02(A), PO-02(B) and PO-02(C)

In the previous sections, each of the individual performance criteria PO-02(A), PO-02(B) and PO-02(C) have been assessed. The performance for attainment of outcome B has been completed using the attainment values for PO-02(A), PO-02(B) and PO-02(C) and is given below:

Table PO-02.2 summarizes the scores of each of the three performance criteria and these scores have been used to assess an overall score for outcome PO-02.

Table PO-02.2: Overall score for outcome PO-02 at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
PO-02(A)	30.42	23.12	21.11	13.68	12.43	3.47	5
PO-02(B)	34.33	30.95	21.74	8.23	4.65	3.82	5
PO-02(C)	40.22	32.47	15.61	8.02	3.29	3.98	5
Overall score	34.99	28.85	19.49	9.98	6.79	3.76	

The performance criteria wise assessment score distribution of outcome ‘PO-02’ is shown in fig. PO-02.2.

Attainment of Performance Criteria for Program Outcome PO-02 in 2015-16

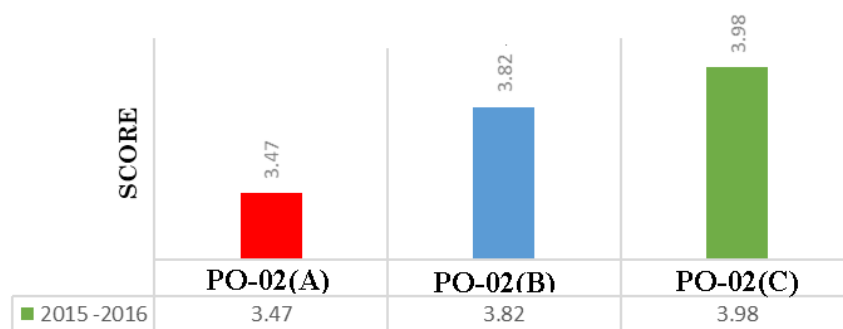


Figure PO-02.2: Performance criteria-wise assessment score distribution of outcome ‘PO-02’

The data presented above pertains to the courses offered during academic year 2015-16. The attainment of the program outcome ‘PO-02’ through assessment of PO-02(A), PO-02(B) and PO-02(C) in the selected courses is achieved “Good”.

Assessment of Attainment of Program Outcome

PO-03

Ability to design a sustainable system/Solution within realistic economic and environmental constraints

(2015-16)

for the
Bachelor of Engineering
in
Electrical Engineering



Electrical & Instrumentation Engineering Department
TIET, Patiala (Punjab) –INDIA

Attainment of Program Outcome ‘PO-03’

The attainment of Program Outcome **PO-03**: “Ability to design a sustainable system/Solution within realistic economic and environmental constraints” The Program Outcome ‘PO-03’ has been classified into following performance criteria:

***PO-03(A):** Ability to formulate problems for electrical systems*

***PO-03(B):** Design process to satisfy project objective for electrical systems*

***PO-03(C):** Work with real time systems within realistic constraints*

***PO-03(D):** Build prototypes, wherever needed, that meet design specifications*

The program assessment committee identified the following courses for the assessment of Program Outcome ‘PO-03’. The courses used for the assessment during three academic years are marked bold.

- **UEE402: Transmission and Distribution of Power**
- **UEI501: Control Systems**
- **UEE502: High Voltage Engineering**
- **UEE503: Network Analysis and Synthesis**
- **UEI503: Digital Signal Processing and Applications**
- **UEE504: Power Electronics**
- UEI504: Microprocessor and Applications
- **UEE601: Flexible AC transmission systems**
- **UEE602: Power System Analysis and Stability**
- UEE603: Switchgear and Protection
- **UEE791: Project Semester**
- **UEE793: Capstone Project**
- **UEE801: Electric Drives(UEE801)**
- **UEE804: Operation and Control of Power Systems**
- UCS401: Computer System Architecture

Outcome PO-06 has been assessed through four performance criteria PO-03(A), PO-03(B), PO-03(C) and PO-03(D). The following courses have been considered by the program assessment committee for the assessment of performance criteria ‘PO-03(A)’, ‘PO-03(B)’, ‘PO-03(C)’ and ‘PO-03(D)’ for the academic year 2015-16.

Performance Criteria	Course -1	Course-2
PO-03(A)	UEE602: Power System Analysis and Stability	UEE804: Operation and Control of Power Systems
PO-03(B)	UEE791: Project Semester	UEE793: Capstone Project
PO-03(C)	UEE602: Power System Analysis and Stability	UEE601: Flexible AC Transmission Systems
PO-03(D)	UEE801: Electric Drives	UEE793: Capstone Project

The step by step methodology used to measure the attainment of Program Outcome ‘PO-03’ is shown in Fig. PO-03 for academic year (AY) 2015-16. The similar procedure is followed to measure the attainment of Program Outcome ‘PO-03’ for all three academic years under consideration.

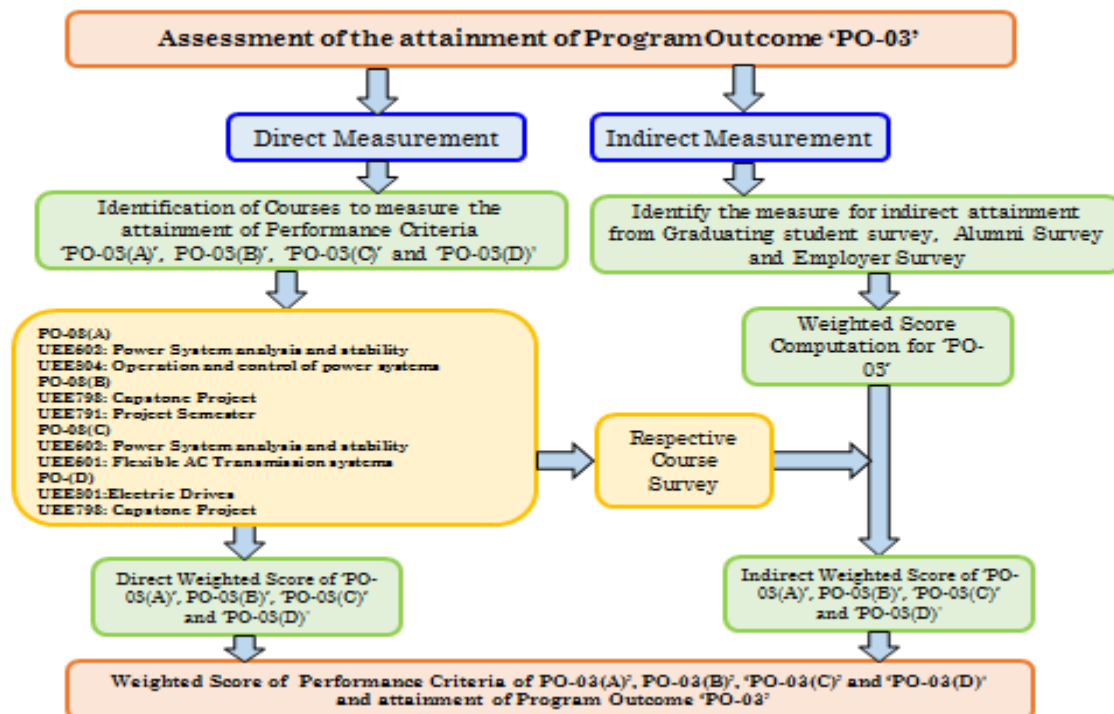


Fig. PO-03: Process for measurement of attainment of outcome 'PO-03' for the year 2015-16

The Rubric used to convert marks obtained by students to a scale in the range of 1 to 5 is described in Table PO-03(a) and Table PO-03(b) for theoretical and other sessional component respectively.

Table PO-03(a): Rubric for Outcome Measurement of Theoretical Component

S. No.	Range of Marks (%)	Score (1-5)
1	$75 \leq \text{Marks} \leq 100$	5
2	$60 \leq \text{Marks} < 75$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

Table PO-03(b): Rubric for Outcome Measurement of Sessional Component

S. No.	Range of Marks (%)	Score (1-5)
1	$80 \leq \text{Marks} \leq 100$	5
2	$60 \leq \text{Marks} < 80$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

The following sections summarize separate assessments for each of the performance criteria using the subjects mentioned.

Assessment of Outcome 'PO-03' using Performance Criterion 'PO-03(A)'

PO-03(A): Ability to formulate problems for electrical systems

The performance criteria 'PO-03(A)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE602: Power System analysis and stability* and *UEE804 Operation and Control of Power System* are used to assess performance criteria PO-03(A) as a direct measure. The analysis for each of these courses is provided below:

UEE602: Power Systems Analysis and Stability

The performance of course UEE602: Power System analysis and stability is used to measure the attainment of outcome 'PO-03(A)' through the End Semester Examination (Question No. 1(b), May 2016, weightage 06 marks).

Question:

Q.1(b)	Express the sequence currents in phase (ABC) domain $I_{A1}=10\angle 0^\circ, I_{A2}=3\angle 180^\circ, I_{A3}=2\angle 80^\circ$	(06)
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The performance of the students in the above question is summarized in Table PO-03(A).1 using rubrics defined in Table PO-03 (a).

Table PO-03(A).1: Students' performance in question targeting 'PO-03(A)': Course UEE602

S. No	Roll No.	Name of Student	Marks (6)	Score (1-5)
1	101304051	KritikaSingla	6	5
2	101304061	NazukAggarwal	6	5
3	101304063	NishthaRaheja	1.5	2
4	101304064	ParasBawa	6	5
5	101304065	ParthAhuja	6	5
6	101304066	Parushi	5	5
7	101304067	PencyGoyal	6	5
8	101304068	Piyush Jindal	6	5
9	101304069	PiyushTripathi	2	2
10	101304070	PrachiGarg	6	5
11	101304071	PrashantKataria	1	1

S. No	Roll No.	Name of Student	Marks (6)	Score (1-5)
12	101304072	PreetiGarg	6	5
13	101304073	PriyankArora	2.5	3
14	101304074	Priyanka	6	5
15	101304075	Priyanka Singh	6	5
16	101304076	PriyanshMahajan	6	5
17	101304078	Rajan	0	1
18	101304079	Rajat Sharma	6	5
19	101304080	RatulGoyal	6	5
20	101304081	Ravinder Singh	6	5
21	101304082	RishabhJuneja	6	5
22	101304083	Robin Manktala	6	5
23	101304084	RohanGhai	6	5
24	101304085	RohanSingla	6	5
25	101304086	RohanWadhawan	6	5
26	101304087	RohitGoyal	5	5
27	101304088	RubinaBamba	6	5
28	101304089	SagarPulani	6	5
29	101304090	SahilKataria	6	5
30	101304091	Sakshi	6	5
31	101304092	Sandal Singh Sidhu	4.5	5
32	101304093	SandeepKaur	6	5
33	101304095	Saurabh Mohan	6	5
34	101304096	Shagundeep Singh	1.5	2
35	101304097	Shailly Gupta	6	5
36	101304098	Shaina	6	5
37	101304099	Shivika Gupta	6	5
38	101304100	ShresthRai	6	5
39	101304101	ShubhamGoyal	1	1
40	101304102	Shubham Gupta	6	5
41	101304103	Shubham Sharma	6	5
42	101304104	Shubham Sharma	6	5
43	101304105	ShubhamSoin	4.5	5
44	101304106	SiddharthGoyal	2	2
45	101304107	SidharthGarg	6	5
46	101304108	SimranKaur	6	5
47	101304109	Simranjit Singh	1	1
48	101304111	SumitDhingra	4	4
49	101304112	SumitKaushik	6	5
50	101304113	TusharDheer	6	5
51	101304114	Tushar Sharma	6	5

S. No	Roll No.	Name of Student	Marks (6)	Score (1-5)
52	101304116	UtsavChhabra	4.5	5
53	101304117	Vaibhav Gupta	1	1
54	101304118	Vaishali	6	5
55	101304119	VarunBansal	6	5
56	101304120	Veni Jindal	6	5
57	101304121	Vishal Arora	6	5
58	101304122	YugeshGoyal	6	5
59	101484009	JyotiKaushal	6	5
60	101484011	Pawan Kumar	5.5	5
61	101484012	RajatSingla	6	5
62	101484013	SatveerKaur	6	5
63	101484014	Saurabh Kumar Wadhawan	6	5
64	101484015	Shweta Sharma	6	5
65	101484016	Sukhjeet Singh	6	5

The performance of students through the course UEE602 for criteria PO-03(A) is summarized in Table PO-03(A).2

Table PO-03(A).2: Average score of student performance in the course UEE602 for criteria 'PO-03(A)'

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE602	83.08	1.54	1.54	6.15	7.69	4.46

UEE804: Operation and Control of Power System

The performance of course UEE804: *Operation and Control of Power System* is used to measure the attainment of outcome 'PO-03(A)' through the End Semester Examination (Question No. 3, December 2015, weightage 20 marks).

Question:

Q.3	Derive the necessary equations for two area load frequency control and draw its block diagram. Also derive the state model for two area load frequency control	(20)
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The performance of the students in the above question is summarized in Table PO-03(A).3 using rubrics defined in Table PO-03 (a).

Table PO-03(A).3: Students' performance in question targeting 'PO-03(A)': Course UEE804

S. No	Roll No.	Name of Student	Marks (20)	Score (1-5)
1	101104031	KanikaLodha	2	1
2	101204001	Aashna	18	5
3	101204002	Abhinav Sharma	18	5
4	101204003	Abhishek Jain	18	5
5	101204004	Aditya Jain	0	1
6	101204005	Akash Deep	18	5
7	101204006	AkashRatna	13	4
8	101204009	Akshu Gupta	18	5
9	101204010	AmanGoyal	8	3
10	101204011	Amarpreet	0	1
11	101204012	AmitBansal	8	3
12	101204013	Anshul Kumar	4	2
13	101204014	AnukritiDwivedi	19	5
14	101204015	ArushiNagpal	16	5
15	101204016	AyushVaid	4	2
16	101204018	ChahatSingla	17	5
17	101204019	DeekshaGoyal	18	5
18	101204020	Dhruv Sharma	16	5
19	101204021	GauravArora	6	2
20	101204022	GursharanKaur	18	5
21	101204023	Gursimran Singh	14	4
22	101204024	Harjot Singh	16	5
23	101204025	Harsh Kothari	18	5
24	101204026	HemanshuGarg	18	5
25	101204027	HimanshuTakkar	18.5	5
26	101204028	Iqbal Singh Garcha	18	5
27	101204030	Ishtjot Singh	18	5

S. No	Roll No.	Name of Student	Marks (20)	Score (1-5)
28	101204031	JasdeepGarg	18	5
29	101204033	JasleenKaur	18.5	5
30	101204035	KapilKinger	18	5
31	101204037	Karanbir Singh Kahlon	3	1
32	101204038	Karanveer Singh Bhangoo	8	3
33	101204039	KartikArora	5	2
34	101204040	KashishSethi	0	1
35	101204041	Kaustubh Singh	18	5
36	101204042	KrishnankAtrey	15	5
37	101204043	Lovely Goyal	5	2
38	101204045	Manik Mittal	8.5	3
39	101204046	Marshall	18	5
40	101204048	MohitKukkar	10.5	3
41	101204049	MohitManhas	18	5
42	101204051	NalinKaushik	18	5
43	101204053	NishantArora	18	5
44	101204054	P Siddharth	17	5
45	101204057	Rahul Kamboj	17	5
46	101204059	RajatSahore	8	3
47	101204060	Rajatdeep Singh	10	3
48	101204061	RamanpreetKaur	18	5
49	101204063	SahilArora	18	5
50	101204064	Sahil Mittal	16	5
51	101204065	SanchitGoel	19	5
52	101204066	Sewak Ram	16	5
53	101204067	Sheenu	11.5	3
54	101204070	Shubham Bhatia	18	5
55	101204071	ShubhamGoel	8	3
56	101204074	ShubhamKansal	14.5	4
57	101204075	Sukhdarshanpal Singh	16.5	5
58	101204076	Sultan Singh	16	5
59	101254001	TejasviAnand	16	5
60	101254002	Sahilpreet Singh	0	1
61	101254003	Naman Kumar	18	5
62	101254004	Sachin Pathak	7	2
63	101254005	SrijanAditya	8	3
64	101254006	NavjotKaur	16.5	5
65	101254008	Milan Jain	16	5
66	101254009	Mohit	18	5
67	101254010	Gaurav	6.5	2
68	101254012	VarunKhanna	6	2

S. No	Roll No.	Name of Student	Marks (20)	Score (1-5)
69	101254013	Swati Srivastava	14	4
70	101254014	ShubhamSingla	18	5
71	101254015	SorabhDevgun	7	2
72	101254016	ParasGhai	18	5
73	101254017	Kuldeep Singh Deora	18	5
74	101384001	Sachin Gupta	18.5	5
75	101384002	Nakul Kumar	2	1
76	101384004	AnkurSingla	18	5
77	101384005	Gagandeep Singh	9	3
78	101384006	HimanshuBansal	10	3
79	101384007	Navdeep Singh	18.5	5
80	101384008	Parampreet Singh	19	5

The performance of students through the course UEE804 for criteria PO-03(A) is summarized in Table PO-03(A).4.

Table PO-03(A).4: Average score of student performance in the course UEE804 for criteria PO-03(A)

Course	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE804	60	5	15	11.25	8.75	3.96

The data from Table PO-03(A).2 and Table PO-03(A).4 is used to evaluate weighted average of direct measure through course portfolio for criteria 'PO-03(A)', and is summarised in Table PO-03(A).5.

Table PO-03(A).5: Weighted Average Student class performance (Course Portfolio) for criteria 'PO-03(A)'

Courses	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE602	83.08	1.54	1.54	6.15	7.69	4.46
UEE804	60	5	15	11.25	8.75	3.96
Student Class Performance Score	71.54	3.27	8.27	8.7	8.22	4.21

b) Indirect Measures:

The indirect measurement of performance criteria 'PO-03(A)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-03(A).6 and Table PO-03(A).7.

Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-03(A)'.

UEE602	Develop an appropriate mathematical model of power system
UEE804	Develop small scale model of alternator, excitation and governing systems

Table PO-03(A).6: Weighted average score of performance criterion 'PO-03(A)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE602	24.59	18.85	28.69	12.30	15.57	3.25
UEE804	40.38	25.00	22.12	4.81	7.69	3.86
Course Survey Score	32.49	21.93	25.41	8.56	11.63	3.56

Assessment Tool: Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of Program Outcome 'PO-03' through indirect measurement using following question in the respective surveys.

Graduating Survey	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
Alumni Survey	
Employer Survey	Do our students have an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability?

Table PO-03(A).7: Weighted average score of performance criterion 'PO-03(A)' based on Other Surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating student survey	29.58	40.85	29.58	0.00	0.00	4.00
Employer survey	26.67	53.33	20.00	0.00	0.00	4.07
Alumni survey	34.30	31.88	26.09	5.80	1.93	3.91
Other Survey Score	30.18	42.02	25.22	1.93	0.64	3.99

c) Overall weighted average score of performance criterion ‘PO-03(A)’

The overall weighted average score of performance criterion ‘PO-03(A)’ is summarised in Table PO-03(A).8 from the data given in Tables PO-03(A).5, PO-03(A).6 and PO-03(A).7.

Table PO-03(A).8: Overall weighted average score of performance criterion ‘PO-03(A)’

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student Class Performance	71.54	3.27	8.27	8.7	8.22	4.21	5
Course Survey Score	32.49	21.93	25.41	8.56	11.63	3.56	4
Other Survey Score	30.18	42.02	25.22	1.93	0.64	3.99	3
Overall score	48.18	19.18	18.22	6.96	7.46	3.94	-

Assessment of Outcome 'PO-03' using Performance Criterion 'PO-03(B)'

PO-03(B): Design process to satisfy project objective for electrical systems

The performance criteria 'PO-03(B)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE791: Project Semester* and *UEE793: Capstone Project* are used to assess performance criteria PO-03(B) as a direct measure. The analysis for each of these courses is provided below:

UEE791: Project Semester

The performance through the goal report describing project formulation of course *UEE791: Project Semester* is used to measure the attainment of outcome 'PO-03(B)' for (Jan-May 2016, 05 marks).The students are expected to demonstrate the ***understanding of design goals and constraints***.

Table PO-03(B).1: Students' performance in question targeting 'PO-03(B)':Course UEE791

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101204001	Aashna	3.5	4
2	101204002	Abhinav Sharma	3	4
3	101204003	Abhishek Jain	4	5
4	101204005	Akash Deep	4	5
5	101204006	AkashRatna	4	5
6	101204009	Akshu Gupta	4	5
7	101204010	AmanGoyal	4	5
8	101204012	AmitBansal	4	5
9	101204014	AnukritiDwivedi	5	5
10	101204015	ArushiNagpal	5	5
11	101204016	AyushVaid	4	5
12	101204018	ChahatSingla	4	5
13	101204019	DeekshaGoyal	5	5
14	101204020	Dhruv Sharma	4	5
15	101204021	GauravArora	5	5
16	101204022	GursharanKaur	4	5
17	101204023	Gursimran Singh	4	5
18	101204024	Harjot Singh	5	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
19	101204025	Harsh Kothari	5	5
20	101204026	HemanshuGarg	5	5
21	101204027	HimanshuTakkar	4	5
22	101204028	Iqbal Singh Garcha	3	4
23	101204030	Ishtjot Singh	5	5
24	101204031	JasdeepGarg	3	4
25	101204033	JasleenKaur	5	5
26	101204035	KapilKinger	3	4
27	101204038	Karanveer Singh Bhangoo	4	5
28	101204039	KartikArora	4	5
29	101204041	Kaustubh Singh	4	5
30	101204043	Lovely Goyal	4	5
31	101204045	Manik Mittal	3	4
32	101204046	Marshall	4	5
33	101204048	MohitKukkar	4	5
34	101204049	MohitManhas	4	5
35	101204051	NalinKaushik	5	5
36	101204053	NishantArora	5	5
37	101204054	P Siddharth	4	5
38	101204057	Rahul Kamboj	3	4
39	101204060	Rajatdeep Singh	4	5
40	101204061	RamanpreetKaur	3.5	4
41	101204063	SahilArora	3	4
42	101204064	Sahil Mittal	4	5
43	101204065	SanchitGoel	4	5
44	101204066	Sewak Ram	4	5
45	101204067	Sheenu	5	5
46	101204069	Shubham Bhatia	5	5
47	101204070	ShubhamGoel	4	5
48	101204071	ShubhamKansal	5	5
49	101204074	Sukhdarshanpal Singh	4	5
50	101204075	Sultan Singh	4	5
51	101204076	TejasviAnand	5	5
52	101254003	Sachin Pathak	4	5
53	101254004	SrijanAditya	3	4
54	101254005	NavjotKaur	5	5
55	101254006	Milan Jain	4	5
56	101254008	Gaurav	4	5
57	101254009	VarunKhanna	4	5
58	101254010	Swati Srivastava	4	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
59	101254012	ShubhamSingla	4	5
60	101254013	SorabhDevgun	5	5
61	101254014	ParasGhai	4	5
62	101254016	Sachin Gupta	4	5
63	101254017	Nakul Kumar	4	5
64	101384001	AnkurSingla	3.5	4
65	101384002	Gagandeep Singh	5	5
66	101384004	HimanshuBansal	4	5
67	101384005	Navdeep Singh	4	5
68	101384006	Parampreet Singh	3.5	4
69	101384007	SauravGoyal	4	5
70	101384008	Surjeetsingh	4	5

The performance of students through the course UEE791 for criteria PO-03(B) is summarized in Table PO-03(B).2

Table PO-03(B).2: Average score of student performance in the course UEE791 for criteria ‘PO-03(B)’

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE791	82.86	17.14	0.00	0.00	0.00	4.83

UEE793: Capstone Project

The performance of course UEE793: *Capstone Project* is used to measure the attainment of outcome ‘PO-03(B)’ through the ability of students to write the project report of capstone project (weightage 20 marks).

The performance of the students in the above component is summarized in Table PO-03(B).3 using rubrics defined in Table PO-03(b).

Table PO-03(B).3: Students’ performance in question targeting ‘PO-03(B)’: Course UEE793

S. No	Roll No.	Name of Student	Marks (20)	Score (1-5)
1	101204057	Rahul Kamboj	15	4
2	101204059	RajatSahore	15	4
3	101204060	Rajatdeep Singh	15	4
4	101204064	Sahil Mittal	15	4
5	101204074	Sukhдарshan Singh	15	4

S. No	Roll No.	Name of Student	Marks (20)	Score (1-5)
6	101204043	Lovely Goyal	16	5
7	101204071	ShubhamKansal	16	5
8	101204053	NishantArora	16	5
9	101204020	Dhruv Sharma	16	5
10	101204076	TejasviAnand	16	5
11	101254002	Naman	16	5
12	101204042	Kaustubh Singh	15	4
13	101204049	MohitManhas	15	4
14	101204051	Nalin	15	4
15	101204075	Sultan	15	4
17	101204025	Harsh Kothari	16	5
18	101204006	AkashRatna	16	5
19	101204009	Akshu Gupta	16	5
20	101254003	Sachin Pathak	16	5
21	101204013	Anshul Kumar	16	5
22	101204012	AmitBansal	15	4
23	101204039	KartikArora	15	4
24	101204004	Aditya Jain	15	4
25	101204016	AyushVaid	15	4
26	101204021	GauravArora	15	4
27	101204069	Shubham Bhatia	15	4
28	101254009	VarunKhanna	15	4
29	101204038	Karanvir Singh Bhangoo	15	4
30	101254001	Sahilpreet Singh	15	4
31	101204030	Ishtjot Singh	15	4
32	101204048	MohitKukkar	15	4
33	101204028	Iqbal Singh Garcha	16	5
34	101204035	KapilKinger	16	5
35	101204037	Karanbir Singh Kahlon	16	5
36	101204027	HimanshuTakkar	16	5
37	101204042	KrishnankAtrey	15	4
38	101254005	NavjotKaur	15	4
39	101254008	Gaurav Sharma	15	4
40	101204040	KashishSethi	15	4
41	101204067	SheenuGarg	15	4
42	101384006	Parampreet Singh Bawa	15	4
43	101254006	Milan Jain	15	4
44	101204031	JasdeepGarg	15	4
45	101204001	Aashna Sharma	15	4
46	101254015	Kuldeep Singh Deora	15	4

S. No	Roll No.	Name of Student	Marks (20)	Score (1-5)
47	101254016	Sachin Gupta	15	4
48	101204018	ChahatSingla	16	5
49	101204015	ArushiNagpal	16	5
50	101204022	GursharanKaur	16	5
51	101204033	Jasleen	16	5
52	101204061	RamanpreetKaur	16	5
53	101254014	ParasGhai	15	4
54	101254013	SorabhDevgan	15	4
55	101204019	DeekshaGoyal	15	4
56	101204014	Anukriti	15	4
57	101254010	Swati Srivastav	15	4
58	101254017	Nakul Kumar	16	5
59	101204063	SahilArora	16	5
60	101254004	Srijan	16	5
61	101204003	Abhishek Jain	16	5
62	101204002	Abhinav Sharma	16	5
63	101204070	ShubhamGoel	16	5
64	101384007	SauravGoyal	15	4
65	101384008	Surjeet Singh	15	4
66	101384004	HimanshuBansal	15	4
67	101384005	Navdeep Singh	15	4
68	101384001	AnkurSingla	15	4
69	101384002	Gagandeep Singh	15	4
70	101204046	Marshall	14	4
71	101204045	Manik	14	4
72	101204054	PvnSiddharth	14	4
73	101204063	Sewak Ram	14	4
74	101254012	ShubhamSingla	14	4
75	101204024	Harjot Singh	15	4
76	101204023	Gursimran Singh	15	4
77	101204010	AmanGoyal	15	4
78	101204026	HemanshuGarg	15	4
79	101204005	AkashdeepBatish	15	4
80	101204011	Amarpreet	14	4
81	101204065	Sanchit	14	4

The performance of students through the course UEE793 for criteria PO-03(B) is summarized in Table PO-03(B).4.

Table PO-03(B).4: Average score of student performance in the course UEE793 for criteria PO-03(B)

Course	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE793	32.50	67.50	0.00	0.00	0.00	4.33

The data from Table PO-03(B).2 and Table PO-03(B).4 is used to evaluate weighted average of direct measure through course portfolio for criteria ‘PO-03(B)’, and is summarised in Table PO-03(B).5.

Table PO-03(B).5: Weighted Average Student class performance (Course Portfolio) for criteria ‘PO-03(B)’

Courses	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE791	82.86	17.14	0.00	0.00	0.00	4.83
UEE793	32.50	67.50	0.00	0.00	0.00	4.33
Student Class Performance Score	57.68	42.32	0	0	0	4.58

b) Indirect Measures:

The indirect measurement of performance criteria 'PO-03(B)' has been assessed through surveys such as Course survey, Graduating Student Survey, Alumni Survey and Employer Survey. The weighted average score in respective surveys is summarised in PO-03(B).7.

Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-03(B)'.

UEE791	Carry out design calculations and implementations in the area of project
UEE793	To design an electrical engineering project implementing an integrated design approach applying knowledge accrued in various professional courses.

Table PO-03(B).6: Weighted average score of performance criterion 'PO-03(B)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE791	32.86	41.43	21.43	0.00	4.29	3.93
UEE793	27.5	33.75	33.75	1.25	3.75	3.8
Course Survey Score	30.18	37.59	27.59	0.63	4.02	3.87

c) Overall weighted average score of performance criterion 'PO-03(B)'

The overall weighted average score of performance criterion 'PO-03(B)' is summarised in Table PO-03(B).7 from the data obtained in Tables PO-03(B).5 and PO-03(A).7.

Table PO-03(B).7: Overall weighted average score of performance criterion 'PO-03(B)'

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student Class Performance	57.68	42.32	0	0	0	4.58	5
Course Survey Score	30.18	37.59	27.59	0.63	4.02	3.87	4
Other Surveys Score	30.18	42.02	25.22	1.93	0.64	3.99	3
Overall Score	41.64	40.67	15.50	0.69	1.50	4.20	-

Assessment of Outcome 'PO-03' using Performance Criterion 'PO-03(C)'

PO-03(C): Work with real time systems within realistic constraints

The performance criteria 'PO-03(C)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE601: Flexible AC Transmission System* and *UEE602: Power System analysis and stability* are used to assess performance criteria PO-03(C) as a direct measure. The analysis for each of these courses is provided below:

UEE601: Flexible AC Transmission System

The performance of course UEE601: Flexible AC Transmission System is used to measure the attainment of outcome 'PO-03(C)' through the End Semester Examination (Question No. 2 and 6, May 2016, weightage 30 marks).

Question:

Q.2	(a) Illustrate the merits and limitations of VSI. (b) Harmonics across the output voltage of VSI is reduced by multilevel inverter. Justify the statement.	(15)
Q.6	(a) Active power flow can be maximized with TCPAR in series with the transmission line, discuss? (b) Explain the working of delay angle controlled thyristor tap changer supplying a resistive load. Draw the associated waveforms.	(15)

The performance of the students in the above questions is summarized in Table PO-03(C).1 using rubrics defined in Table PO-03 (a).

Table PO-03(C).1: Students' performance in question targeting 'PO-03(C)':Course UEE601

S. No	Roll No.	Name of Student	Marks (30)	Score (1-5)
1	101304051	KritikaSingla	28	5
2	101304061	NazukAggarwal	21	4
3	101304063	NishthaRaheja	23.5	5
4	101304064	ParasBawa	14	3
5	101304065	ParthAhuja	19	4
6	101304066	Parushi	26	5
7	101304067	PencyGoyal	7	2

S. No	Roll No.	Name of Student	Marks (30)	Score (1-5)
8	101304068	Piyush Jindal	7	2
9	101304069	PiyushTripathi	13	3
10	101304070	PrachiGarg	21	4
11	101304071	PrashantKataria	4	1
12	101304072	PreetiGarg	28	5
13	101304073	PriyankArora	24	5
14	101304074	Priyanka	21	4
15	101304075	Priyanka Singh	20.5	4
16	101304076	PriyanshMahajan	22	4
17	101304077	Rahul Meena	9	2
18	101304078	Rajan	18	4
19	101304079	Rajat Sharma	19	4
20	101304080	RatulGoyal	15	3
21	101304081	Ravinder Singh	23	5
22	101304082	RishabhJuneja	21	4
23	101304083	Robin Manktala	12	3
24	101304084	RohanGhai	20	4
25	101304085	RohanSingla	26	5
26	101304086	RohanWadhawan	22	4
27	101304087	RohitGoyal	12	3
28	101304088	RubinaBamba	25	5
29	101304089	SagarPulani	16.5	3
30	101304090	SahilKataria	25	5
31	101304091	Sakshi	20	4
32	101304092	Sandal Singh Sidhu	0	1
33	101304093	SandeepKaur	10	2
34	101304095	Saurabh Mohan	11	2
35	101304096	Shagundeep Singh	2	1
36	101304097	Shailly Gupta	27	5
37	101304098	Shaina	15	3
38	101304099	Shivika Gupta	21	4
39	101304100	ShresthRai	7	2
40	101304101	ShubhamGoyal	20.5	4
41	101304102	Shubham Gupta	27	5
42	101304103	Shubham Sharma	14	3
43	101304104	Shubham Sharma	21	4
44	101304105	ShubhamSoin	27	5
45	101304106	SiddharthGoyal	12	3
46	101304107	SidharthGarg	27	5
47	101304108	SimranKaur	21	4

S. No	Roll No.	Name of Student	Marks (30)	Score (1-5)
48	101304109	Simranjit Singh	11	2
49	101304111	SumitDhingra	9	2
50	101304112	SumitKaushik	24	5
51	101304113	TusharDheer	16	3
52	101304114	Tushar Sharma	18	4
53	101304116	UtsavChhabra	9	2
54	101304117	Vaibhav Gupta	26	5
55	101304118	Vaishali	20	4
56	101304119	VarunBansal	6	2
57	101304120	Veni Jindal	29	5
58	101304121	Vishal Arora	19	4
59	101304122	YugeshGoyal	13	3
60	101484009	JyotiKaushal	11	2
61	101484011	Pawan Kumar	24.5	5
62	101484012	RajatSingla	18	4
63	101484013	SatveerKaur	25	5
64	101484014	Saurabh Kumar Wadhawan	14.5	3
65	101484015	Shweta Sharma	20.5	4
66	101484016	Sukhjeet Singh	26	5

The performance of students through the course UEE601 for criteria PO-03(C) is summarized in Table PO-03(C).2

Table PO-03(C).2: Average score of student performance in the course UEE601 for criteria 'PO-03(C)'

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE601	28.79	31.82	18.18	16.67	4.55	3.64

UEE602: Power System analysis and stability

The performance of course UEE602: Power System analysis and stability is used to measure the attainment of outcome 'PO-03(C)' through the End Semester Examination (Question No. 5(d), May 2016, weightage 05 marks).

Question:

Q.5(d)	Show that for double line to ground fault at the terminals of an isolated generator (zf as fault impedance in each phase and zg is ground impedance w.r.t. fault point), all the three sequence networks are connected in parallel for fault analysis.	(05)
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The performance of the students in the above question is summarized in Table PO-03(C).3 using rubrics defined in Table PO-03(a).

Table PO-03(C).3: Students' performance in question targeting 'PO-03(C)': Course UEE602

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101304051	KritikaSingla	2	3
2	101304061	NazukAggarwal	3	4
3	101304063	NishthaRaheja	0	1
4	101304064	ParasBawa	0	1
5	101304065	ParthAhuja	3	4
6	101304066	Parushi	1	2
7	101304067	PencyGoyal	0	1
8	101304068	Piyush Jindal	2	3
9	101304069	PiyushTripathi	0	1
10	101304070	PrachiGarg	4	5
11	101304071	PrashantKataria	0	1
12	101304072	PreetiGarg	0	1
13	101304073	PriyankArora	0	1
14	101304074	Priyanka	0	1
15	101304075	Priyanka Singh	0	1
16	101304076	PriyanshMahajan	1	2
17	101304078	Rajan	0	1
18	101304079	Rajat Sharma	1	2
19	101304080	RatulGoyal	0	1
20	101304081	Ravinder Singh	0	1
21	101304082	RishabhJuneja	4	5
22	101304083	Robin Manktala	1	2
23	101304084	RohanGhai	3	4
24	101304085	RohanSingla	4	5
25	101304086	RohanWadhawan	2	3
26	101304087	RohitGoyal	0	1
27	101304088	RubinaBamba	1	2
28	101304089	SagarPulani	4	5
29	101304090	SahilKataria	2	3
30	101304091	Sakshi	0	1
31	101304092	Sandal Singh Sidhu	0	1

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
32	101304093	SandeepKaur	0.5	1
33	101304095	Saurabh Mohan	0	1
34	101304096	Shagundeeep Singh	0	1
35	101304097	Shailly Gupta	2	3
36	101304098	Shaina	5	5
37	101304099	Shivika Gupta	0	1
38	101304100	ShresthRai	2	3
39	101304101	ShubhamGoyal	2	3
40	101304102	Shubham Gupta	4	5
41	101304103	Shubham Sharma	2	3
42	101304104	Shubham Sharma	2	3
43	101304105	ShubhamSoin	0	1
44	101304106	SiddharthGoyal	1	2
45	101304107	SidharthGarg	1	2
46	101304108	SimranKaur	0	1
47	101304109	Simranjit Singh	0	1
48	101304111	SumitDhingra	4	5
49	101304112	SumitKaushik	0	1
50	101304113	TusharDheer	1	2
51	101304114	Tushar Sharma	0	1
52	101304116	UtsavChhabra	0	1
53	101304117	Vaibhav Gupta	0	1
54	101304118	Vaishali	0	1
55	101304119	VarunBansal	0	1
56	101304120	Veni Jindal	3	4
57	101304121	Vishal Arora	1	2
58	101304122	YugeshGoyal	1	2
59	101484009	JyotiKaushal	3	4
60	101484011	Pawan Kumar	0	1
61	101484012	RajatSingla	1	2
62	101484013	SatveerKaur	3	4
63	101484014	Saurabh Kumar Wadhawan	0	1
64	101484015	Shweta Sharma	2	3
65	101484016	Sukhjeet Singh	1	2

The performance of students through the course UEE602 for criteria PO-03(C) is summarized in Table PO-03(C).4.

Table PO-03(C).4: Average score of student performance in the course UEE602 for criteria PO-03(C)

Course	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE602	10.77	9.23	15.38	18.46	46.15	2.20

The data from Table PO-03(C).2 and Table PO-03(C).4 is used to evaluate weighted average of direct measure through course portfolio for criteria ‘PO-03(C)’, and is summarised in Table PO-03(C).5.

Table PO-03(C).5: Weighted Average Student class performance (Course Portfolio) for criteria ‘PO-03(C)’

Courses	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE601	28.79	31.82	18.18	16.67	4.55	3.64
UEE602	10.77	9.23	15.38	18.46	46.15	2.20
Student Class Performance Score	19.78	20.53	16.78	17.57	25.35	2.92

b) Indirect Measures:

The indirect measurement of performance criteria 'PO-03(C)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-03(C).6 and Table PO-03(A).7.

Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-03(C)'.

UEE601	Evaluate the converters, harmonics on AC and DC side and filtering
UEE602	Conduct studies during balanced and unbalanced faults to decide the fault levels and circuit breaker ratings

Table PO-03(C).6: Weighted average score of performance criterion 'PO-03(C)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE601	24.59	18.85	28.69	12.30	15.57	3.25
UEE602	31.67	25.00	19.17	10.83	13.33	3.51
Course Survey Score	28.13	21.925	23.93	11.565	14.45	3.38

c) Overall weighted average score of performance criterion 'PO-03(C)'

The overall weighted average score of performance criterion 'PO-03(C)' is summarised in Table PO-03(C).7 from the data given in Tables PO-03(C).5, PO-03(C).6 and PO-03(A).7.

Table PO-03(C).7: Overall weighted average score of performance criterion 'PO-03(C)'

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student Class performance	19.78	20.53	16.78	17.57	25.35	2.92	5
Course Survey	28.13	21.93	23.93	11.57	14.45	3.38	4
Other Surveys	30.18	42.02	25.22	1.93	0.64	3.99	3
Overall Score	25.16	26.37	21.27	11.66	15.54	3.34	-

Assessment of Outcome 'PO-03' using Performance Criterion 'PO-03(D)'

PO-03(D): Build prototypes wherever needed, that meet design specifications

The performance criteria 'PO-03(D)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE801: Electric Drives* and *UEE793: Capstone Project* are used to assess performance criteria PO-03(D) as a direct measure. The analysis for each of these courses is provided below:

UEE801: Electric Drives

The performance of course *UEE801: Electric Drives* is used to measure the attainment of outcome 'PO-03(D)' by giving a mini project work in Oct. 2015 to the students as a part of their laboratory work. The students work in a team of two to three students. This component carries weightage of 10 marks.

Question:

Mini Project	Use of Simulation Software SIMULINK to simulate converter controlled drive	(10)
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The performance of the students in the project is summarized in Table PO-03(D).1 using rubrics defined in Table PO-03(b).

Table PO-03(D).1: Students' performance in question targeting 'PO-03(D)': Course UEE801

S. No	Roll No.	Name of Student	(10)	Score (1-5)
1	101204001	Aashna	3.5	2
2	101204002	Abhinav Sharma	6	4
3	101204003	Abhishek Jain	6	4
4	101204005	Akash Deep	6	4
5	101204006	Akash Ratna	6	4
6	101204009	Akshu Gupta	5	3
7	101204010	Aman Goyal	6	4
8	101204012	Amit Bansal	4	3
9	101204014	Anukriti Dwivedi	4	3
10	101204015	Arushi Nagpal	7.5	4
11	101204016	Ayush Vaid	5	3

12	101204018	ChahatSingla	3	2
13	101204019	DeekshaGoyal	5	3
14	101204020	Dhruv Sharma	3.5	2
15	101204021	GauravArora	3.5	2
16	101204022	GursharanKaur	6	4
17	101204023	Gursimran Singh	6	4
18	101204024	Harjot Singh	7.5	4
19	101204025	Harsh Kothari	5.5	3
20	101204026	HemanshuGarg	7	4
21	101204027	HimanshuTakkar	4	3
22	101204028	Iqbal Singh Garcha	6.5	4
23	101204030	Ishtjot Singh	2	2
24	101204031	JasdeepGarg	7	4
25	101204033	JasleenKaur	6	4
26	101204035	KapilKinger	4	3
27	101204037	Karanbir Singh Kahlon	4	3
28	101204038	Karanveer Singh Bhangoo	2	2
29	101204039	KartikArora	2	2
30	101204041	Kaustubh Singh	2	2
31	101204042	KrishnankAtrey	5	3
32	101204043	Lovely Goyal	3.5	2
33	101204045	Manik Mittal	3	2
34	101204046	Marshall	4	3
35	101204049	MohitManhas	4	3
36	101204051	NalinKaushik	3	2
37	101204053	NishantArora	2.5	2
38	101204054	P Siddharth	5	3
39	101204057	Rahul Kamboj	3.5	2
40	101204060	Rajatdeep Singh	4	3
41	101204061	RamanpreetKaur	4	3
42	101204063	SahilArora	5	3
43	101204064	Sahil Mittal	5	3
44	101204065	SanchitGoel	5	3
45	101204066	Sewak Ram	3.5	2
46	101204067	Sheenu	3	2
47	101204069	Shubham Bhatia	5	3
48	101204070	ShubhamGoel	6	4
49	101204071	ShubhamKansal	3.5	2
50	101204074	Sukhdarshanpal Singh	5	3
51	101204075	Sultan Singh	4	3
52	101204076	TejasviAnand	2	2

53	101254001	Sahilpreet Singh	5	3
54	101254003	Sachin Pathak	6	4
55	101254006	Milan Jain	5	3
56	101254009	VarunKhanna	7	4
57	101254010	Swati Srivastava	4	3
58	101254012	ShubhamSingla	5	3
59	101254013	SorabhDevgun	5	3
60	101254014	ParasGhai	8	5
61	101254016	Sachin Gupta	7	4
62	101254017	Nakul Kumar	4	3
63	101384001	AnkurSingla	7.5	4
64	101384002	Gagandeep Singh	6	4
65	101384004	HimanshuBansal	7.5	4
66	101384005	Navdeep Singh	6	4
67	101384006	Parampreet Singh	6.5	4
68	101384007	SauravGoyal	7	4
69	101384008	Surjeet Singh	7	4

The performance of students through the course UEE801 for criteria PO-03(D) is summarized in Table PO-03(D).2

Table PO-03(D).2: Average score of student performance in the course UEE801 for criteria ‘PO-03(D)’

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE801	1.45	34.78	39.13	24.64	0.00	3.13

UEE793: Capstone Project

The performance of course UEE793: Capstone Project is used to measure the attainment of outcome ‘PO-03(D)’ by evaluating the student performance through the component of capstone project “Project working and viva” having weightage 60 marks.

The performance of the students in the above assessment process is summarized in Table PO-03(D).3 using rubrics defined in TablePO-03(b).

Table PO-03(D).3: Students' performance in question targeting 'PO-03(D)': Course UEE793

S. No	Roll No.	Name of Student	Total Marks (60)	Score (1-5)
1	101204057	Rahul Kamboj	43	4
2	101204059	RajatSahore	42	4
3	101204060	Rajatdeep Singh	43	4
4	101204064	Sahil Mittal	43	4
5	101204074	Sukhdarshan Singh	42	4
6	101204043	Lovely Goyal	46	4
7	101204071	ShubhamKansal	43	4
8	101204053	NishantArora	41	4
9	101204020	Dhruv Sharma	42	4
10	101204076	TejasviAnand	40	4
11	101254002	Naman	39	4
12	101204042	Kaustubh Singh	42	4
13	101204049	MohitManhas	44	4
14	101204051	Nalin	45	4
15	101204075	Sultan	39	4
16	101204025	Harsh Kothari	45	4
17	101204006	Akashratna	45	4
18	101204009	Akshugupta	38	4
19	101254003	Sachin pathak	43	4
20	101204013	Anshulkumar	36	4
21	101204012	AmitBansal	44	4
22	101204039	KartikArora	43	4
23	101204004	Aditya Jain	37	4
24	101204016	AyushVaid	41	4
25	101204021	GauravArora	43	4
26	101204069	Shubham Bhatia	40	4
27	101254009	VarunKhanna	43	4
28	101204038	Karanvir Singh Bhangoo	43	4
29	101254001	Sahilpreet Singh	41	4
30	101204030	Ishtjot Singh	40	4
31	101204048	MohitKukkar	41	4
32	101204028	Iqbal Singh Garcha	41	4
33	101204035	KapilKinger	39	4
34	101204037	Karanbir Singh Kahlon	38	4
35	101204027	HimanshuTakkar	42	4
36	101204042	KrishnankAtrey	41	4
37	101254005	NavjotKaur	40	4

38	101254008	Gaurav Sharma	44	4
39	101204040	KashishSethi	41	4
40	101204067	SheenuGarg	38	4
41	101384006	Parampreet Singh Bawa	46	4
42	101254006	Milan Jain	45	4
43	101204031	JasdeepGarg	45	4
44	101204001	Aashna Sharma	38	4
45	101254015	Kuldeep Singh Deora	38	4
46	101254016	Sachin Gupta	45	4
47	101204018	ChahatSingla	42	4
48	101204015	ArushiNagpal	43	4
49	101204022	GursharanKaur	44	4
50	101204033	Jasleen	44	4
51	101204061	RamanpreetKaur	41	4
52	101254014	ParasGhai	44	4
53	101254013	SORABH DEVGAN	43	4
54	101204019	DEEKSHA GOYAL	44	4
55	101204014	ANUKRITI	42	4
56	101254010	Swati srivastav	39	4
57	101254017	Nakul Kumar	43	4
58	101204063	Sahilarora	42	4
59	101254004	Srijan	38	4
60	101204003	Abhishekjain	42	4
61	101204002	Abhinav Sharma	43	4
62	101204070	Shubhamgoel	41	4
63	101384007	SauravGoyal	47	4
64	101384008	Surjeet Singh	42	4
65	101384004	HimanshuBansal	43	4
66	101384005	Navdeep Singh	42	4
67	101384001	AnkurSingla	42	4
68	101384002	Gagandeep Singh	43	4
69	101204046	Marshall	43	4
70	101204045	Manik	44	4
71	101204054	PVN Siddharth	43	4
72	101204063	Sewak Ram	46	4
73	101254012	ShubhamSingla	45	4
74	101204024	Harjot Singh	45	4
75	101204023	Gursimran Singh	44	4
76	101204010	AmanGoyal	41	4
77	101204026	Hemanshugarg	46	4
78	101204005	Akashdeepbatish	42	4

79	101204011	Amarpreet	37	4
80	101204065	Sanchit	38	4

The performance of students through the course UEE793 for criteria PO-03(D) is summarized in Table PO-03(D).4.

Table PO-03(D).4: Average score of student performance in the course UEE793 for criteria PO-03(D)

Course	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE793	0.00	100.00	0.00	0.00	0.00	4.00

The data from Table PO-03(D).2 and Table PO-03(D).4 is used to evaluate weighted average of direct measure through course portfolio for criteria ‘PO-03(D)’, and is summarised in Table PO-03(D).5.

Table PO-03(D).5: Weighted Average Student class performance (Course Portfolio) for criteria ‘PO-03(D)’

Courses	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE801	1.45	34.78	39.13	24.64	0.00	3.13
UEE793	0.00	100.00	0.00	0.00	0.00	4.00
Student Class Performance Score	0.73	67.39	19.57	12.32	0.00	3.57

b) Indirect Measures:

The indirect measurement of performance criteria 'PO-03(D)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-03(D).6 and Table PO-03(A).7.

Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-03(D)'.

UEE801	Conceptualize the basic drive system and analyse it for different types of loads
UEE793	To design an electrical engineering project implementing an integrated design approach applying knowledge accrued in various professional courses

Table PO-03(D).6: Weighted average score of performance criterion 'PO-03(D)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE801	46.65	6.36	6.36	8.54	10.12	3.84
UEE793	27.5	33.75	33.75	1.25	3.75	3.8
Course Survey Score	37.08	20.06	20.06	4.90	6.94	3.82

c) Overall weighted average score of performance criterion 'PO-03(D)'

The overall weighted average score of performance criterion 'PO-03(D)' is summarised in Table PO-03(D).7 from the data given in Tables PO-03(D).5, PO-03(D).6 and PO-03(A).7.

Table PO-03(D).7: Overall weighted average score of performance criterion 'PO-03(D)'

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student Class Performance	0.73	67.39	19.57	12.32	0.00	3.57	5
Course Survey	37.08	20.06	20.06	4.90	6.94	3.82	4
Other Surveys	30.18	42.02	25.22	1.93	0.64	3.99	3
Overall Score	20.21	45.27	21.15	7.25	2.47	3.76	-

Overall assessment of Program Outcome PO-03 using scores of PO-03(A), PO-03(B), PO-03(C) and PO-03(D)

In the previous sections, each of the individual performance criteria PO-03(A), PO-03(B), PO-03(C) and PO-03(D) have been assessed. The performance for attainment of outcome PO-03 has been completed using the attainment values for PO-03(A), PO-03(B), PO-03(C) and PO-03(D) and is provided below:

Table PO-03.2 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome PO-03.

Table PO-03.2: Overall score for outcome PO-03 at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
PO-03(A)	48.18	19.18	18.22	6.96	7.46	3.94	5
PO-03(B)	41.64	40.67	15.50	0.69	1.50	4.20	5
PO-03(C)	25.48	26.37	20.95	11.01	16.18	3.34	5
PO-03(D)	20.21	45.27	21.15	7.25	2.47	3.76	
Overall Score	33.88	32.87	18.95	6.48	6.90	3.81	

The performance criteria wise assessment score distribution of outcome ‘PO-03’ is shown in Fig.PO-03.2

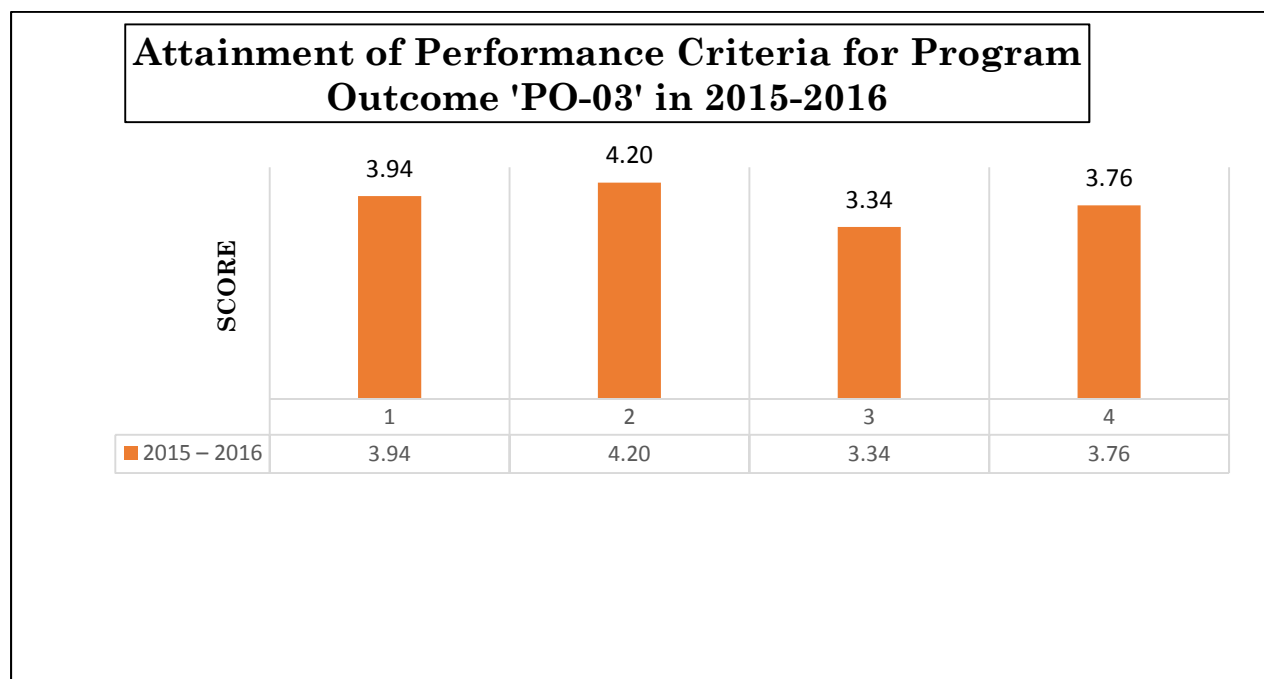


Fig.PO-03.2: Attainment of Performance Criteria for Program Outcome “PO-03” in 2015-2016

The data presented above pertains to the courses offered during academic year 2015-16.

Assessment of Attainment of Program Outcome

PO-04

An ability to function in multidisciplinary teams
(2015-2016)

for the
Bachelor of Engineering
in
Electrical Engineering



THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Electrical & Instrumentation Engineering Department
Thapar Institute of Engineering and Technology, Patiala
(Punjab) -INDIA

Attainment of Program Outcome ‘PO-04’

The attainment of program outcome **PO-04: An ability to function in multidisciplinary teams** has been measured using a standard procedure for the BE Electrical Engineering program. The program outcome ‘PO-04’ has been classified into following performance criteria;

PO-04(A): *Shares responsibility and information schedule with others in team*

PO-04(B): *Participates in the development and selection of ideas*

The program assessment committee identified the following courses for the assessment of program outcome ‘PO-04’:

- **UEE001: Electrical Engineering**
- UHU001: Communication Skills
- UHU031: Organizational Behaviour
- UEE401: Alternating Current Machines
- UEE502: High Voltage Engineering
- UEE504: Power Electronics
- **UEE591: Summer Training**
- UEE802: Intelligent Algorithms in Power Systems
- **UEE791: Project Semester**
- UEE793: Capstone Project
- UEE702: Intelligent Techniques In Electrical Engineering

Outcome PO-04 has been assessed through two performance criteria PO-04(A) and PO-04(B). The following courses have been considered by the program assessment committee for the assessment of performance criteria ‘PO-04(A)’ and ‘PO-04(B)’ for the academic year 2015-16.

Performance Criteria	Course -1	Course-2
PO-04(A)	UEE001 : Electrical Engineering	UEE791: Project Semester
PO-04(B)	UEE591: Summer Training	UEE791: Project Semester

The step by step methodology used to measure the attainment of program outcome ‘PO-04’ through performance criteria ‘PO-04(A)’ is shown in Fig. PO-04.1 for academic year (AY) 2015-16. The similar procedure is followed to measure the attainment of program outcome ‘PO-04’ for all three academic years under consideration.

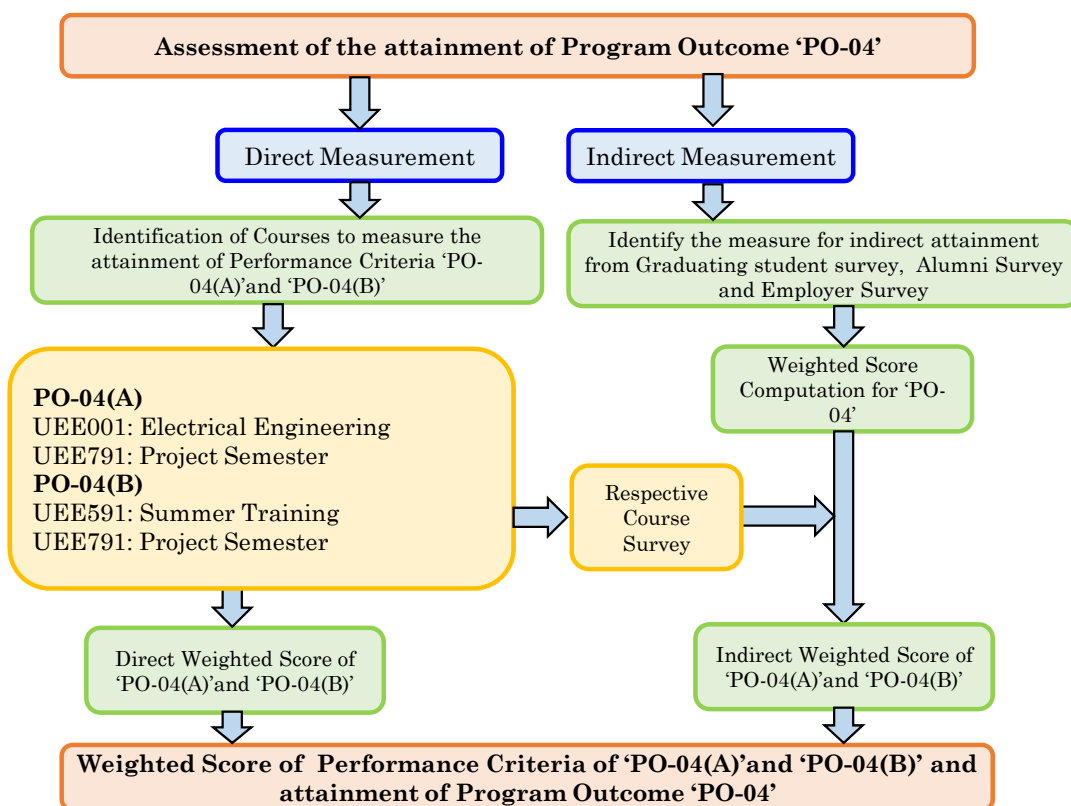


Fig. PO-04.1: Process for measurement of attainment of outcome 'PO-04' for the year 2015-16

The Rubric used to convert marks obtained by students to a scale in the range of 1 to 5 is described in Table PO-04.1.

Table PO-04.1: Rubric for Outcome Measurement

S. No.	Range of Marks (%)	Score (1-5)
1	$80 \leq \text{Marks} \leq 100$	5
2	$60 \leq \text{Marks} < 80$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

The following sections summarize separate assessments for each of the performance criteria using the subjects mentioned.

Assessment of Outcome 'PO-04' using performance criterion PO-04(A)

PO-04(A): Shares responsibility and information schedule with others in team

The performance criteria 'PO-04(A)' has been measured through direct assessment using the course portfolio and indirect assessment using course survey and other surveys (Graduating student survey, Alumni Survey and Employer survey)

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE001: Electrical Engineering* and *UEE 791: Project Semester* were used to assess performance criteria PO-04(A) as a direct measure. The analysis for each of these courses is provided below:

UEE001: Electrical Engineering

The performance of course *UEE001: Electrical Engineering* is used to measure the attainment of 'PO-04(A)' through the evaluation of sharing responsibility and information schedule with others in team during the project work involving self-effort hours (10 marks) taught in Jul-Dec 2015. The performance of the students in the above question is summarized in Table PO-04(A).1 using rubrics defined in Table PO-04.1.

Table PO-04(A).1: Students' performance in question targeting 'PO-04(A)'; course UEE001

S. No.	Roll No.	Name of Student	Marks (10)	Score (1-5)
1	101504067	Malay Chand	7.5	4
2	101504068	Manpreet Singh	8	5
3	101504069	Mayank Kumar	9	5
4	101504070	Mehul Natu	10	5
5	101504071	Mohit Goyal	9	5
6	101504072	Navi Sood	8	5
7	101504073	Neha Bhargava	9	5
8	101504074	Neha Singla	10	5
9	101504075	Nihal Singh	8	5
10	101504076	Nikhil Sharma	9	5
11	101504077	Nitesh Mittal	9	5
12	101504078	Nitin Gupta	7.5	4
13	101504079	Nitish Kumar Soni	7.5	4
14	101504081	Osho	7	4
15	101504082	Pankaj Goyal	7.5	4
16	101504083	Parmeet Singh Sangha	7	4
17	101504084	Parth Gupta	8	5
18	101504085	Pinak Bhardwaj	7.5	4
19	101504086	Prabhav Pande	7	4
20	101504087	Pragati Sharma	9	5
21	101504088	Pranav Joshi	9	5
22	101504089	Pranav Mathur	8	5
23	101504091	Pranav Singh	9	5
24	101504092	Pranjal Mehta	7	4
25	101504094	Prateek Gupta	8	5
26	101504095	Prateek Rana	7.5	4
27	101504096	Praveen Kumar Yadav	9	5
28	101504097	Raghav Kumar Tiwari	7	4
29	101504098	Ramandeep Singh	8	5
30	101504099	Ramandeep Singh	7	4
31	101504100	Ramneet Kaur	7	4
32	101504101	Ravneet Sharma	9	5
33	101504103	Rohan Malhotra	8	5

S. No.	Roll No.	Name of Student	Marks (10)	Score (1-5)
34	101504104	Rohit Arora	8	5
35	101504105	Rushil Krishna	9	5
36	101504106	Sahil Arora	8	5
37	101504107	Sahil Bansal	8	5
38	101504108	Sahil Virk	8	5
39	101504109	Sainesh Karamchandani	7.5	4
40	101504110	Samarth Agrawal	7.5	4
41	101504111	Sanidhya Chauhan	9	5
42	101504112	Sanket Kumar Bansal	9.5	5
43	101504113	Sannya Singal	9.5	5
44	101504114	Satyam Kumar	9	5
45	101504115	Shanun Randev	7	4
46	101504116	Shaurya Gaba	7	4
47	101504117	Sheikh Mohd Najam Ul Sehar	9	5
48	101504118	Shrey Arora	8	5
49	101504119	Shubham Gupta	7	4
50	101504120	Stuti Sidhu	8	5
51	101504121	Suhas Mahajan	8	5
52	101504122	Swanav Swaroop	8.5	5
53	101504123	Utkarsh Kumar	8.5	5
54	101504124	Utkarsh Verma	9	5
55	101504125	Vaibhav Chawla	8	5
56	101504126	Vaibhav Singh	8	5
57	101504127	Vikram Kumawat	7.5	4
58	101504128	Viraj Baswana	7	4
59	101504130	Vishal Bansal	8	5
60	101504131	Vishu Jain	8	5
61	101504133	Riya Gupta	8	5
62	401504006	Ritunjay Gupta	8	5
63	401504007	Simarpreet Singh	7.5	4
64	401504008	Uday Bhandari	8	5
65	401504009	Vaibhav Girdhar	8	5

The overall performance of students for the above criterion is summarized in Table PO-04(A).2:

Table PO-04(A).2: Average score of student performance in the course UEE001 for criteria PO-04(A)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE001	67.69	32.31	0.00	0.00	0.00	4.68

UEE 791: Project Semester

The performance of course *UEE791: Project Semester* is used to measure the attainment of outcome 'PO-04(B)' through the ability of students to work in group(s) and take initiative for appropriate action. The evaluation of this is obtained by the marks in one of the components of Industry Mentor Assessment (weightage 5 marks) taught in Jan-Jun 2016.

The performance of the students in the above question is then summarized as given below in Table PO-04(A).3 using rubrics defined in Table PO-04.1.

Table PO-04(A).3: Students' performance in question targeting 'PO-04(A)'; Course UEE791

S. No.	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101204001	Aashna	3.5	4
2	101204002	Abhinav Sharma	4	5
3	101204003	Abhishek Jain	4	5
4	101204005	Akash Deep	4	5
5	101204006	Akash Ratna	4	5
6	101204009	Akshu Gupta	4	5
7	101204010	Aman Goyal	5	5
8	101204012	Amit Bansal	4	5
9	101204014	Anukriti Dwivedi	5	5
10	101204015	Arushi Nagpal	5	5
11	101204016	Ayush Vaid	3	4
12	101204018	Chahat Singla	5	5
13	101204019	Deeksha Goyal	5	5
14	101204020	Dhruv Sharma	5	5
15	101204021	Gaurav Arora	5	5
16	101204022	Gursharan Kaur	5	5
17	101204023	Gursimran Singh	4	5
18	101204024	Harjot Singh	5	5
19	101204025	Harsh Kothari	4	5
20	101204026	Hemanshu Garg	5	5
21	101204027	Himanshu Takkar	5	5
22	101204028	Iqbal Singh Garcha	4	5
23	101204030	Ishjot Singh	3	4
24	101204031	Jasdeep Garg	5	5
25	101204033	Jasleen Kaur	4	5
26	101204035	Kapil Kinger	4	5
27	101204038	Karanveer Singh Bhangoo	3	4
28	101204039	Kartik Arora	4	5
29	101204041	Kaustubh Singh	4	5
30	101204043	Lovely Goyal	5	5
31	101204045	Manik Mittal	3	4
32	101204046	Marshall	5	5
33	101204048	Mohit Kukkar	5	5
34	101204049	Mohit Manhas	4	5
35	101204051	Nalin Kaushik	5	5
36	101204053	Nishant Arora	5	5
37	101204054	P Siddharth	4	5
38	101204057	Rahul Kamboj	4	5
39	101204060	Rajatdeep Singh	5	5
40	101204061	Ramanpreet Kaur	4	5
41	101204063	Sahil Arora	5	5
42	101204064	Sahil Mittal	4	5
43	101204065	Sanchit Goel	5	5
44	101204066	Sewak Ram	5	5

S. No.	Roll No.	Name of Student	Marks (5)	Score (1-5)
45	101204067	Sheenu	5	5
46	101204069	Shubham Bhatia	5	5
47	101204070	Shubham Goel	5	5
48	101204071	Shubham Kansal	5	5
49	101204074	Sukhdarshanpal Singh	4	5
50	101204075	Sultan Singh	5	5
51	101204076	Tejasvi Anand	5	5
52	101254003	Sachin Pathak	4	5
53	101254004	Srijan Aditya	4	5
54	101254005	Navjot Kaur	5	5
55	101254006	Milan Jain	4	5
56	101254008	Gaurav	5	5
57	101254009	Varun Khanna	4	5
58	101254010	Swati Srivastava	4	5
59	101254012	Shubham Singla	5	5
60	101254013	Sorabh Devgun	5	5
61	101254014	Paras Ghai	5	5
62	101254016	Sachin Gupta	5	5
63	101254017	Nakul Kumar	5	5
64	101384001	Ankur Singla	4	5
65	101384002	Gagandeep Singh	5	5
66	101384004	Himanshu Bansal	4	5
67	101384005	Navdeep Singh	4	5
68	101384006	Parampreet Singh	3	4
69	101384007	Saurav Goyal	3.5	4
70	101384008	Surjeet Singh	4	5

The overall performance of students for the above criterion is summarized as given below in Table PO-04(A).4:

Table PO-04(A).4: Average score of student performance in the course UEE791 for criteria PO-04(A)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE791	90.00	10.00	0.00	0.00	0.00	4.90

The data from Table PO-04(B).2 and PO-04(B).4 is used to evaluate weighted average of direct measure through course portfolio for criteria PO-04(B), and is summarised in Table PO-04(A).5.

Table PO-04(A).5: Weighted Average Student class performance (course portfolio) for criteria PO-04(A)

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE001	67.69	32.31	0.00	0.00	0.00	4.68
UEE791	90.00	10.00	0.00	0.00	0.00	4.90
Student Class Performance Score	78.85	21.16	0.00	0.00	0.00	4.79

b) Indirect Measures

The indirect measurement of performance criteria 'PO-04(A)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarized in Table PO-04(A).6 and Table PO-04(A).7.

(i) Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-04(A)'.

UEE001	Compare the characteristics and operational aspects of various electric motors and shall choose as per the application
UEE791	Associate with the implementation of the project requiring individual and teamwork skills.

Table PO-04(A).6: Weighted average score of performance criterion 'PO-04(A)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE001	36.36	32.73	21.82	4.24	4.85	3.92
UEE791	31.43	32.86	32.86	1.43	1.43	3.91
Course Survey Score	33.90	32.80	27.34	2.84	3.14	3.92

(ii) Assessment Tool : Graduating Student Survey, Alumni Survey and Employer Survey (other surveys) are used to assess the attainment of program outcome 'PO-04' through indirect measurement using following question in the respective surveys.

Graduating Student Survey	an ability to function on multidisciplinary teams.
Alumni Survey	
Employer Survey	Do our students have an ability to function on multidisciplinary teams?

Table PO-04(A).7: Weighted average score of performance criterion 'PO-04(A)' based on surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating Student Survey	6.67	40.00	35.56	15.56	2.22	3.33
Employer Survey	66.67	33.33	0.0	0.0	0.0	4.67
Alumni Survey	32.85	37.2	22.71	4.83	2.42	3.93
Other Survey Score	29.67	34.77	21.26	8.66	5.62	3.74

c) Overall weighted average score of performance criterion 'PO-04(A)'

Finally overall weighted average score of performance criterion 'PO-04(A)' is evaluated summarised in Table PO-04(A).8 from the data given in Table PO-04(A).5, PO-04(A).6 and PO-04(A).7.

Table PO-04(A).8: Overall weighted average score of performance criterion 'PO-04(A)'

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student Class Performance	78.85	21.16	0.00	0.00	0.00	4.79	5
Course Surveys	33.90	32.80	27.34	2.84	3.14	3.92	4
Other Surveys	29.67	34.77	21.26	8.66	5.62	3.74	3
Overall Score	51.57	28.44	14.43	3.11	2.45	4.24	

Assessment of Outcome 'PO-04' using performance criterion PO-04(B)

PO-04(B): Participates in the development and selection of ideas

a.) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE591: Summer Training* and *UEE791: Project Semester* were used to assess performance criteria PO-04(B) as a direct measure. The analysis for each of these courses is provided below:

UEE591: Summer Training

The performance of course *UEE591: Summer Training* is used to measure the attainment of outcome 'PO-04(B)' through the evaluation of latest ideas gathered by students (30 marks) taught in Jan-June 2017.

The performance of the students in the above question is summarized in Table PO-04(B).1 using rubrics defined in Table PO-04.1.

Table PO-04(B).1: Students' performance in question targeting 'PO-04(B)'; course: UEE591

S. No.	Roll No.	Name	Marks (30)	Score(1-5)
1	101304049	Karanjot Singh Kochar	26	5
2	101304001	Aarushi Bajaj	10	2
3	101304002	Abhey Arora	12	3
4	101304003	Abhishek Taksali	19	4
5	101304004	Adhikaansh Tayal	12	3
6	101304005	Aditi Narang	14	3
7	101304006	Aditya	16	3
8	101304007	Akshat	15	3
9	101304008	Akshay Kapoor	22	4
10	101304009	Akshay Kumar	10	2
11	101304010	Akshay Kumar Chaudhary	17	3
12	101304011	Akshay Sharma	10	2
13	101304012	Amandeep Kaur	20	4
14	101304013	Amandeep Singh	19	4
15	101304014	Amaninder Singh Randhawa	9	2
16	101304015	Angad Kapoor	10	2
17	101304016	Ankita Garg	17	3
18	101304017	Ankur Malik	12	3
19	101304018	Anmol Jawa	22	4
20	101304019	Anmolpreet Singh	18	4
21	101304020	Anyuti Tiwary	22	4
22	101304021	Arpit Sharma	17	3
23	101304022	Arsh Kundal	8	2
24	101304023	Arshbir Kaur	22	4
25	101304024	Arshdeep Singh Bagga	19	4

S. No.	Roll No.	Name	Marks (30)	Score(1-5)
26	101304025	Ashish	16	3
27	101304026	Ashish Rajpal	22	4
28	101304028	Berry Lubana	20	4
29	101304029	Bhanu Duggal	22	4
30	101304030	Bhanu Marwaha	22	4
31	101304031	Chirag Gaba	14	3
32	101304032	Dipin Garg	17	3
33	101304033	Dishant Vanvari	13	3
34	101304034	Divyesh Pratap Singh	13	3
35	101304035	Elham Anwar	15	3
36	101304036	Gurseerat Singh Meen	22	4
37	101304037	Gurseywak Singh	8	2
38	101304038	Gurveer Singh	7	2
39	101304040	Hariansh Sehgal	7	2
40	101304041	Hartejdeep Singh	11	2
41	101304042	Himanshu Goyal	16	3
42	101304044	Jasjit Singh	15	3
43	101304045	Jassimran Singh Julka	13	3
44	101304046	Jessica Dhaliwal	20	4
45	101304047	Kanwarpal Singh	11	2
46	101304048	Karan Kumar	11	2
47	101304050	Kashish Aggarwal	20	4
48	101304051	Kritika Singla	17	3
49	101304052	Love Gaba	13	3
50	101304054	Manik Mittal	13	3
51	101304055	Maninderjit Singh	11	2
52	101304056	Mayank Singla	18	4
53	101304057	Mridul Bhutani	15	3
54	101304058	Naman Garg	18	4
55	101304059	Navdeep Singh	17	3
56	101304060	Navdeep Singh	20	4
57	101304061	Nazuk Aggarwal	16	3
58	101304062	Nishant Garg	18	4
59	101304063	Nishtha Raheja	17	3
60	101304064	Paras Bawa	12	3
61	101304065	Parth Ahuja	15	3
62	101304066	Parushi	16	3
63	101304067	Pency Goyal	15	3
64	101304068	Piyush Jindal	13	3
65	101304069	Piyush Tripathi	12	3
66	101304070	Prachi Garg	10	2
67	101304071	Prashant Kataria	11	2
68	101304072	Preeti Garg	16	3
69	101304073	Priyank Arora	22	4
70	101304074	Priyanka	18	4
71	101304075	Priyanka Singh	16	3
72	101304076	Priyansh Mahajan	15	3
73	101304077	Rahul Meena	9	2
74	101304078	Rajan	9	2
75	101304079	Rajat Sharma	14	3
76	101304080	Ratul Goyal	12	3
77	101304081	Ravinder Singh	12	3
78	101304082	Rishabh Juneja	12	3
79	101304083	Robin Manktala	10	2
80	101304084	Rohan Ghai	10	2
81	101304085	Rohan Singla	16	3
82	101304086	Rohan Wadhawan	15	3

S. No.	Roll No.	Name	Marks (30)	Score(1-5)
83	101304087	Rohit Goyal	10	2
84	101304088	Rubina Bamba	7	2
85	101304089	Sagar Pulani	13	3
86	101304090	Sahil Kataria	10	2
87	101304091	Sakshi	10	2
88	101304092	Sandal Singh Sidhu	16	3
89	101304093	Sandeep Kaur	15	3
90	101304094	Satripleen Kaur	17	3
91	101304095	Saurabh Mohan	17	3
92	101304096	Shagundeeep Singh	12	3
93	101304097	Shailly Gupta	14	3
94	101304098	Shaina	15	3
95	101304099	Shivika Gupta	7	2
96	101304100	Shresth Rai	20	4
97	101304101	Shubham Goyal	14	3
98	101304102	Shubham Gupta	15	3
99	101304103	Shubham Sharma	14	3
100	101304104	Shubham Sharma	14	3
101	101304105	Shubham Soin	14	3
102	101304106	Siddharth Goyal	18	4
103	101304107	Sidharth Garg	17	3
104	101304108	Simran Kaur	17	3
105	101304109	Simranjit Singh	9	2
106	101304111	Sumit Dhingra	12	3
107	101304112	Sumit Kaushik	15	3
108	101304113	Tushar Dheer	12	3
109	101304114	Tushar Sharma	15	3
110	101304116	Utsav Chhabra	12	3
111	101304117	Vaibhav Gupta	13	3
112	101304118	Vaishali	12	3
113	101304119	Varun Bansal	14	3
114	101304120	Veni Jindal	16	3
115	101304121	Vishal Arora	13	3
116	101304122	Yugesh Goyal	16	3
117	101484001	Amandeep Singh	16	3
118	101484002	Amrinder Singh	16	3
119	101484003	Ashmeen Singh	12	3
120	101484004	Azad Singh	7	2
121	101484005	Chandan Garg	8	2
122	101484007	Deepak Singla	8	2
123	101484008	Diljeet Singh	21	4
124	101484009	Jyoti Kaushal	14	3
125	101484011	Pawan Kumar	22	4
126	101484012	Rajat Singla	16	3
127	101484013	Satveer Kaur	16	3
128	101484014	Saurabh Kumar Wadhawan	13	3
129	101484015	Shweta Sharma	16	3
130	101484016	Sukhjeet Singh	17	3

The overall performance of students in the above question is then summarized in Table PO-04(B).2

Table PO-04(B).2: Average score of student performance in the course UEE591 for criteria PO-04(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE591	0.77	20.00	57.69	21.54	0.00	3.00

UEE791: Project Semester

The performance of course *UEE791: Project Semester* is used to measure the attainment of outcome 'PO-04(B)' through the ability of students to redesign products, processes or systems in order to improve productivity, quality, safety and other desired needs. The evaluation of the above is obtained from the marks of Midway Report assessment (5 marks) taught in Jan-Jun 2017.

The performance of the students in the above question is summarized in Table PO-04(B).3 using rubrics defined in Table PO-04.1.

Table PO-04(B).3: Students' performance in question targeting 'PO-04(B)'; Course UEE791

S. No.	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101204001	Aashna	3	4
2	101204002	Abhinav Sharma	3	4
3	101204003	Abhishek Jain	4	5
4	101204005	Akash Deep	4	5
5	101204006	Akash Ratna	4	5
6	101204009	Akshu Gupta	4	5
7	101204010	Aman Goyal	4	5
8	101204012	Amit Bansal	5	5
9	101204014	Anukriti Dwivedi	4	5
10	101204015	Arushi Nagpal	4	5
11	101204016	Ayush Vaid	4	5
12	101204018	Chahat singla	3	4
13	101204019	Deeksha Goyal	5	5
14	101204020	Dhruv Sharma	5	5
15	101204021	Gaurav Arora	4	5
16	101204022	Gursharan Kaur	4	5
17	101204023	Gursimran Singh	4	5
18	101204024	Harjot Singh	4	5
19	101204025	Harsh kothari	4.5	5
20	101204026	Hemanshu Garg	4	5
21	101204027	Himanshu Takkar	2	3
22	101204028	Iqbal Singh Garcha	4	5
23	101204030	Ishtjot Singh	4	5
24	101204031	Jasdeep Garg	3	4
25	101204033	Jasleen Kaur	4	5
26	101204035	Kapil Kinger	3.5	4
27	101204038	Karanveer Singh Bhangoo	4	5
28	101204039	Kartik Arora	3	4
29	101204041	Kaustubh Singh	3	4
30	101204043	Lovely Goyal	3	4
31	101204045	Manik Mittal	4	5
32	101204046	Marshall	4	5
33	101204048	Mohit Kukkar	4	5
34	101204049	Mohit Manhas	3	4
35	101204051	Nalin Kaushik	5	5
36	101204053	Nishant Arora	4	5
37	101204054	P Siddharth	4	5
38	101204057	Rahul Kamboj	4	5
39	101204060	Rajatdeep Singh	5	5
40	101204061	Ramanpreet Kaur	4	5
41	101204063	Sahil Arora	4	5
42	101204064	Sahil Mittal	4	5

S. No.	Roll No.	Name of Student	Marks (5)	Score (1-5)
43	101204065	Sanchit Goel	3	4
44	101204066	Sewak Ram	3	4
45	101204067	Sheenu	4	5
46	101204069	Shubham Bhatia	4	5
47	101204070	Shubham Goel	4	5
48	101204071	Shubham Kansal	5	5
49	101204074	Sukhdarshanpal Singh	4	5
50	101204075	Sultan Singh	3	4
51	101204076	Tejasvi Anand	5	5
52	101254003	Sachin Pathak	4	5
53	101254004	Srijan Aditya	4	5
54	101254005	Navjot Kaur	4	5
55	101254006	Milan Jain	3	4
56	101254008	Gaurav	3.5	4
57	101254009	Varun Khanna	4	5
58	101254010	Swati Srivastava	5	5
59	101254012	Shubham Singla	5	5
60	101254013	Sorabh Devgun	5	5
61	101254014	Paras Ghai	5	5
62	101254016	Sachin Gupta	4	5
63	101254017	Nakul Kumar	3	4
64	101384001	Ankur Singla	3.5	4
65	101384002	Gagandeep Singh	4	5
66	101384004	Himanshu Bansal	4	5
67	101384005	Navdeep Singh	4	5
68	101384006	Parampreet Singh	3.5	4
69	101384007	Saurav Goyal	5	5
70	101384008	Surjeet Singh	4	5

The overall performance of students for the above criterion is summarized as given below in Table PO-04(B).4:

Table PO-04(B).4: Average score of student performance in the course UEE791 for criteria PO-04(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE791	74.29	24.29	1.43	0.00	0.00	4.73

The above data from Table PO-04(B).2 and PO-04(B).4. is used to evaluate weighted average of direct measure through Course Portfolio for criteria PO-04(B), and is summarised in Table PO-04(B).5.

Table PO-04(B).5: Weighted Average Student class performance (course portfolio) for criteria PO-04(B)

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE591	0.77	20.00	57.69	21.54	0.00	3.00
UEE791	74.29	24.29	1.43	0.00	0.00	4.73
Student Class Performance Score	37.53	22.15	29.56	10.77	0.00	3.86

b) Indirect Measures:

The indirect measurement of performance criteria 'PO-04(B)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer

Survey). The weighted average score in respective surveys is summarised in Table PO-04(B).6 and Table PO-04(B).7.3

(i) Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-04(A)'.

UEE591	Use resources to adopt latest technologies
UEE791	Carry out design calculations and implementations in the area of project.

Table PO-04(B).6: Weighted average score of performance criterion 'PO-04(B)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE591	33.85	25.38	33.08	6.15	1.54	3.84
UEE791	40.00	22.86	31.43	1.43	4.29	3.93
Course Survey Score	36.93	24.12	32.26	3.79	2.92	3.89

Assessment Tool: Graduating Student Survey, Alumni Survey and Employer Survey (other surveys) are used to assess the attainment of program outcome 'PO-04' through indirect measurement using following question in the respective surveys.

Graduating Student Survey	an ability to function on multidisciplinary teams.
Alumni Survey	
Employer Survey	Do our students have an ability to function on multidisciplinary teams?

c) Overall weighted average score of performance criterion 'PO-04(B)'

The overall weighted average score of performance criterion 'PO-04(B)' is summarised in Table PO-04(B).7 from the data given in Tables PO-04(B).5, PO-04(B).6 and PO-04(A).7.

Table PO-04(B).7: Overall weighted average score of performance criterion 'PO-04(B)'

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student Class Performance	37.53	22.15	29.56	10.77	0.00	3.86	5
Course Surveys	36.93	24.12	32.26	3.79	2.92	3.89	4
Other Surveys	35.40	36.84	19.42	6.80	1.55	3.98	3
Overall Score	36.80	26.48	27.93	7.45	1.36	3.90	

Overall assessment of program outcome PO-04 using scores of PO-04(A) and PO-04(B)

In the previous sections, each of the individual performance criteria PO-04(A) and PO-04(B) have been assessed. The performance for attainment of outcome PO-04 has been completed using the attainment values for PO-04(A) and PO-04(B) and is provided below in Table PO-04.1 and Fig PO-04.2:

Table PO-04.2 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome PO-04.

Table PO-04.2: Overall score for outcome PO-04 at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
PO-04(A)	51.57	28.44	14.43	3.11	2.45	4.24	5
PO-04(B)	36.80	26.48	27.93	7.45	1.36	3.90	5
Overall Score	44.19	27.46	21.18	5.28	1.91	4.07	

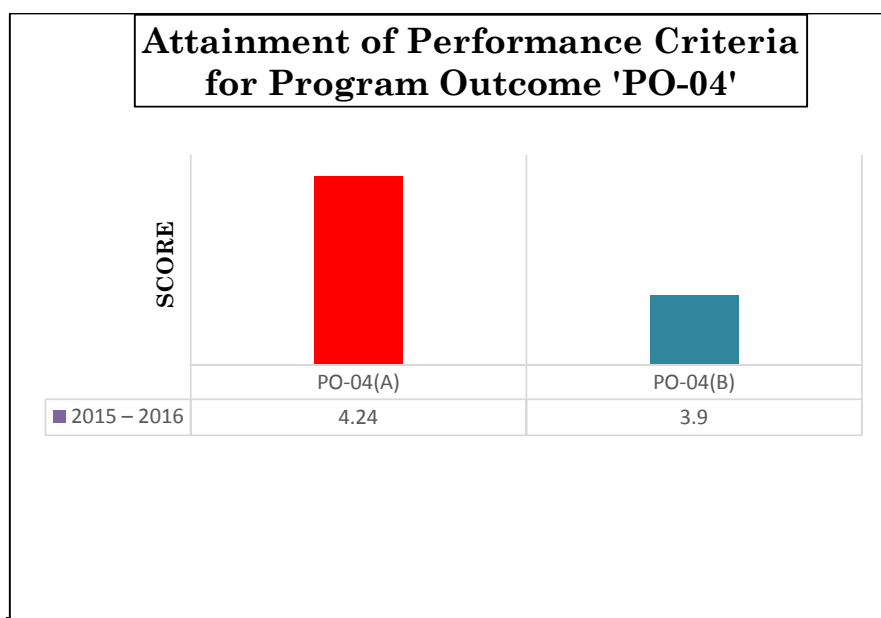


Fig PO-04.2: Performance criteria-wise assessment score of outcome 'PO-04' in the year 2015-16

Assessment of Attainment of Program Outcome

PO-05

An ability to identify, formulates, and solve engineering problems

(2015-16)

for the

Bachelor of Engineering

in

Electrical Engineering



THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Electrical & Instrumentation Engineering Department
Thapar Institute of Engineering & Technology,
Patiala (Punjab) –INDIA

Attainment of Program Outcome 'PO-05'

The attainment of program outcome **PO-05: An ability to identify, formulate, and solve engineering problems** has been measured for the BE Electrical Engineering program. The program outcome 'PO-05' has been classified into following performance criteria:

PO-05(A): *Classify information to identify engineering problems*

PO-05(B): *Develop appropriate models to formulate solutions*

PO-05(C): *Use analytical, computational and/or experimental methods to obtain solutions*

The program assessment committee identified the following courses for the assessment of program outcome 'PO-05': The courses used for the assessment during last three academic years are marked bold

- UEE301: Direct Current Machines and Transformers
- **UEE401: Alternating current machines**
- UEE405: Network Theory & Design
- UEE501: Generalized Theory of Electrical Machines
- **UEI503: Digital signal processing and applications**
- **UEI504: Microprocessor and Applications**
- UEE523: High Voltage Transmission Systems
- UEE524: Power Quality Monitoring and Conditioning
- **UEE603: Switchgear and Protection**
- UEE802: Intelligent Algorithms in Power Systems
- **UEI841: Advanced Control Systems**
- UEE502: High Voltage Engineering
- UMA062: Graph Theory
- UEE804: Operation and Control of Power Systems
- UEE605: Power System Analysis & Stability
- UEE801: Electric Drives

Outcome PO-05 has been assessed through three performance criteria PO-05(A), PO-05(B) and PO-05(C). The following courses have been considered by the program assessment committee for the assessment of performance criteria 'PO-05(A)', 'PO-05(B)' and 'PO-05(C)' for the academic year 2015-16.

Performance Criteria	Course -1	Course-2
PO-05(A)	UEE401:Alternating Current Machines	UEI503: Digital Signal Processing and Application
PO-05(B)	UEE603: Switchgear and Protection	UEI841: Advanced Control Systems
PO-05(C)	UEE401: Alternating Current Machines	UEI504: Microprocessor and Applications

The step by step methodology used to measure the attainment of program outcome ‘PO-05’ is shown in Fig. PO-05 for academic year (AY) 2015-16. The similar procedure is followed to measure the attainment of program outcome ‘PO-05’ for all three academic years under consideration.

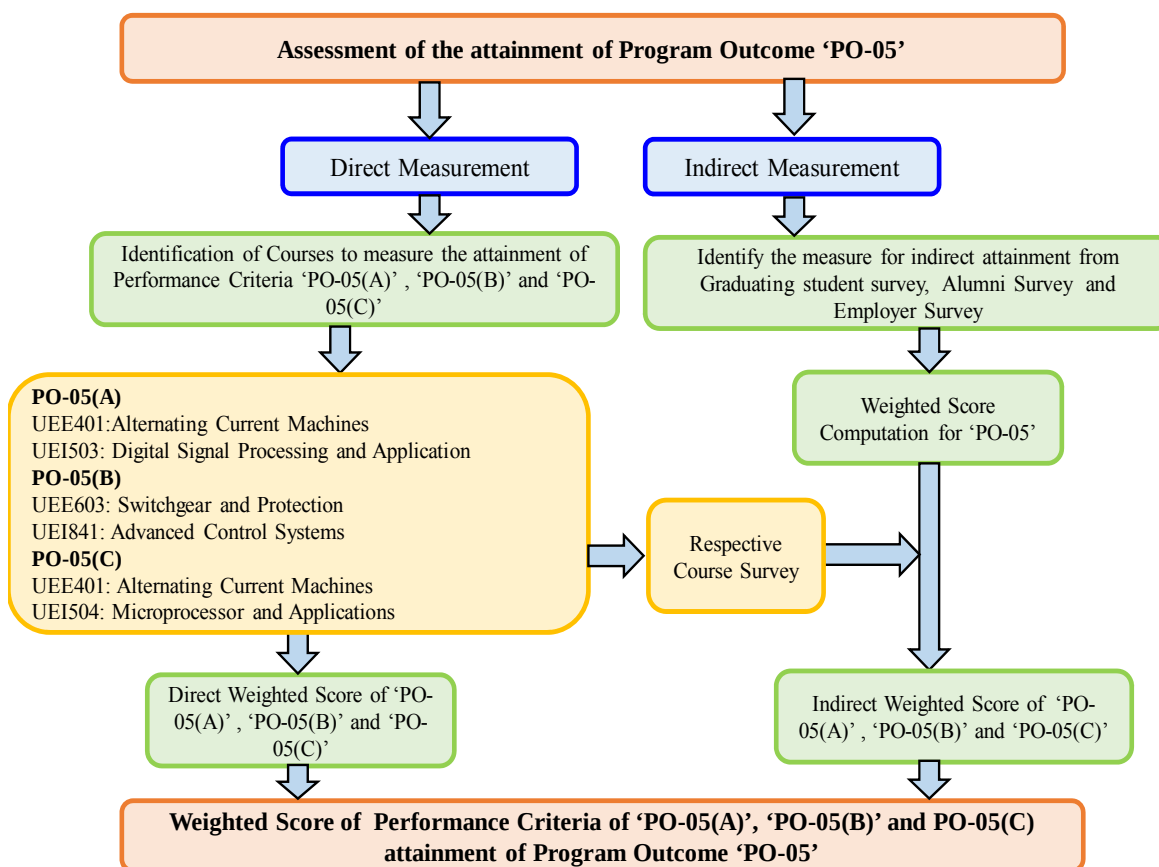


Fig. PO-05.1: Process for measurement of attainment of outcome 'PO-05' for the year 2015-16

The Rubric used to convert marks obtained by students to a scale in the range of 1 to 5 is described in Table PO-05.1.

Table PO-05.1: Rubric for Outcome Measurement

S. No.	Range of Marks (%)	Score (1-5)
1	$75 \leq \text{Marks} \leq 100$	5
2	$60 \leq \text{Marks} < 75$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

The following sections summarize separate assessments for each of the performance criteria using the subjects mentioned.

Assessment of Outcome 'PO-05' using Performance Criterion 'PO-05(A)'

PO-05(A): Classify information to identify engineering problems.

The performance criteria 'PO-05(A)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE401: Alternating Current Machines* and *UEI503: Digital Signal Processing and Applications* are used to assess performance criteria PO-05(A) as a direct measure. The analysis for each of these courses is provided below:

(i) UEE401: Alternating Current Machines

The performance of course UEE401: Alternating Current Machines is used to measure the attainment of outcome 'PO-05(A)' through the End Semester Examination (Question No. 3(a), Jan-May 2016, 8 marks).

Question:

Q.3 (a)	A 230 V, 380 W, 50 Hz, 4-pole, single phase induction motor gave the following test results: No-load test: 230 V, 84 W, 2.8 A Blocked-rotor test: 110 V, 460 W, 6.2 A The stator winding resistance is 4.6 ohms and during the blocked rotor test, the auxiliary winding is open. Determine the equivalent circuit parameters and draw the equivalent circuit.	(8)
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The performance of the students in the above question is summarized in Table PO-05(A).1 using rubrics defined in Table PO-05.1.

Table PO-05(A).1: Students' performance in question targeting 'PO-05(A)':Course UEE401

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
1	101404001	Abhay Mahipal	8	5
2	101404002	Abhijeet Singh Sankhla	0	1
3	101404004	Abhinav Arora	3.5	3
4	101404006	Abhishek Sharma	2	2
5	101404007	Ajay Singh	0	1
6	101404009	Alka Thakur	7	5
7	101404012	Ankush Goyal	6.5	5
8	101404013	Anmol Arjun Bharaj	1	1
9	101404014	Anmol Goyat	3	2
10	101404015	Anmol Rattan Kaur	6.5	5
11	101404017	Anubhav Kumar	3.5	3
12	101404018	Apeksha Goel	3	2
13	101404019	Arnish Jain	3.5	3
14	101404020	Arshiya	7.5	5
15	101404021	Arshjot Kaur	8	5
16	101404023	Ayush Jain	1.5	1
17	101404024	Bhawani Singh	0	1
18	101404025	Chirag Jain	3.5	3
19	101404026	Davileen Garg	7	5
20	101404027	Dilpreet Kaur	1	1
21	101404028	Divesh Kamdar	1.5	1
22	101404029	Divyam Aggarwal	5	4
23	101404031	Divyanshu Siddharth	7	5
24	101404032	Garima	0.5	1
25	101404033	Garv Chahar	0	1
26	101404035	Gaurav Rathore	1	1
27	101404036	Gurpreet Singh	6	5
28	101404037	Gursagar Singh	6	5
29	101404038	Gurupinder Pal Singh	7.5	5
30	101404039	Harmanpreet Singh	2	2
31	101404041	Harshit Kaushik	0	1
32	101404042	Harshvir Singh	8	5
33	101404043	Harsimarjot Kaur	6.5	5
34	101404044	Harsimran Singh	5	4
35	101404045	Hartej Singh Bains	1	1
36	101404046	Heema Gupta	4.5	3

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
37	101404047	Hitesh Kumar	1.5	1
38	101404048	Ishita Mahindru	1.5	1
39	101404049	Jagmeet Singh Bawa	2	2
40	101404050	Jagnoor Kaur	7	5
41	101404051	Jashanpreet Singh	7	5
42	101404052	Jatin Bansal	6	5
43	101404053	Jatin Raheja	7	5
44	101404054	Kanishak Sharma	7	5
45	101404055	Karan Sanjeev Bajaj	8	5
46	101404056	Kirtish Madaan	7	5
47	101404057	Mahitosh Sharma	7	5
48	101404058	Manan Mittal	8	5
49	101404059	Mandeep Singh Panesar	6.5	5
50	101404060	Manisha Gupta	8	5
51	101404061	Manit Gupta	0	1
52	101404062	Manjosh Singh Dhillon	3.5	3
53	101404063	Manpreet Singh Brar	2	2
54	101404064	Manvir Kaur	6	5
55	101404065	Mehak Bhatia	7	5
56	101404066	Mithilesh Kumar	0	1
57	101404067	Mohit Goyal	7	5
58	101404068	Mridul Marwaha	8	5
59	101404069	Mudit Arora	8	5
60	101404070	Naveen Parashar	2	2
61	101404072	Nigam Wadhwa	6	5
62	101404073	Nikhil Danodia	2.5	2
63	101404074	Nishita Kumari	7.5	5
64	101404075	Nitin Gupta	6.5	5
65	101404076	Nitish Arora	8	5

The performance of students through the course UEE401 for criteria PO-05(A) is summarized in Table PO-05(A).2

Table PO-05(A).2: Average score of student performance in the course UEE401 for criteria 'PO-05(A)'

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE401	50.77	3.08	9.23	12.31	24.62	3.43

UEI503: Digital Signal Processing and Applications

The performance of course *UEI503: Digital Signal Processing and Applications* is used to measure the attainment of outcome 'PO-05(A)' through the End Semester Examination (Question No. 3 (b), Jan-May 2016, 5 marks).

Question:

Q.3 (b)	Find the transfer function and impulse response of (i) An ideal LPF with a digital cutoff frequency of 0.25. (ii) An ideal HPF with a digital cutoff frequency of 0.30. (iii) An ideal bandpass between $F=0.1$ and $F=0.3$. Also provide the impulse response and spectrum of triangular window along with all its characteristics.	5
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The performance of the students in the above question is summarized in Table PO-05(A).3 using rubrics defined in Table PO-05.1.

Table PO-05(A).3: Students' performance in question targeting 'PO-05(A)': Course UEI503

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101304001	Aarushi Bajaj	4	5
2	101304002	Abhey Arora	0	1
3	101304003	Abhishek Taksali	3	4
4	101304004	Adhikaansh Tayal	1.5	2
5	101304005	Aditi Narang	3.5	4
6	101304006	Aditya	3.5	4
7	101304007	Akshat	5	5
8	101304008	Akshay Kapoor	5	5
9	101304009	Akshay Kumar	2	3
10	101304011	Akshay Sharma	3	4
11	101304012	Amandeep Kaur	3.5	4
12	101304013	Amandeep Singh	5	5
13	101304014	Amaninder Singh Randhawa	0.5	1
14	101304015	Angad Kapoor	4	5
15	101304016	Ankita Garg	4.5	5
16	101304018	Anmol Jawa	4	5
17	101304019	Anmolpreet Singh	2.5	3
18	101304020	Anyuti Tiwary	4	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
19	101304021	Arpit Sharma	4.5	5
20	101304023	Arshbir Kaur	3	4
21	101304024	Arshdeep Singh Bagga	2	3
22	101304025	Ashish	4	5
23	101304026	Ashish Rajpal	4	5
24	101304028	Berry Lubana	4	5
25	101304029	Bhanu Duggal	3	4
26	101304030	Bhanu Marwaha	2	3
27	101304031	Chirag Gaba	4.5	5
28	101304032	Dipin Garg	4.5	5
29	101304033	Dishant Vanvari	4.5	5
30	101304034	Divyesh Pratap Singh	3.5	4
31	101304035	Elham Anwar	2.5	3
32	101304036	Gurseerat Singh Meen	0	1
33	101304037	Gursewak Singh	0	1
34	101304040	Hariansh Sehgal	0	1
35	101304041	Hartejdeep Singh	0.5	1
36	101304042	Himanshu Goyal	0	1
37	101304044	Jasjit Singh	0	1
38	101304045	Jassimran Singh Julka	4.5	5
39	101304046	Jessica Dhaliwal	5	5
40	101304047	Kanwarpal Singh	0	1
41	101304048	Karan Kumar	2	3
42	101304049	Karanjot Singh Kochar	4.5	5
43	101304050	Kashish Aggarwal	4	5
44	101304052	Love Gaba	3.5	4
45	101304054	Manik Mittal	4	5
46	101304056	Mayank Singla	1	2
47	101304057	Mridul Bhutani	3	4
48	101304058	Naman Garg	5	5
49	101304059	Navdeep Singh	3.5	4
50	101304060	Navdeep Singh	2	3
51	101304062	Nishant Garg	2	3
52	101304094	Satripleen Kaur	4	5
53	101484001	Amandeep Singh	2	3
54	101484002	Amrinder Singh	4	5
55	101484008	Diljeet Singh	3.5	4

The performance of students through the course UEI501 for criteria PO-05(A) is summarized in Table PO-05(A).4.

Table PO-05(A).4: Average score of student performance in the course UEI501 for criteria PO-05(A)

Course	% of Students in each Score					Average Score
	5	4	3	2	1	
UEI501	41.82	21.82	16.36	3.64	16.36	3.69

The data from Table PO-05(A).2 and Table PO-05(A).4 is used to evaluate weighted average of direct measure through course portfolio for criteria 'PO-05(A)', and is summarised in Table PO-05(A).5.

Table PO-05(A).5: Weighted Average Student class performance (Course Portfolio) for criteria 'PO-05(A)'

Courses	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE401	50.77	3.08	9.23	12.31	24.62	3.43
UEI501	41.82	21.82	16.36	3.64	16.36	3.69
Student class performance score	46.29	12.45	12.80	7.97	20.49	3.56

b) Indirect Measures:

The indirect measurement of performance criteria 'PO-05(A)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-05(A).6 and Table PO-05(A).7.

(i) Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-05(A)'.

UEE401	Determine the equivalent circuit parameters of three phase induction motor and single phase induction motor.
UEI501	Design digital filter structures for both FIR and IIR using different techniques.

Table PO-05(A).6: Weighted average score of performance criterion 'PO-05(A)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE401	37.16	19.30	14.59	5.95	23.01	3.41
UEI501	48.95	28.92	12.85	5.02	4.26	4.13
Course survey score	43.05	24.1	13.7	5.48	13.63	3.77

- (ii) **Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-05' through indirect measurement using following question in the respective surveys.

Graduating Survey	An ability to identify, formulate and solve engineering problems.
Alumni Survey	
Employer Survey	Do our students have an ability to identify, formulate, and solve engineering problems?

Table PO-05(A).7: Weighted average score of performance criterion 'PO-05(A)' based on Other Surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating student survey	19.77	44.07	30.51	5.08	0.56	3.77
Employer survey	60	40	0	0	0	4.60
Alumni survey	30.43	36.23	24.64	5.80	2.90	3.85
Other survey score	36.73	40.1	18.38	3.62	1.15	4.07

c) Overall weighted average score of performance criterion 'PO-05(A)'

The overall weighted average score of performance criterion 'PO-05(A)' is summarised in Table PO-05(A).8 from the data given in Tables PO-05(A).5, PO-05(A).6 and PO-05(A).7.

Table PO-05(A).8: Overall weighted average score of performance criterion 'PO-05(A)'

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance score	46.29	12.45	12.80	7.97	20.49	3.56	5
Course surveys score	43.05	24.1	13.7	5.48	13.63	3.77	4
Other surveys score	36.73	40.1	18.38	3.62	1.15	4.07	3
Overall weighted score	42.82	23.24	14.49	6.05	13.36	3.75	-

Assessment of Outcome 'PO-05' using Performance Criterion 'PO-05(B)'

PO-05(B): Develop appropriate models to formulate solutions

a.) Assessment Tool: Students' performance using Course Portfolio

Two courses namely UEE603: Switchgear and Protection and UEI841: Advanced Control Systems are used to assess performance criteria PO-05(B) as a direct measure. The analysis for each of these courses is provided below:

UEE603: Switchgear and Protection

The performance of course *UEE603: Switchgear and Protection* is used to measure the attainment of outcome 'PO-05(B)' through End Semester Examination (Question No. 3 (c), Jan-May 2016, 6 marks).

Question:

Q.7	Find the portion of the winding protected against earth fault on a 11kV, 50 MVA star-connected alternator having a reactance of 1.5 ohms per phase and negligible resistance. The generator neutral is grounded with 10 ohms. Differential protection scheme is used which operates when the out of balance current exceeds 5% of the full load current.	(6)
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The performance of the students in the above question is then summarized as given below in Table PO-05(B).3 using rubrics defined in Table PO-05.1.

Table PO-05(B).3: Students' performance in question targeting 'PO-05(B)'; Course UEE603

S. No	Roll No.	Name of Student	Marks (6)	Score (1-5)
1	101304001	Aarushi Bajaj	4	4
2	101304002	Abhey Arora	0	1
3	101304003	Abhishek Taksali	6	5
4	101304004	Adhikaansh Tayal	0	1
5	101304005	Aditi Narang	1	1
6	101304006	Aditya	3	3
7	101304007	Akshat	3	3
8	101304008	Akshay Kapoor	2	2
9	101304009	Akshay Kumar	0	1
10	101304010	Akshay Kumar Chaudhary	2	2
11	101304011	Akshay Sharma	5.5	5
12	101304012	Amandeep Kaur	1	1
13	101304013	Amandeep Singh	0	1
14	101304014	Amaninder Singh	1	1
15	101304015	Angad Kapoor	2	2
16	101304016	Ankita Garg	6	5
17	101304018	Anmol Jawa	1	1
18	101304019	Anmolpreet Singh	4	4
19	101304020	Anyuti Tiwary	2	2
20	101304021	Arpit Sharma	2	2
21	101304022	Arsh Kundal	5	5
22	101304023	Arshbir Kaur	2	2
23	101304024	Arshdeep Singh Bagga	6	5

S. No	Roll No.	Name of Student	Marks (6)	Score (1-5)
24	101304028	Berry Lubana	6	5
25	101304029	Bhanu Duggal	6	5
26	101304030	Bhanu Marwaha	0	1
27	101304031	Chirag Gaba	5	5
28	101304032	Dipin Garg	6	5
29	101304033	Dishant Vanvari	1	1
30	101304034	Divyesh Pratap Singh	6	5
31	101304035	Elham Anwar	6	5
32	101304036	Gurseerat Singh Meen	0	1
33	101304037	Gursewak Singh	3	3
34	101304040	Hariansh Sehgal	2	2
35	101304041	Hartejdeep Singh	0	1
36	101304042	Himanshu Goyal	1	1
37	101304046	Jessica Dhaliwal	6	5
38	101304047	Kanwarpal Singh	0	1
39	101304048	Karan Kumar	1	1
40	101304049	Karanjot Singh Kochar	3	3
41	101304050	Kashish Aggarwal	6	5
42	101304051	Kritika Singla	0	1
43	101304052	Love Gaba	2	2
44	101304054	Manik Mittal	0	1
45	101304055	Maninderjit Singh	2	2
46	101304056	Mayank Singla	6	5
47	101304057	Mridul Bhutani	2	2
48	101304058	Naman Garg	6	5
49	101304059	Navdeep Singh	5	5
50	101304060	Navdeep Singh	6	5
51	101304061	Nazuk Aggarwal	4	4
52	101304062	Nishant Garg	6	5
53	101304063	Nishtha Raheja	2	2
54	101304064	Paras Bawa	2	2
55	101304065	Parth Ahuja	0	1
56	101304066	Parushi	2	2
57	101304067	Pency Goyal	2	2
58	101304068	Piyush Jindal	2	2
59	101304069	Piyush Tripathi	1	1
60	101304070	Prachi Garg	5	5

S. No	Roll No.	Name of Student	Marks (6)	Score (1-5)
61	101304071	Prashant Kataria	0	1
62	101304072	Preeti Garg	2	2
63	101304073	Priyank Arora	2	2
64	101304074	Priyanka	5	5
65	101304075	Priyanka Singh	5	5
66	101304076	Priyansh Mahajan	6	5
67	101484008	Diljeet Singh	6	5
68	101484009	Jyoti Kaushal	2	2
69	101484011	Pawan Kumar	6	5

The overall performance of students for the above criterion is summarized in Table PO-05(B).4.

Table PO-05(B).4: Average score of student performance in the course UEE603 for criteria PO-05(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE603	34.78	4.35	5.80	26.09	28.99	2.90

UEI841: Advanced Control Systems

The performance of course UEI841: Advanced Control Systems is used to measure the attainment of outcome 'PO-05(B)' through the End Semester Examination (Question No. 10, Jan-May 2015, 10 marks).

Question:

Q.10	Consider the following discrete-time state model:	(10)
	$x(k+1) = \begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(k)$ Design a suitable state feedback gain matrix K such that the system will have closed loop poles at $z = 0.5 \pm j0.5$.	

The performance of the students in the above question is then summarized as given below in Table PO-05(B).1 using rubrics defined in Table PO-05.1.

Table PO-05(B).1: Students' performance in question targeting 'PO-05(B)'; Course UEI841

Sr.No.	Roll No.	Name	Marks(10)	Score(1-5)
1	101304001	Aarushi Bajaj	10.0	5
2	101304002	Abhey Arora	8.0	5

Sr.No.	Roll No.	Name	Marks(10)	Score(1-5)
3	101304003	Abhishek Taksali	4.0	3
4	101304004	AdhikaanshTayal	0.0	1
5	101304005	Aditi Narang	10.0	5
6	101304006	Aditya	10.0	5
7	101304007	Akshat	8.0	5
8	101304008	Akshay Kapoor	8.0	5
9	101304009	Akshay Kumar	10.0	5
10	101304010	Akshay Kumar Chaudhary	4.0	3
11	101304011	Akshay Sharma	8.0	5
12	101304012	Amandeep Kaur	6.0	4
13	101304013	Amandeep Singh	8.0	5
14	101304015	Angad Kapoor	8.0	5
15	101304016	Ankita Garg	6.0	4
16	101304018	Anmol Jawa	6.0	4
17	101304019	Anmolpreet Singh	10.0	5
18	101304020	AnyutiTiwary	10.0	5
19	101304021	Arpit Sharma	10.0	5
20	101304022	Arsh Kundal	6.0	4
21	101304023	Arshbir Kaur	8.0	5
22	101304024	Arshdeep Singh Bagga	8.0	5
23	101304025	Ashish	6.0	4
24	101304026	Ashish Rajpal	10.0	5
25	101304028	Berry Lubana	10.0	5
26	101304029	Bhanu Duggal	10.0	5
27	101304030	Bhanu Marwaha	6.0	4
28	101304031	Chirag Gaba	10.0	5
29	101304032	Dipin Garg	10.0	5
30	101304033	Dishant Vanvari	6.0	4
31	101304034	Divyesh Pratap Singh	6.0	4
32	101304035	Elham Anwar	8.0	5
33	101304036	Gurseerat Singh Meen	10.0	5
34	101304037	Gursewak Singh	10.0	5
35	101304040	Hariansh Sehgal	2.0	2
36	101304041	Hartejdeep Singh	8.0	5
37	101304042	Himanshu Goyal	8.0	5
38	101304044	Jasjit Singh	10.0	5
39	101304045	Jassimran Singh Julka	10.0	5

Sr.No.	Roll No.	Name	Marks(10)	Score(1-5)
40	101304046	Jessica Dhaliwal	10.0	5
41	101304048	Karan Kumar	6.0	4
42	101304049	Karanjot Singh Kochar	8.0	5
43	101304050	Kashish Aggarwal	10.0	5
44	101304052	Love Gaba	5.0	3
45	101304054	Manik Mittal	8.0	5
46	101304056	Mayank Singla	6.0	4
47	101304057	Mridul Bhutani	4.0	3
48	101304058	Naman Garg	10.0	5
49	101304059	Navdeep Singh	6.0	4
50	101304060	Navdeep Singh	10.0	5
51	101304062	Nishant Garg	10.0	5
52	101304094	Satripleen Kaur	10.0	5
53	101484001	Amandeep Singh	8.0	5
54	101484002	Amrinder Singh	8.0	5
55	101484003	Ashmeen Singh	8.0	5
56	101484004	Azad Singh	6.0	4
57	101484005	Chandan Garg	6.0	4
58	101484007	Deepak Singla	10.0	5
59	101484008	Diljeet Singh	10.0	5

The overall performance of students for the above criterion is summarized in Table PO-05(B).2

Table PO-05(B).2: Average score of student performance in the course UEI841 for criteria PO-05(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEI841	67.80	22.03	6.78	1.69	1.69	4.53

The above data is used to evaluate weighted average student class performance (course portfolio) for criteria PO-05(B) is given in Table PO-05(B).5.

Table PO-05(B).5: Weighted Average Student class performance (Course Portfolio) for criteria PO-05(B)

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE603	34.78	4.35	5.80	26.09	28.99	2.90
UEI841	67.80	22.03	6.78	1.69	1.69	4.53
Student class performance score	51.29	13.19	6.29	13.89	15.34	3.71

b) Indirect measures for Performance criteria PO-05(B) (Surveys)

- (i) **Assessment Tool:** Student Course Surveys are used to assess the attainment of program outcome 'PO-05(B)' through indirect measurement using following course learning objectives in the respective courses.

UEE603	Design scheme for protection of generators and transformers using differential scheme.
UEI841	Develop design skills in optimal control problems

Table PO-05(B).6: Weighted average score of performance criterion 'PO-05(B)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE603	18.69	28.455	24.39	13.00	15.44	3.21
UEI841	24.59	40.16	16.39	9.836	9.01	3.61
Course surveys score	21.64	34.30	20.39	11.41	12.22	3.41

- (i) **Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-05' through indirect measurement is summarized in Table PO-05(A).7.

c) Overall weighted average score of performance criterion 'PO-05(B)'

Finally overall weighted average score of performance criterion 'PO-05(B)' is evaluated as given below in Table PO-05(B).7.

Table PO-05(B).7: Overall weighted average score of performance criterion 'PO-05(B)'

Course	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance score	51.29	13.19	6.29	13.89	15.34	3.71	5
Course surveys score	21.64	34.30	20.39	11.41	12.22	3.41	4
Other surveys score	36.73	40.1	18.38	3.62	1.15	4.07	3
Overall weighted score	37.76	26.95	14.01	10.49	10.75	3.7	

Assessment of Outcome 'PO-05' using performance criterion PO-05(C)

PO-05(C): Use analytical, computational and/or experimental methods to obtain solutions

a.) Assessment Tool: Students' performance using Course Portfolio

Two courses namely UEE401: Alternating Current Machines and UEI504 Microprocessor and Applications are used to assess performance criteria PO-05(C) as a direct measure. The analysis for each of these courses is provided below:

UEE401: Alternating Current Machines

The performance of course *UEE401: Alternating Current Machines* is used to measure the attainment of outcome 'PO-05(C)' through the End Semester Examination (Question No. 4 (b), Jan-May 2016, 10 marks).

Question:

Q4 (b).	A 6.6 kV, 3-phase, 50 Hz star connected alternator gave the following data for open circuit and short circuit tests.						(10)
	I_f in A	3.2	5	7.5	10	14	
	E_f in kV	3.10	4.90	6.60	7.50	8.24	
	I_{SC} in A	500	778	1170			
	Per phase armature resistance is 0.2 ohm. Calculate the voltage regulation at full-load current of 500 A at 0.8 power factor lagging by e.m.f. method.						

The performance of the students in the above question is then summarized as given below in Table PO-05(C).1 using rubrics defined in Table PO-05.1.

Table PO-05(C).1: Student's performance in question targeting 'PO-05(C)'; Course UEE401

S. No	Roll No.	Name of Student	Total Marks (10)	Score (1-5)
1	101404001	Abhay Mahipal	8	5
2	101404002	Abhijeet Singh Sankhla	7.5	5
3	101404004	Abhinav Arora	4	3
4	101404006	Abhishek Sharma	5	3
5	101404007	Ajay Singh	0	1
6	101404009	Alka Thakur	9	5
7	101404012	Ankush Goyal	8.5	5
8	101404013	Anmol Arjun Bharaj	8	5
9	101404014	Anmol Goyat	0	1
10	101404015	Anmol Rattan Kaur	6.5	4
11	101404017	Anubhav Kumar	8	5
12	101404018	Apeksha Goel	4	3
13	101404019	Arnish Jain	6	4
14	101404020	Arshiya	4	3
15	101404021	Arshjot Kaur	5	3
16	101404023	Ayush Jain	8	5
17	101404024	Bhawani Singh	9	5
18	101404025	Chirag Jain	6	4
19	101404026	Davileen Garg	6	4
20	101404027	Dilpreet Kaur	6.5	4
21	101404028	Divesh Kamdar	10	5
22	101404029	Divyam Aggarwal	7	4

S. No	Roll No.	Name of Student	Total Marks (10)	Score (1-5)
23	101404031	Divyanshu Siddharth	10	5
24	101404032	Garima	7	4
25	101404033	Garv Chahar	6	4
26	101404035	Gaurav Rathore	0	1
27	101404036	Gurpreet Singh	5	3
28	101404037	Gursagar Singh	7.5	5
29	101404038	Gurupinder Pal Singh	6	4
30	101404039	Harmanpreet Singh	1	1
31	101404041	Harshit Kaushik	5	3
32	101404042	Harshvir Singh	8	5
33	101404043	Harsimarjot Kaur	10	5
34	101404044	Harsimran Singh	8	5
35	101404045	Hartej Singh Bains	0	1
36	101404046	Heema Gupta	5	3
37	101404047	Hitesh Kumar	8.5	5
38	101404048	Ishita Mahindru	5	3
39	101404049	Jagmeet Singh Bawa	5	3
40	101404050	Jagnoor Kaur	6	4
41	101404051	Jashanpreet Singh	8.5	5
42	101404052	Jatin Bansal	10	5
43	101404053	Jatin Raheja	7	4
44	101404054	Kanishak Sharma	3	2
45	101404055	Karan Sanjeev Bajaj	5	3
46	101404056	Kirtish Madaan	7.5	5
47	101404057	Mahitosh Sharma	5	3
48	101404058	Manan Mittal	0	1
49	101404059	Mandeep Singh Panesar	6	4
50	101404060	Manisha Gupta	0	1
51	101404061	Manit Gupta	7	4
52	101404062	Manjosh Singh Dhillon	7	4
53	101404063	Manpreet Singh Brar	9.5	5
54	101404064	Manvir Kaur	5	3
55	101404065	Mehak Bhatia	7	4
56	101404066	Mithilesh Kumar	10	5
57	101404067	Mohit Goyal	9	5
58	101404068	Mridul Marwaha	5	3
59	101404069	Mudit Arora	4.5	3

S. No	Roll No.	Name of Student	Total Marks (10)	Score (1-5)
60	101404070	Naveen Parashar	0	1
61	101404072	Nigam Wadhwa	3	2
62	101404073	Nikhil Danodia	0	1
63	101404074	Nishita Kumari	6	4
64	101404075	Nitin Gupta	8	5
65	101404076	Nitish Arora	10	5

The overall performance of students for the above criterion is summarized in Table PO-05(C).2.

Table PO-05(C).2: Average score of student performance in the course UEE401 for criteria PO-05(C)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE401	35.38	24.62	23.08	3.08	13.85	3.65

UEI 504: Microprocessor and Applications

The performance of course *UEI 504: Microprocessor and Applications* is used to measure the attainment of outcome 'PO-05(C)' through the Lab Examination (by giving the Lab marks Jan- May 2016, 20 marks).

Question:

Q.	1. To write an assembly language for adding two 8 bit numbers in 8085 microprocessor. 2. To write an assembly language program for subtracting 2 8-bit numbers by using-8085 microprocessor. 3. To write an assembly language program for adding two 16 bit numbers using 8085 microprocessor. 4. To write an assembly language program for subtracting two 16 bit numbers using 8085 microprocessor. 5. To write an assembly language for multiplying two 8 bit numbers by using 8085 microprocessor. 6. To write an assembly language program for dividing two 8 bit numbers using 8085 microprocessor. 7. To write a program to add five numbers in an array using 8085 microprocessor. 8. To find the largest and smallest number in an array using 8085 microprocessor. 9. To write an assembly language for adding two 8 bit numbers by using 8086 microprocessor. 10. To write an assembly language for subtracting two 8 bit numbers by using 8086 microprocessor.	15
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The performance of the students in the above question is then summarized as given below in Table PO-05(C).2 using rubrics defined in Table PO-05.1.

Table PO-05(C).3: Student's performance in question targeting 'PO-05(C)'; Course UEI504

S. No	Roll No.	Name of Student	Marks (20)	Score (1-5)
1	101304001	Aarushi Bajaj	18	5
2	101304002	Abhey Arora	15	4
3	101304003	Abhishek Taksali	14	4
4	101304004	Adhikaansh Tayal	12	4
5	101304005	Aditi Narang	18	5
6	101304006	Aditya	18	5
7	101304007	Akshat	15	4
8	101304008	Akshay Kapoor	18	5
9	101304009	Akshay Kumar	17	5
10	101304009	Akshay kumar Choudhary	12.5	4

S. No	Roll No.	Name of Student	Marks (20)	Score (1-5)
11	101304011	Akshay Sharma	17.5	5
12	101304012	Amandeep Kaur	18	5
13	101304013	Amandeep Singh	13	4
14	101304014	Amaninder Singh Randhawa	13.5	4
15	101304015	Angad Kapoor	16	5
16	101304016	Ankita Garg	19	5
17	101304017	Ankur Malik	0	1
18	101304018	Anmol Jawa	18	5
19	101304019	Anmolpreet Singh	15	4
20	101304020	Anyuti Tiwary	17	5
21	101304021	Arpit Sharma	15.5	4
22	101304022	Arsh Kundal	10	3
23	101304023	Arshbir Kaur	19	5
24	101304024	Arshdeep Singh Bagga	13	4
25	101304025	Ashish	13.5	4
26	101304026	Ashish Rajpal	11	3
27	101304028	Berry Lubana	14	4
28	101304029	Bhanu Duggal	17	5
29	101304030	Bhanu Marwaha	15	4
30	101304031	Chirag Gaba	12	4
31	101304032	Dipin Garg	12	4
32	101304033	Dishant Vanvari	14	4
33	101304034	Divyesh Pratap Singh	18	5
34	101304035	Elham Anwar	16	5
35	101304036	Gurseerat Singh Meen	10	3
36	101304037	Gursewak Singh	12	4
37	101304040	Hariansh Sehgal	14	4
38	101304041	Hartejdeep Singh	13.5	4
39	101304042	Himanshu Goyal	14.5	4
40	101304044	Jasjit Singh	14.75	4
41	101304045	Jassimran Singh Julka	18	5
42	101304046	Jessica Dhaliwal	18.5	5
43	101304047	Kanwarpal Singh	12.5	4
44	101304048	Karan Kumar	17	5
45	101304049	Karanjot Singh Kochar	18.5	5
46	101304050	Kashish Aggarwal	17	5
47	101304052	Love Gaba	15.5	4

S. No	Roll No.	Name of Student	Marks (20)	Score (1-5)
48	101304054	Manik Mittal	16.75	5
49	101304055	Maninderjit Singh	17	5
50	101304056	Mayank Singla	15.5	4
51	101304057	Mridul Bhutani	13.5	4
52	101304058	Naman Garg	15.5	4
53	101304059	Navdeep Singh	18.5	5
54	101304060	Navdeep Singh	18	5
55	101304062	Nishant Garg	16.5	5
56	101304094	Satripleen Kaur	16	5
57	101484001	Amandeep Singh	17	5
58	101484002	Amrinder Singh	17	5
59	101484003	Ashmeen Singh	14.5	4
60	101484005	Chandan Garg	17.5	5
61	101484007	Deepak Singla	18	5
62	101484008	Diljeet Singh	15.5	4
63	101304051	Kritika Singla	14.25	4
64	101304061	Nazuk Aggarwal	17	5
65	101304063	Nishtha Raheja	18.25	5

The overall performance of students for the above criterion is summarized in Table PO-05(C).4.

Table PO-05(C).4: Average score of student performance in the course UEE804 for criteria PO-05(C)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEI504	49.23	44.62	4.62	0.00	1.54	4.40

The above data is used to evaluate weighted average student class performance (course portfolio) for criteria PO-05(C) as given in Table PO-05(C).5.

Table PO-05(C).5: Weighted Average Student class performance (course portfolio) for criteria PO-05(C)

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE401	35.38	24.62	23.08	3.08	13.85	3.65
UEI504	49.23	44.62	4.62	0.00	1.54	4.40
Student class performance score	42.31	34.62	13.85	1.54	7.69	4.02

b) Indirect measures for Performance criteria PO-05(C) (Surveys)

- (i) **Assessment Tool:** Student Course Surveys are used to assess the attainment of program outcome 'PO-05(B)' through indirect measurement using following course learning objectives in the respective courses.

UEE401	Elaborate the power flow equations of synchronous generator and synchronous motor including concept of active and reactive power control
UEI504	Programming example and interfacing using 8085 & 8086 kits

Table PO-05(C).6: Weighted average score of performance criterion 'PO-05(C)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE401	37.16	19.30	14.59	5.95	23.01	3.41
UEI504	37.72	20.45	19.22	10.40	12.21	3.61
Course surveys score	37.44	19.87	16.90	8.17	17.61	3.51

- (ii) **Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-05' through indirect measurement is summarized in Table PO-05(A).7.

c) Overall weighted average score of performance criterion 'PO-05(C)'

Finally overall weighted average score of performance criterion 'PO-05(C)' is evaluated as given below in Table PO-05(C).7.

Table PO-05(C).7: Overall weighted average score of performance criterion 'PO-05(C)'

Course	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	42.31	34.62	13.85	1.54	7.69	4.02	5
Course surveys score	37.44	19.87	16.90	8.17	17.61	3.51	4
Other surveys score	36.73	40.1	18.38	3.62	1.15	4.07	3
Overall weighted score	39.29	31.07	15.99	4.27	9.36	3.86	

Overall assessment of program outcome PO-05 using scores of PO-05(A), PO-05(B) and PO-05(C)

In the previous sections, each of the individual performance criteria PO-05(A), PO-05(B) and PO-05(C) have been assessed. The performance for attainment of outcome PO-05 has been completed using the attainment values for PO-05(A), PO-05(B) and PO-05(C) are given in Table PO-05.2 and Fig. PO-05.2:

Table PO-05.2 summarizes the scores of each of the three performance criteria and these scores have been used to assess an overall score for outcome PO-05.

Table PO-05.2: Overall score for outcome PO-05 at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
PO-05(A)	42.82	23.24	14.49	6.05	13.36	3.75	5
PO-05(B)	37.76	26.95	14.01	10.49	10.75	3.7	5
PO-05(C)	39.29	31.07	15.99	4.27	9.36	3.86	5
Overall score	39.95	27.08	14.83	6.93	11.15	3.77	

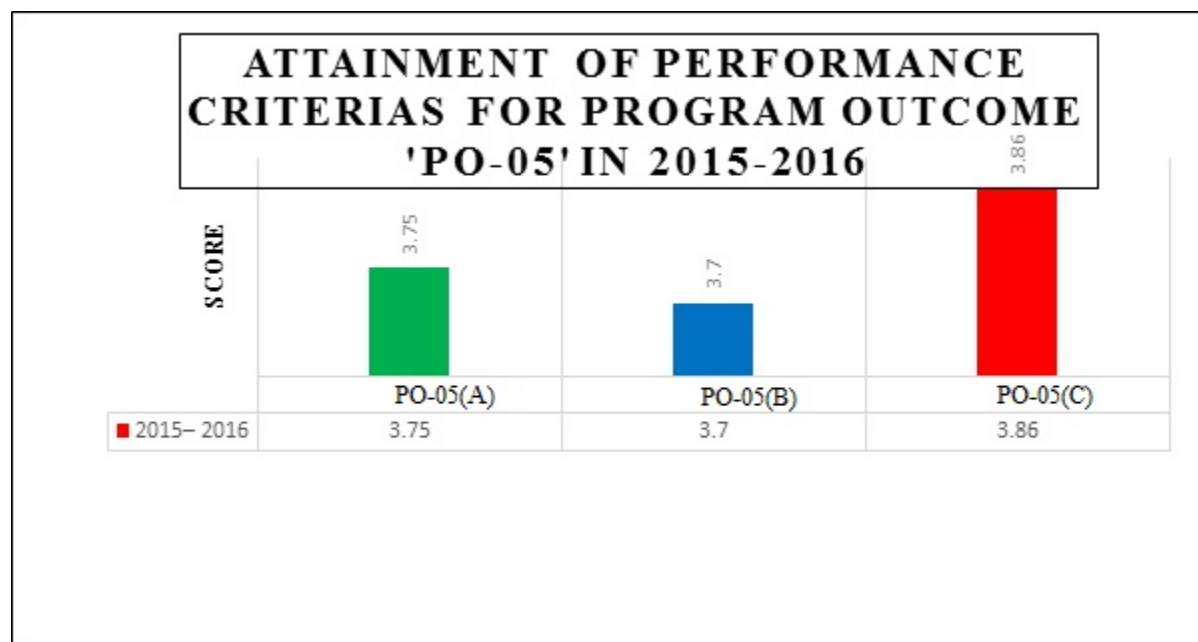


Figure PO-05.2: Performance criteria-wise assessment score distribution of outcome PO-05

Assessment of Attainment of Program outcome

PO-06

An understanding of professional and ethical responsibility
(2015-16)

for the
Bachelor of Engineering
in
Electrical Engineering



Electrical & Instrumentation Engineering Department
Thapar Institute of Engineering and Technology, Patiala
(Punjab) -INDIA

Attainment of Program outcome ‘PO-06’

The attainment of program outcome PO-06: *An understanding of professional and ethical responsibility* has been measured for the BE Electrical Engineering program. The program outcome ‘PO-06’ has been classified into following performance criteria:

PO-06(A): *Able to interact with the people in organizations, industries and/or professional societies in a professional manner to achieve their goals*

PO-06(B): *Able to evaluate ethical issues that may occur in professional practice using professional codes of ethics ensuring protection of organization, human safety and well-being of society*

The program assessment committee identified the following courses for the assessment of program outcome ‘PO-06’:

- UEN002: Energy and Environment
- UHU003: Professional Communication
- UHU005: Humanities for Engineers
- UTA002: Manufacturing Processes
- **UTA008: Engineering Design-I**
- UTA010: Engineering Design-II
- UTA011: Engineering Design-III
- UEE522: Energy Auditing and Management
- **UEE591: Summer Training**
- **UEE791: Project Semester**
- UEE793: Capstone Project
- UEE801: Electric Drives

Outcome PO-06 has been assessed through two performance criteria PO-06(A) and PO-06(B). The following courses have been considered by the program assessment committee for the assessment of performance criteria PO-06(A) and PO-06(B) for the academic year 2015-16.

Performance Criteria	Course -1	Course-2
PO-06(A)	UEE591: Summer Training	UEE791: Project Semester
PO-06(B)	UTA008: Engineering Design-I	UEE791: Project Semester

The step by step methodology used to measure the attainment of program outcome ‘PO-06’ is shown in Fig. PO-06.1 for academic year (AY) 2015-16.

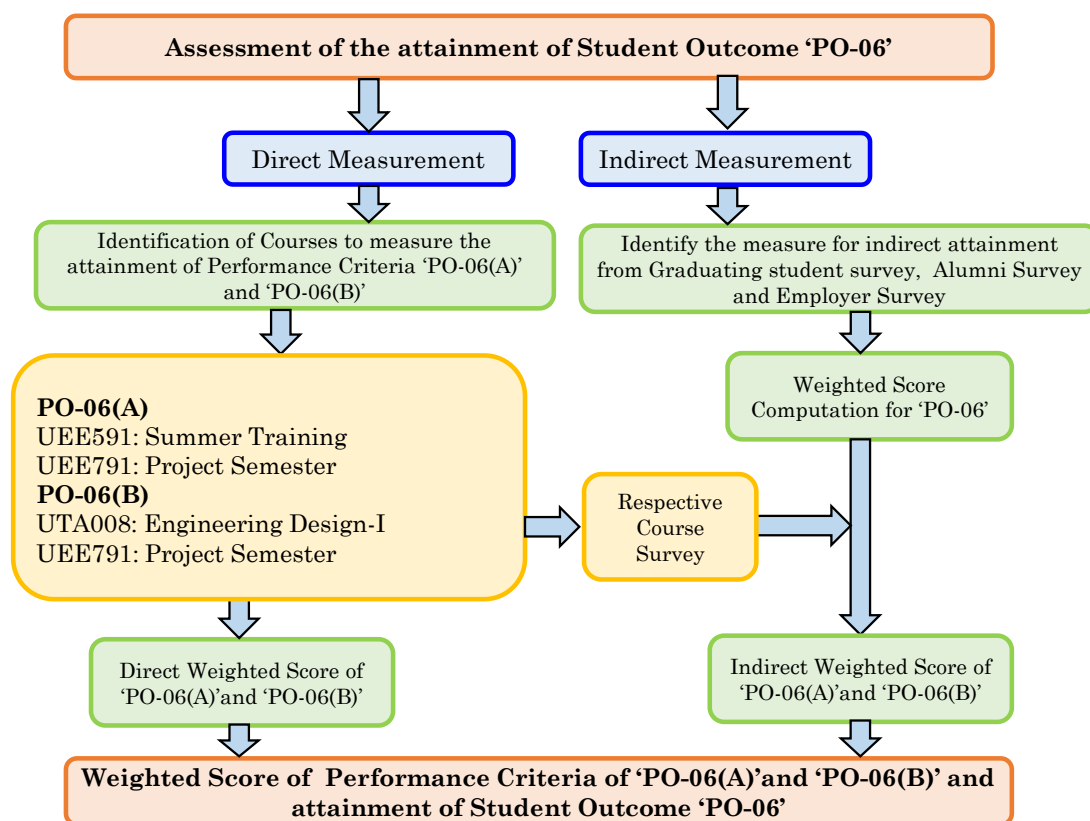


Fig. PO-06.1: Process for measurement of attainment of outcome 'PO-06' for the year 2015-16

The following Rubric has been used to convert marks obtained by students to a Likert scale in the range of 1 to 5 are described in Table PO-06.1 in most cases unless specifically mentioned.

Table PO-06.1: Rubric for Outcome Measurement

S. No.	Range of Marks (%)	Score (1-5)
1	$80 \leq \text{Marks} < 100$	5
2	$60 \leq \text{Marks} < 80$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

The following sections summarize separate assessments for each of the performance criteria using the courses mentioned.

Assessment of Outcome 'PO-06' using Performance Criterion 'PO-06(A)'

PO-06(A): Able to interact with the people in organizations, industries and/or professional societies in a professional manner to achieve their goals.

The performance criteria 'PO-06(A)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating Student Survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE591: Summer Training* and *UEE791: Project Semester* are used to assess performance criteria PO-06(A) as a direct measure. The analysis for each of these courses is provided below:

UEE591: Summer Training

The performance of course *UEE591: Summer Training* is used to measure the attainment of outcome 'PO-06(A)' by considering the component of industry interaction in assessment of summer training undergone by the students during June-July 2015, (5 Marks) **reflecting the professional efforts in achieving their goals.**

The performance of the students in the above measure is summarized in Table PO-06(A).1 using rubrics defined in Table PO-06.1.

Table PO-06(A).1: Students' performance in question targeting 'PO-06(A)': Course UEE591

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101304001	Aarushi Bajaj	3	4
2	101304002	Abhey Arora	3	4
3	101304003	Abhishek Taksali	3	4
4	101304004	Adhikaansh Tayal	2	3
5	101304005	Aditi Narang	3	4
6	101304006	Aditya	3	4
7	101304007	Akshat	3	4
8	101304008	Akshay Kapoor	4	5
9	101304009	Akshay Kumar	3	4
10	101304010	Akshay Kumar Chaudhary	3	4
11	101304011	Akshay Sharma	2	3
12	101304012	Amandeep Kaur	3	4
13	101304013	Amandeep Singh	4	5
14	101304014	Amaninder Singh Randhawa	2	3

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
15	101304015	Angad Kapoor	2	3
16	101304016	Ankita Garg	3	4
17	101304017	Ankur Malik	2	3
18	101304018	Anmol Jawa	4	5
19	101304019	Anmolpreet Singh	3	4
20	101304020	Anyuti Tiwary	4	5
21	101304021	Arpit Sharma	3	4
22	101304022	Arsh Kundal	2	3
23	101304023	Arshbir Kaur	3	4
24	101304024	Arshdeep Singh Bagga	4	5
25	101304025	Ashish	3	4
26	101304026	Ashish Rajpal	4	5
27	101304028	Berry Lubana	4	5
28	101304029	Bhanu Duggal	4	5
29	101304030	Bhanu Marwaha	5	5
30	101304031	Chirag Gaba	3	4
31	101304032	Dipin Garg	3	4
32	101304033	Dishant Vanvari	3	4
33	101304034	Divyesh Pratap Singh	3	4
34	101304035	Elham Anwar	4	5
35	101304036	Gurseerat Singh Meen	4	5
36	101304037	Gursewak Singh	3	4
37	101304038	Gurveer Singh	2	3
38	101304040	Hariansh Sehgal	2	3
39	101304041	Hartejdeep Singh	3	4
40	101304042	Himanshu Goyal	3	4
41	101304044	Jasjit Singh	3	4
42	101304045	Jassimran Singh Julka	3	4
43	101304046	Jessica Dhaliwal	4	5
44	101304047	Kanwarpal Singh	3	4
45	101304048	Karan Kumar	3	4
46	101304049	Karanjot Singh Kochar	4	5
47	101304050	Kashish Aggarwal	4	5
48	101304051	Kritika Singla	3	4
49	101304052	Love Gaba	3	4
50	101304054	Manik Mittal	4	5
51	101304055	Maninderjit Singh	3	4
52	101304056	Mayank Singla	4	5
53	101304057	Mridul Bhutani	3	4
54	101304058	Naman Garg	4	5
55	101304059	Navdeep Singh	4	5
56	101304060	Navdeep Singh	3	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
57	101304061	Nazuk Aggarwal	4	5
58	101304062	Nishant Garg	4	5
59	101304063	Nishtha Raheja	3	4
60	101304064	Paras Bawa	3	4
61	101304065	Parth Ahuja	3	4
62	101304066	Parushi	4	5
63	101304067	Pency Goyal	3	4
64	101304068	Piyush Jindal	3	4
65	101304069	Piyush Tripathi	3	4
66	101304070	Prachi Garg	3	4
67	101304071	Prashant Kataria	2	3
68	101304072	Preeti Garg	4	5
69	101304073	Priyank Arora	4	5
70	101304074	Priyanka	3	4
71	101304075	Priyanka Singh	3	4
72	101304076	Priyansh Mahajan	4	5
73	101304077	Rahul Meena	1	2
74	101304078	Rajan	3	4
75	101304079	Rajat Sharma	2	3
76	101304080	Ratul Goyal	3	4
77	101304081	Ravinder Singh	4	5
78	101304082	Rishabh Juneja	4	5
79	101304083	Robin Manktala	3	4
80	101304084	Rohan Ghai	3	4
81	101304085	Rohan Singla	4	5
82	101304086	Rohan Wadhawan	4	5
83	101304087	Rohit Goyal	4	5
84	101304088	Rubina Bamba	3	4
85	101304089	Sagar Pulani	3	4
86	101304090	Sahil Kataria	4	5
87	101304091	Sakshi	4	5
88	101304092	Sandal Singh Sidhu	4	5
89	101304093	Sandeep Kaur	4	5
90	101304094	Satripleen Kaur	3	4
91	101304095	Saurabh Mohan	4	5
92	101304096	Shagundeep Singh	3	4
93	101304097	Shailly Gupta	4	5
94	101304098	Shaina	4	5
95	101304099	Shivika Gupta	3	4
96	101304100	Shresth Rai	4	5
97	101304101	Shubham Goyal	4	5
98	101304102	Shubham Gupta	3	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
99	101304103	Shubham Sharma	4	5
100	101304104	Shubham Sharma	4	5
101	101304105	Shubham Soin	4	5
102	101304106	Siddharth Goyal	4	5
103	101304107	Sidharth Garg	4	5
104	101304108	Simran Kaur	3	4
105	101304109	Simranjit Singh	1	2
106	101304111	Sumit Dhingra	3	4
107	101304112	Sumit Kaushik	4	5
108	101304113	Tushar Dheer	3	4
109	101304114	Tushar Sharma	4	5
110	101304116	Utsav Chhabra	3	4
111	101304117	Vaibhav Gupta	3	4
112	101304118	Vaishali	3	4
113	101304119	Varun Bansal	3	4
114	101304120	Veni Jindal	4	5
115	101304121	Vishal Arora	3	4
116	101304122	Yugesh Goyal	4	5
117	101484001	Amandeep Singh	3	4
118	101484002	Amrinder Singh	3	4
119	101484003	Ashmeen Singh	3	4
120	101484004	Azad Singh	2	3
121	101484005	Chandan Garg	3	4
122	101484007	Deepak Singla	3	4
123	101484008	Diljeet Singh	4	5
124	101484009	Jyoti Kaushal	3	4
125	101484011	Pawan Kumar	4	5
126	101484012	Rajat Singla	3	4
127	101484013	Satveer Kaur	4	5
128	101484014	Saurabh Kumar Wadhawan	4	5
129	101484015	Shweta Sharma	4	5
130	101484016	Sukhjeet Singh	3	4

The performance of students through the course UEE591 for criteria PO-06(A) is summarized in Table PO-06(A).2.

Table PO-06(A).2: Average score of student performance in the course UEE591 for criteria 'PO-06(A)'

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE591	40.00	50.00	8.46	1.54	0.00	4.28

UEE791: Project Semester

The performance of course *UEE791: Project Semester* is used to measure the attainment of outcome ‘PO-06(A)’ by considering the communication skill component in oral presentation of project semester in Jan-June 2016 session. The expectation from the students is a **professional presentation taking place in a logical sequence reflecting upon the interaction with the people in industry/organization.**

The performance of the students in the above question is summarized in Table PO-06(A).3 using rubrics defined in Table PO-06.1.

Table PO-06(A).3: Students’ performance in question targeting ‘PO-06(A)’: Course UEE791

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101204001	Aashna	3	4
2	101204002	Abhinav Sharma	4	5
3	101204003	Abhishek Jain	3	4
4	101204005	Akash Deep	5	5
5	101204006	Akash Ratna	4	5
6	101204009	Akshu Gupta	5	5
7	101204010	Aman Goyal	4	5
8	101204012	Amit Bansal	4	5
9	101204014	Anukriti Dwivedi	5	5
10	101204015	Arushi Nagpal	4	5
11	101204016	Ayush Vaid	3.5	4
12	101204018	Chahat Singla	4	5
13	101204019	Deeksha Goyal	5	5
14	101204020	Dhruv Sharma	4	5
15	101204021	Gaurav Arora	4	5
16	101204022	Gursharan Kaur	4	5
17	101204023	Gursimran Singh	4	5
18	101204024	Harjot Singh	4	5
19	101204025	Harsh Kothari	4	5
20	101204026	Hemanshu Garg	4	5
21	101204027	Himanshu Takkar	4	5
22	101204028	Iqbal Singh Garcha	3	4
23	101204030	Ishtjot Singh	3	4
24	101204031	Jasdeep Garg	5	5
25	101204033	Jasleen Kaur	4	5
26	101204035	Kapil Kinger	3	4
27	101204038	Karanveer Singh Bhangoo	3	4
28	101204039	Kartik Arora	3	4
29	101204041	Kaustubh Singh	4	5
30	101204043	Lovely Goyal	4	5
31	101204045	Manik Mittal	5	5
32	101204046	Marshall	4	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
33	101204048	Mohit Kukkar	4	5
34	101204049	Mohit Manhas	5	5
35	101204051	Nalin Kaushik	5	5
36	101204053	Nishant Arora	4	5
37	101204054	P Siddharth	4	5
38	101204057	Rahul Kamboj	4	5
39	101204060	Rajatdeep Singh	3	4
40	101204061	Ramanpreet Kaur	3	4
41	101204063	Sahil Arora	5	5
42	101204064	Sahil Mittal	5	5
43	101204065	Sanchit Goel	4	5
44	101204066	Sewak Ram	5	5
45	101204067	Sheenu	2	3
46	101204069	Shubham Bhatia	3	4
47	101204070	Shubham Goel	4	5
48	101204071	Shubham Kansal	2	3
49	101204074	Sukhedarshanpal Singh	3.5	4
50	101204075	Sultan Singh	3	4
51	101204076	Tejasvi Anand	3	4
52	101254003	Sachin Pathak	5	5
53	101254004	Srijan Aditya	4	5
54	101254005	Navjot Kaur	4	5
55	101254006	Milan Jain	4	5
56	101254008	Gaurav	4	5
57	101254009	Varun Khanna	4	5
58	101254010	Swati Srivastava	4	5
59	101254012	Shubham Singla	3	4
60	101254013	Sorabh Devgun	4	5
61	101254014	Paras Ghai	4	5
62	101254016	Sachin Gupta	4	5
63	101254017	Nakul Kumar	4	5
64	101384001	Ankur Singla	3	4
65	101384002	Gagandeep Singh	4	5
66	101384004	Himanshu Bansal	5	5
67	101384005	Navdeep Singh	3	4
68	101384006	Parampreet Singh	4	5
69	101384007	Saurav Goyal	4	5
70	101384008	Surjeet Singh	3	4

The performance of students through the course UEE791 for criteria PO-06(A) is summarized in Table PO-06(A).4.

Table PO-06(A).4: Average score of student performance in the course UEE791 for criteria PO-06(A)

Course	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE791	71.43	25.71	2.86	0.00	0.00	4.69

The data from Table PO-06(A).2 and Table PO-06(A).4 is used to evaluate weighted average of direct measure through course portfolio for criteria ‘PO-06(A)’, and is summarised in Table PO-06(A).5.

Table PO-06(A).5: Weighted Average Student class performance (Course Portfolio) for criteria ‘PO-06(A)’

Courses	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE591	40	50	8.46	1.54	0.00	4.28
UEE791	71.43	25.71	2.86	0.00	0.00	4.69
Weighted Average Score	55.71	37.86	5.66	0.77	0.00	4.49

b) Indirect Measures:

The indirect measurement of performance criteria 'PO-06(A)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-06(A).6 and Table PO-06(A).7.

(i) **Assessment Tool:** Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'A'.

UEE591	Communicate their work effectively through writing and presentation
UEE791	Communicate their work effectively through writing and presentation

Table PO-06(A).6: Weighted average score of performance criterion 'PO-06(A)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE591	29.23	32.31	31.54	2.31	4.62	3.79
UEE791	35.71	30.00	30.00	1.43	2.86	3.94
Weighted average score	32.47	31.16	30.77	1.87	3.74	3.87

(ii) **Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-06' through indirect measurement using following question in the respective surveys.

Graduating Survey	An understanding of professional and ethical responsibility
Alumni Survey	
Employer Survey	Do our students have an understanding of professional and ethical responsibility?

Table PO-06(A).7: Weighted average score of performance criterion 'PO-06(A)' based on Other Surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating student survey	15.56	40.00	31.11	8.89	4.44	3.53
Employer survey	31.88	35.27	26.57	4.83	1.45	3.91
Alumni survey	60.00	33.33	6.67	0.00	0.00	4.53
Weighted average score	35.81	36.20	21.45	4.57	1.96	3.99

c) Overall weighted average score of performance criterion ‘PO-06(A)’

The overall weighted average score of performance criterion ‘PO-06(A)’ is summarised in Table PO-06(A).8 from the data given in Tables PO-06(A).5, PO-06(A).6 and PO-06(A).7.

Table PO-06(A).8: Overall weighted average score of performance criterion ‘PO-06(A)’

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	55.71	37.86	5.66	0.77	0.00	4.49	5
Course surveys	32.47	31.16	30.77	1.87	3.74	3.87	4
Other surveys	35.81	36.20	21.45	4.57	1.96	3.99	3
Overall weighted score	42.99	35.21	17.98	2.09	1.74	4.16	-

Assessment of Outcome 'PO-06' using Performance Criterion 'PO-06(B)'

PO-06(B): Able to evaluate ethical issues that may occur in professional practice using professional codes of ethics ensuring protection of organization, human safety and well-being of society

The performance criteria 'PO-06(B)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating Student Survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UTA008: Engineering Design I* and *UEE791: Project Semester* are used to assess performance criteria PO-06(B) as a direct measure. The analysis for each of these courses is provided below:

UTA008: Engineering Design-I

The performance of course *UTA008: Engineering Design-I* is used to measure the attainment of outcome 'PO-06(B)' considering the **ethical issues that may occur in professional practice using professional codes of ethics ensuring protection of organization, human safety and well-being of society** assessed through End semester Examination during July-Dec 2015, (100 Marks).

The performance of the students in the above measure is summarized in Table PO-06(B).1 using rubrics defined in Table PO-06.1.

Table PO-06(B).1: Students' performance in question targeting 'PO-06(B)': Course UTA008

S. No	Roll No.	Name of Student	Marks (100)	Score (1-5)
1	101504002	Aastha Jain	36.5	2
2	101504004	Aayush Vohra	89	5
3	101504005	Aayush Rai Anand	89	5
4	101504006	Abhijeet Singh Bhatia	60	4
5	101504007	Abhinandan Narang	83.5	5
6	101504008	Abhishek Agarwal	84.5	5
7	101504009	Abhishek Pandey	47.5	3
8	101504010	Abhishek Prasad	48	3
9	101504011	Adarsh Agarwal	36	2
10	101504012	Aditi Mishra	61.5	4

S. No	Roll No.	Name of Student	Marks (100)	Score (1-5)
11	101504013	Akshita Kamthan	36	2
12	101504014	Amandeep Singh Dhillon	76	4
13	101504015	Amarjot Singh	81.5	5
14	101504017	Amrit Kaler	41	3
15	101504018	Anahita	62.5	4
16	101504019	Ankit Gupta	84	5
17	101504020	Ankit Mahajan	79	4
18	101504021	Anmol Saluja	54	3
19	101504022	Anurag Dewangan	62.5	4
20	101504023	Arjun Garg	65.5	4
21	101504024	Ashish Nagpal	67.5	4
22	101504025	Ashish Kumar Yadav	64	4
23	101504026	Ashwini Anand Pateriya	88	5
24	101504027	Avantika Dhiman	44	3
25	101504028	Avinash Chaturvedi	50.5	3
26	101504029	Badshah Singh	86.5	5
27	101504030	Baninder Singh	79	4
28	101504031	Bhanu Pratap	53.5	3
29	101504032	Bhavay Gudwani	79	4
30	101504034	Bikram Pathania	74.5	4
31	101504035	Charika Mehta	70	4
32	101504036	Daman Aggarwal	77	4
33	101504037	Deen Dayal	80	5
34	101504038	Deepak Goyal	85.5	5
35	101504040	Divyam Soni	87.5	5
36	101504041	Fiza Singh Multani	67	4
37	101504043	Gurjot Singh Kocher	70	4
38	101504044	Gurleen Kang	45.5	3
39	101504045	Gurleen Kaur	79.5	4
40	101504046	Gurnoor Kaur	63.5	4
41	101504047	Gursimratpaal Singh Sidhu	87.5	5
42	101504049	Harnishan Singh Kang	92.5	5
43	101504050	Harshit Lohaen	95.5	5
44	101504052	Harshjot Singh Pahuja	78.5	4
45	101504053	Hashmeet Singh Ganda	38.5	2
46	101504054	Himanshu Gupta	67	4
47	101504055	Himanshu Sahwal	68.5	4
48	101504059	Jasjit Singh	79	4
49	101504060	Jaskirat Kaur Gill	81	5
50	101504061	Jatinderpal Singh	85	5
51	101504063	Kuljeet Singh	80	5
52	101504064	Kunwar Achint Singh	85.5	5

S. No	Roll No.	Name of Student	Marks (100)	Score (1-5)
53	101504065	Lakhan Sharma	51.5	3
54	101504132	Abhishek Singhal	78.5	4
55	101554002	Aditya Kumar	76	4
56	101554006	Bhisham Mittal	72	4
57	101554008	Evan Garg	57	3
58	101554009	Gayatri Bansal	72.5	4
59	101554010	Gurmehar Singh	76	4
60	101554011	Gursiddak Singh	58	3
61	101554012	Harmanjit Singh	71	4
62	101554015	Ipsita Sahoo	77	4
63	101554017	Kratika Agarwal	41	3
64	101554021	Piyush Kumar Gupta	78	4
65	101554023	Prakhar Srivastava	75	4
66	101554031	Sajan Goyal	65	4
67	101554032	Sanchit Sharma	68	4
68	101554033	Saransh Sehgal	85.5	5
69	101554034	Savi	82	5
70	101554035	Shishant Airon	73.5	4
71	101554036	Simran Saluja	78.5	4
72	101684019	Hitesh Gulati	84.5	5
73	101684020	Kanishk Agarwal	85	5
74	401504001	Abhishek Garg	86.5	5
75	401504002	Divya Kumar Gupta	34	2

The performance of students through the course UTA008 for criteria PO-06(B) is summarized in Table PO-06(B).2.

Table PO-06(B).2: Average score of student performance in the course UTA008 for criteria 'PO-06(B)'

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UTA008	30.67	46.67	16.00	6.66	0.00	4.01

UEE791: Project Semester

The performance of course *UEE791: Project Semester* is used to measure the attainment of outcome ‘PO-06(B)’ considering the following expected outcomes assessed in Project Semester during Jan-June 2016, (10 Marks).

a) Final design of process/ equipment/ systems optimized through engineering, social, environmental, ethical, economic, financial, institutional and commercial considerations.

b) Application of engineering principles and software/ mathematical tools using engineering knowledge and concepts/ codes/ standards.

The evaluation of the above mentioned factors (a) and (b) is obtained by the assessment of Industry mentor marks.

The performance of the students in the above measure is summarized in Table PO-06(B).3 using rubrics defined in Table PO-06.1.

Table PO-06(B).3: Students’ performance in question targeting ‘PO-06(B)’: Course UEE791

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
1	101204001	Aashna	9.5	5
2	101204002	Abhinav Sharma	8	5
3	101204003	Abhishek Jain	9	5
4	101204005	Akash Deep	10	5
5	101204006	Akash Ratna	9	5
6	101204009	Akshu Gupta	10	5
7	101204010	Aman Goyal	8	5
8	101204012	Amit Bansal	10	5
9	101204014	Anukriti Dwivedi	10	5
10	101204015	Arushi Nagpal	9	5
11	101204016	Ayush Vaid	10	5
12	101204018	Chahat Singla	8	5
13	101204019	Deeksha Goyal	9	5
14	101204020	Dhruv Sharma	10	5
15	101204021	Gaurav Arora	8.5	5
16	101204022	Gursharan Kaur	9	5
17	101204023	Gursimran Singh	9	5
18	101204024	Harjot Singh	10	5
19	101204025	Harsh Kothari	9	5
20	101204026	Hemanshu Garg	10	5
21	101204027	Himanshu Takkar	8	5
22	101204028	Iqbal Singh Garcha	7.5	4
23	101204030	Ishtjot Singh	5	3
24	101204031	Jasdeep Garg	10	5

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
25	101204033	Jasleen Kaur	10	5
26	101204035	Kapil Kinger	7.5	4
27	101204038	Karanveer Singh Bhangoo	8	5
28	101204039	Kartik Arora	8	5
29	101204041	Kaustubh Singh	8	5
30	101204043	Lovely Goyal	9	5
31	101204045	Manik Mittal	8	5
32	101204046	Marshall	8	5
33	101204048	Mohit Kukkar	6	4
34	101204049	Mohit Manhas	9	5
35	101204051	Nalin Kaushik	10	5
36	101204053	Nishant Arora	10	5
37	101204054	P Siddharth	9	5
38	101204057	Rahul Kamboj	9	5
39	101204060	Rajatdeep Singh	7.5	4
40	101204061	Ramanpreet Kaur	8.5	5
41	101204063	Sahil Arora	9	5
42	101204064	Sahil Mittal	9	5
43	101204065	Sanchit Goel	10	5
44	101204066	Sewak Ram	9	5
45	101204067	Sheenu	10	5
46	101204069	Shubham Bhatia	9	5
47	101204070	Shubham Goel	9	5
48	101204071	Shubham Kansal	10	5
49	101204074	Sukhdarshanpal Singh	9	5
50	101204075	Sultan Singh	8	5
51	101204076	Tejasvi Anand	10	5
52	101254003	Sachin Pathak	9	5
53	101254004	Srijan Aditya	9	5
54	101254005	Navjot Kaur	10	5
55	101254006	Milan Jain	8	5
56	101254008	Gaurav	9	5
57	101254009	Varun Khanna	8	5
58	101254010	Swati Srivastava	8	5
59	101254012	Shubham Singla	9	5
60	101254013	Sorabh Devgun	9	5
61	101254014	Paras Ghai	9	5
62	101254016	Sachin Gupta	10	5
63	101254017	Nakul Kumar	9	5
64	101384001	Ankur Singla	7	4
65	101384002	Gagandeep Singh	9	5
66	101384004	Himanshu Bansal	10	5

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
67	101384005	Navdeep Singh	7	4
68	101384006	Parampreet Singh	9	5
69	101384007	Saurav Goyal	8	5
70	101384008	Surjeet Singh	7	4

The performance of students through the course UEE791 for criteria PO-06(B) is summarized in Table PO-06(B).4.

Table PO-06(B).4: Average score of student performance in the course UEE791 for criteria PO-06(B)

Course	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE791	88.57	10.00	1.43	0.00	0.00	4.87

The data from Table PO-06(B).2 and Table PO-06(B).4 is used to evaluate weighted average of direct measure through course portfolio for criteria ‘PO-06(B)’, and is summarised in Table PO-06(B).5.

Table PO-06(B).5: Weighted Average Student class performance (Course Portfolio) for criteria ‘PO-06(B)’

Courses	% of Students in each Score					Average Score
	5	4	3	2	1	
UTA008	30.67	46.67	16.00	6.66	0.00	4.01
UEE791	88.57	10.00	1.43	0.00	0.00	4.87
Weighted Average Score	59.62	28.34	8.72	3.33	0.00	4.44

b) Indirect Measures:

The indirect measurement of performance criteria 'PO-06(B)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-06(B).6 and Table PO-06(A).7.

(i) **Assessment Tool:** Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-06(B)'.

UTA008	Interpret the meaning and intent of tolerance dimensions and geometric tolerance symbolism
UEE791	Demonstrate the knowledge of professional responsibilities and respect for ethics

Table PO-06(B).6: Weighted average score of performance criterion 'PO-06(B)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UTA008	27.74	37.42	28.39	4.52	1.94	3.85
UEE791	35.71	28.57	27.14	5.71	2.86	3.89
Weighted average score	31.73	33.00	27.77	5.12	2.40	3.87

(ii) **Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-06' through indirect measurement using following question in the respective surveys.

Graduating Survey	An understanding of professional and ethical responsibility
Alumni Survey	
Employer Survey	Do our students have an understanding of professional and ethical responsibility?

c) Overall weighted average score of performance criterion 'PO-06(B)'

The overall weighted average score of performance criterion 'PO-06(B)' is summarized in Table PO-06(B).7 from the data given in Tables PO-06(B).5, PO-06(B).6 and PO-06(A).7.

Table PO-06(B).7: Overall weighted average score of performance criterion ‘PO-06(B)’

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	59.62	28.34	8.72	3.33	0.00	4.44	5
Course surveys	31.73	33.00	27.77	5.12	2.40	3.87	4
Other surveys	35.81	36.20	21.45	4.57	1.96	3.99	3
Overall weighted score	44.37	31.86	18.25	4.24	1.29	4.14	-

Overall assessment of program outcome PO-06 using scores of PO-06(A) and PO-06(B)

In the previous sections, each of the individual performance criteria PO-06(A) and PO-06(B) has been assessed. The performance for attainment of outcome ‘PO-06’ has been completed using the attainment values for PO-06(A) and PO-06(B) are given below:

Table PO-06.2 summarizes the scores of each of the two performance criteria and these scores have been used to assess an overall score for outcome ‘PO-06’.

Table PO-06.2: Overall score for outcome ‘PO-06’ at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
PO-06(A)	42.99	35.21	17.98	2.09	1.74	4.16	5
PO-06(B)	44.37	31.86	18.25	4.24	1.29	4.14	5
Overall score	43.68	33.54	18.12	3.17	1.52	4.15	-

The performance criteria wise assessment score distribution of outcome ‘PO-06’ is shown in Fig. PO-06.2.

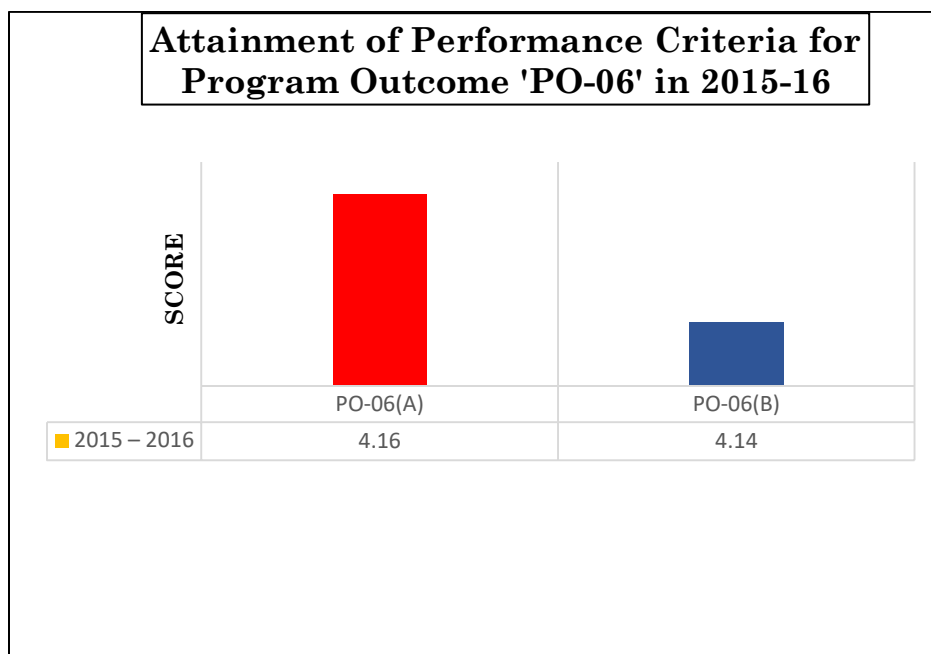


Fig. PO-06.2: Performance criteria-wise assessment score distribution of outcome ‘PO-06’

The data presented above pertains to the courses offered during academic year 2015-16. The attainment of the program outcome ‘PO-06’ through assessment of PO-06(A) and PO-06(B) in the selected courses is achieved as “Very Good”.

Assessment of Attainment of Program Outcome

PO-07

An ability to communicate effectively

(2015-16)

for the
Bachelor of Engineering
in
Electrical Engineering



THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Electrical & Instrumentation Engineering Department
Thapar Institute of Engineering and Technology, Patiala
(Punjab) -INDIA

Attainment of Program Outcome ‘PO-07’

The attainment of program outcome PO-07: *Ability to review, document and effectively communicate the knowledge* has been measured using a standard procedure for the BE Electrical Engineering program. The program outcome ‘PO-07’ has been classified into following performance criteria;

PO-07(A): *Prepare and present variety of documents such as project or laboratory reports and inspection reports with discipline specific standards*

PO-07(B): *Able to communicate effectively with peers in well-organised and logical manner using adequate technical knowledge to solve engineering problems*

The program assessment committee identified the following courses for the assessment of program outcome ‘PO-07’:

- UTA010: Engineering Design II
- UEE504: Power Electronics
- UEE591: Summer Training
- UEE601: FACTS
- UEE691: Design Project
- **UEE791: Project Semester**
- **UEE793: Capstone Project**
- UEE801: Electric Drives
- UEE802: Intelligent Algorithms in Power Systems
- UEE804: Operation and Control of Power Systems
- UEI841: Advanced Control Systems
- UHU031: Organizational Behavior
- UHU032: Human Values, Ethics and IPR
- UHU001: Communication Skills
- **UEE603: Switchgear and Protection**

Outcome PO-07 has been assessed by two performance criteria *PO-07(A)* and *PO-07(B)*. The following courses have been considered by the program assessment committee for the assessment of performance criteria *PO-07(A)* and *PO-07(B)* for the academic year 2015-16.

Performance Criteria	Course -1	Course-2
PO-07(A)	UEE603: Switchgear and Protection	UEE791: Project Semester
PO-07(B)	UEE791: Project Semester	UEE793: Capstone Project

The step by step methodology used to measure the attainment of program outcome 'PO-07' through performance criteria 'PO-07(A)' is shown in Fig. PO-07(A).1.

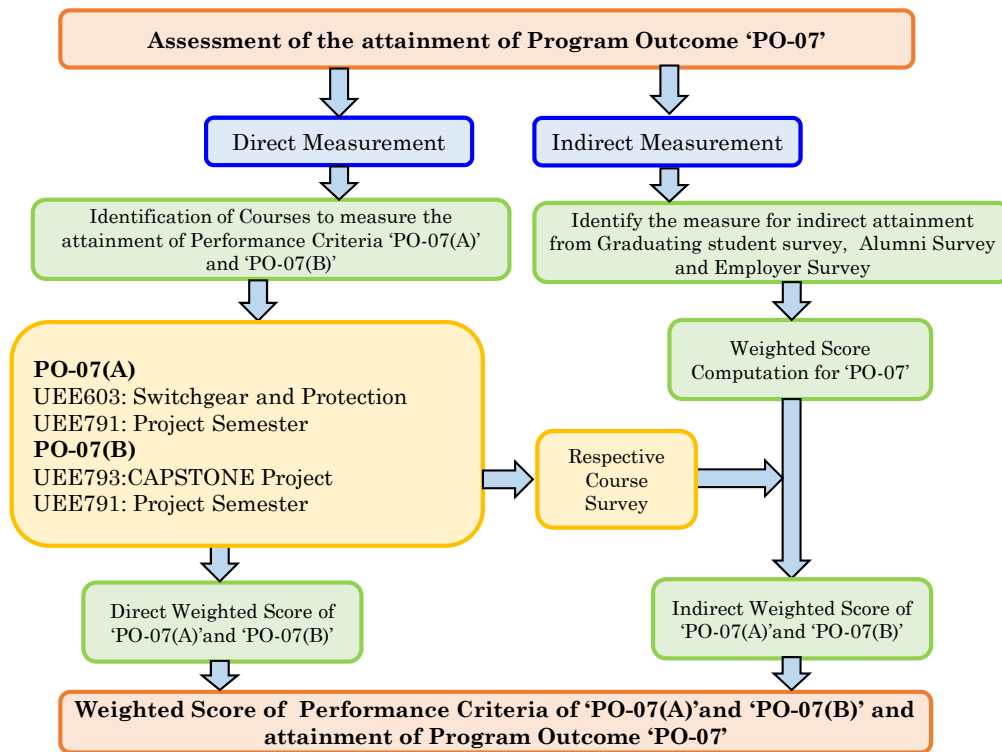


Fig. PO-07(A).1: Process for measurement of attainment of outcome ' PO-07(A)' for the year 2015-16

The Rubric used to convert marks obtained by students to a Likert scale in the range of 1 to 5 is described in Table PO-07(A).1.

Table PO-07(A).1: Rubric for Outcome Measurement

S. No.	Range of Marks (%)	Score (1-5)
1	$80 \leq \text{Marks} \leq 100$	5
2	$60 \leq \text{Marks} < 80$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

The following sections summarize separate assessments for each of the performance criteria using the subjects mentioned. These assessment outcomes are used in assessing the program outcome PO-07 for year 2015-16.

Assessment of Outcome 'PO-07' using performance criterion PO-07(A)

PO-07(A): Prepare and present variety of documents such as project or laboratory reports and inspection reports with discipline specific standards

The performance criteria 'PO-07(A)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE 603: Switchgear and Protection* and *UEE791: Summer Training* are used to assess performance criteria PO-07(A) as a direct measure. The analysis for each of these courses is provided below:

UEE 603: Switchgear and Protection

The performance criteria is used to measure the attainment of outcome 'PO-07(A)' by considering evaluation of aforementioned subject in Jan-June 2016. The internal marks from the faculty mentor, lab report marks and viva voce marks are the major components in the evaluation process. Lab reports marks are considered here for evaluation of performance criteria 'PO-07(A)' where performances with respect to Quality of the report writing: layout, structure, written and graphical material, referencing and Work content: quality work, student effort are considered.

The performance of the students in the above question is then summarized as given below in Table PO-07(A).1.

Table PO-07(A).1: Students' performance in Project work targeting 'PO-07(A)'; Course UEE603

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101304001	Aarushi Bajaj	4.5	5
2	101304002	Abhey Arora	2	3
3	101304003	Abhishek Taksali	2	3
4	101304004	Adhikaansh Tayal	2	3
5	101304005	Aditi Narang	4.5	5
6	101304006	Aditya	4.5	5
7	101304007	Akshat	2	3
8	101304008	Akshay Kapoor	3.5	4
9	101304009	Akshay Kumar	4	5
10	101304010	Akshay Kumar Chaudhary	4	5
11	101304011	Akshay Sharma	3.5	4
12	101304012	Amandeep Kaur	4.5	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
13	101304013	Amandeep Singh	3.5	4
14	101304015	Angad Kapoor	3.5	4
15	101304016	Ankita Garg	4	5
16	101304018	Anmol Jawa	4.5	5
17	101304019	Anmolpreet Singh	4.5	5
18	101304020	Anyuti Tiwary	4.5	5
19	101304021	Arpit Sharma	4	5
20	101304022	Arsh Kundal	3	4
21	101304023	Arshbir Kaur	4.5	5
22	101304024	Arshdeep Singh Bagga	3	4
23	101304025	Ashish	3	4
24	101304026	Ashish Rajpal	3	4
25	101304028	Berry Lubana	3	4
26	101304029	Bhanu Duggal	3.5	4
27	101304030	Bhanu Marwaha	2.5	3
28	101304031	Chirag Gaba	3	4
29	101304032	Dipin Garg	3	4
30	101304033	Dishant Vanvari	3	4
31	101304034	Divyesh Pratap Singh	4	5
32	101304035	Elham Anwar	4	5
33	101304036	Gurseerat Singh Meen	3	4
34	101304037	Gursewak Singh	3	4
35	101304040	Hariansh Sehgal	4	5
36	101304041	Hartejdeep Singh	3.5	4
38	101304042	Himanshu Goyal	4.5	5
39	101304044	Jasjit Singh	3.5	4
40	101304045	Jassimran Singh Julka	3.5	4
41	101304046	Jessica Dhaliwal	4.5	5
42	101304047	Kanwarpal Singh	3.5	4
43	101304048	Karan Kumar	3.5	4
44	101304049	Karanjot Singh Kochar	4	5
45	101304050	Kashish Aggarwal	4	5
46	101304052	Love Gaba	4	5
47	101304054	Manik Mittal	4	5
48	101304055	Maninderjit Singh	3.5	4
49	101304056	Mayank Singla	3.5	4
50	101304057	Mridul Bhutani	3.5	4
51	101304058	Naman Garg	4	5
52	101304059	Navdeep Singh	3.5	4
53	101304060	Navdeep Singh	3.5	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
54	101304062	Nishant Garg	4	5
55	101304094	Satripleen Kaur	4.5	5
56	101484001	Amandeep Singh	3.5	4
57	101484002	Amrinder Singh	4	5
58	101484003	Ashmeen Singh	3	4
59	101484004	Azad Singh	4.5	5
60	101484005	Chandan Garg	4	5
62	101484007	Deepak Singla	3.5	4
63	101484008	Diljeet Singh	4	5

The overall performance of students for the above criterion is summarized in Table PO-07(A).2:

Table PO-07(A).2: Average score of student performance in the course UEE603 for criteria PO-07(A)

Assessment Tool	% of students in each score					Average Score
	5	4	3	2	1	
UEE603	45.90	45.90	8.20	0.00	0.00	4.38

(ii) Course: Project Semester (UEE791)

The performance criteria is used to measure the attainment of outcome 'PO-07(A)' through the ability of students working in team, problem formulation, identification of modules, selection of new techniques and tools, identification of devices and displays etc. This criteria is given weightage of 5 marks and is awarded by mentor to the students.

The evaluation of this is obtained by the marks in one of the components of industry mentor assessment (weightage 5 marks).

The performance of the students in the above question is then summarized as given below in Table PO-07(A).3 using the rubrics defined in Table PO-07(A).1.

Table PO-07(A).3: Students' performance in question targeting 'PO-07(A)'; Course UEE791

Sr. No.	Roll No.	Name of Student	Marks (20)	Score (1-5)
1	101204001	Aashna	14	4
2	101204002	Abhinav Sharma	16.5	5
3	101204003	Abhishek Jain	14	4
4	101204005	Akash Deep	15	4
5	101204006	Akash Ratna	17.5	5
6	101204009	Akshu Gupta	14	4
7	101204010	Aman Goyal	16	5

8	101204012	Amit Bansal	14	4
9	101204014	Anukriti Dwivedi	18	5
10	101204015	Arushi Nagpal	15.5	4
11	101204016	Ayush Vaid	13	4
12	101204018	Chahat Singla	18	5
13	101204019	Deeksha Goyal	14	4
14	101204020	Dhruv Sharma	18	5
15	101204021	Gaurav Arora	14	4
16	101204022	Gursharan Kaur	17	5
17	101204023	Gursimran Singh	14	4
18	101204024	Harjot Singh	14.5	4
19	101204025	Harsh Kothari	17.5	5
20	101204026	Hemanshu Garg	16.5	5
21	101204027	Himanshu Takkar	15.5	4
22	101204028	Iqbal Singh Garcha	13	4
23	101204030	Ishtjot Singh	11	3
24	101204031	Jasdeep Garg	16.5	5
25	101204033	Jasleen Kaur	17	5
26	101204035	Kapil Kinger	16	5
27	101204038	Karanveer Singh Bhangoo	14	4
28	101204039	Kartik Arora	13	4
29	101204041	Kaustubh Singh	16.5	5
30	101204043	Lovely Goyal	16	5
31	101204045	Manik Mittal	14	4
32	101204046	Marshall	16.5	5
33	101204048	Mohit Kukkar	15	4
34	101204049	Mohit Manhas	16	5
35	101204051	Nalin Kaushik	17	5
36	101204053	Nishant Arora	18	5
37	101204054	P Siddharth	11.5	3
38	101204057	Rahul Kamboj	14	4
39	101204060	Rajatdeep Singh	13.5	4
40	101204061	Ramanpreet Kaur	14	4
41	101204063	Sahil Arora	16	5
42	101204064	Sahil Mittal	13.5	4
43	101204065	Sanchit Goel	17	5
44	101204066	Sewak Ram	17.5	5
45	101204067	Sheenu	15.5	4
46	101204069	Shubham Bhatia	12.5	4
47	101204070	Shubham Goel	15	4
48	101204071	Shubham Kansal	15	4
49	101204074	Sukhdarshanpal Singh	14	4
50	101204075	Sultan Singh	13	4
51	101204076	Tejasvi Anand	14	4

52	101254003	Sachin Pathak	14.5	4
53	101254004	Srijan Aditya	14	4
54	101254005	Navjot Kaur	18	5
55	101254006	Milan Jain	16	5
56	101254008	Gaurav	17	5
57	101254009	Varun Khanna	14	4
58	101254010	Swati Srivastava	15	4
59	101254012	Shubham Singla	15.5	4
60	101254013	Sorabh Devgun	12.5	4
61	101254014	Paras Ghai	16	5
62	101254016	Sachin Gupta	16	5
63	101254017	Nakul Kumar	16	5
64	101384001	Ankur Singla	11	3
65	101384002	Gagandeep Singh	14	4
66	101384004	Himanshu Bansal	15	4
67	101384005	Navdeep Singh	13	4
68	101384006	Parampreet Singh	15	4
69	101384007	Saurav Goyal	16.5	5
70	101384008	Surjeet singh	13	4

The overall performance of students for the above criterion is summarized in Table PO-07(A).4

Table PO-07(A).4: Average score of student performance in the course UEE791 for criteria PO-07(A)

Assessment Tool	% of students in each score					Average Score
	5	4	3	2	1	
UEE791	40.00	55.71	4.29	0.00	0.00	4.36

The above data is used to evaluate weighted average student class performance (course portfolio) for criteria PO-07(A) is given in Table PO-07(A).5.

Table PO-07(A).5: Weighted Average Student class performance (course portfolio) for criteria PO-07(A)

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE603	45.90	45.90	8.20	0.00	0.00	4.38
UEE791	40.00	55.71	4.29	0.00	0.00	4.36
Students class performance score	42.95	50.81	6.24	0.00	0.00	4.37

b) Indirect measures for Performance criteria PO-07(A) (Surveys)

The indirect measurement of performance criteria 'PO-07(A)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-07(A).6 and Table PO-07(A).7.

(i) Assessment Tools: Student Course Surveys

Table PO-07(A).6: Weighted average score of performance criterion 'PO-07(A)' based on surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE603	13.43	34.76	33.7	9.06	9.06	3.34
UEE791	35.71	30.00	30.00	1.43	2.86	3.94
Course survey score	24.57	32.38	31.85	5.25	5.96	3.64

(ii) Assessment Tool: Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-07' through indirect measurement using following question in the respective surveys.

Table PO-07(A).6: Weighted average score of performance criterion 'PO-07(A)' based on surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating student survey	26.67	40.00	28.89	4.44	0.00	3.89
Employer survey	53.33	46.67	0.00	0.00	0.00	3.95
Alumni survey	39.61	38.16	16.43	4.35	1.45	4.10
Other survey score	39.87	41.61	15.11	2.93	0.48	3.98

c) Overall weighted average score of performance criterion ‘PO-07(A)’

Finally overall weighted average score of performance criterion ‘PO-07(A)’ is evaluated as given below in Table PO-07(A).7:

Table PO-07(A).7: Overall weighted average score of performance criterion ‘PO-07(A)’

Course	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Average score	24.57	32.38	31.85	5.25	5.96	3.64	4
Average student class performance	42.95	50.81	6.24	0.00	0.00	4.37	5
Average score surveys	39.87	41.61	15.11	2.93	0.48	3.98	3
Overall score	35.80	41.60	17.73	2.73	2.15	4.00	

Assessment of Outcome 'PO-07' using performance criterion PO-07(B)

PO-07(B): Able to communicate effectively with peers in well-organised and logical manner using adequate technical knowledge to solve engineering problems

a) Assessment Tool: Students' performance using course portfolio

Two courses namely *UEE793: CAPSTONE Project* and *UEE791: Project Semester* are used to assess performance criteria as a direct measure. The analysis for each of these courses is provided below:

(i) UEE791: Project Semester

The performance criteria is used to measure the attainment of outcome 'PO-07(B)' by considering evaluation of the subject *UEE791: Project Semester*). The marks considered in this case include the component related to peer communication.

The performance of the students in the above question is then summarized as given below in Table PO-07(B).1 using rubrics defined in Table PO-07.1.

Table PO-07(B).1: Students' performance in Project work targeting 'PO-07(B)'; Course UEE791

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101204001	Aashna	4.5	5
2	101204002	Abhinav Sharma	4.5	5
3	101204003	Abhishek Jain	5	5
4	101204005	Akash Deep	4.5	5
5	101204006	Akash Ratna	5	5
6	101204009	Akshu Gupta	4	5
7	101204010	Aman Goyal	4.5	5
8	101204012	Amit Bansal	4	5
9	101204014	Anukriti Dwivedi	5	5
10	101204015	Arushi Nagpal	4.5	5
11	101204016	Ayush Vaid	4.5	5
12	101204018	Chahat Singla	5	5
13	101204019	Deeksha Goyal	4	5
14	101204020	Dhruv Sharma	5	5
15	101204021	Gaurav Arora	4.5	5
16	101204022	Gursharan Kaur	5	5
17	101204023	Gursimran Singh	4.5	5
18	101204024	Harjot Singh	4.5	5
19	101204025	Harsh Kothari	5	5
20	101204026	Hemanshu Garg	5	5
21	101204027	Himanshu Takkar	4.5	5
22	101204028	Iqbal Singh Garcha	4.5	5
23	101204030	Ishtjot Singh	4	5
24	101204031	Jasdeep Garg	4.5	5
25	101204033	Jasleen Kaur	5	5
26	101204035	Kapil Kingar	5	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
27	101204038	Karanveer Singh Bhangoo	4.5	5
28	101204039	Kartik Arora	4.5	5
29	101204041	Kaustubh Singh	5	5
30	101204043	Lovely Goyal	5	5
31	101204045	Manik Mittal	4.5	5
32	101204046	Marshall	5	5
33	101204048	Mohit Kukkar	4.5	5
34	101204049	Mohit Manhas	5	5
35	101204051	Nalin Kaushik	5	5
36	101204053	Nishant Arora	5	5
37	101204054	P Siddharth	3.5	4
38	101204057	Rahul Kamboj	4	5
39	101204060	Rajatdeep Singh	4.5	5
40	101204061	Ramanpreet Kaur	4	5
41	101204063	Sahil Arora	5	5
42	101204064	Sahil Mittal	4.5	5
43	101204065	Sanchit Goel	5	5
44	101204066	Sewak Ram	5	5
45	101204067	Sheenu	4.5	5
46	101204069	Shubham Bhatia	4.5	5
47	101204070	Shubham Goel	4.5	5
48	101204071	Shubham Kansal	4.5	5
49	101204074	Sukhdarshanpal Singh	5	5
50	101204075	Sultan Singh	5	5
51	101204076	Tejasvi Anand	4.5	5
52	101254003	Sachin Pathak	4.5	5
53	101254004	Srijan Aditya	4.5	5
54	101254005	Navjot Kaur	4.5	5
55	101254006	Milan Jain	4	5
56	101254008	Gaurav	4.5	5
57	101254009	Varun Khanna	3.5	4
58	101254010	Swati Srivastava	3.5	4
59	101254012	Shubham Singla	4	5
60	101254013	Sorabh Devgun	3.5	4
61	101254014	Paras Ghai	4.5	5
62	101254016	Sachin Gupta	5	5
63	101254017	Nakul Kumar	5	5
64	101384001	Ankur Singla	3	4
65	101384002	Gagandeep Singh	4	5
66	101384004	Himanshu Bansal	4.5	5
67	101384005	Navdeep Singh	4	5
68	101384006	Parampreet Singh	4	5
69	101384007	Saurav Goyal	4.5	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
70	101384008	Surjeet singh	4	5

The overall performance of students for the above criterion is summarized in Table PO-07(B).2:

Table PO-07(B).2: Average score of student performance in the course UEE791 for criteria PO-07(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE791	92.86	7.14	0.00	0.00	0.00	4.93

(ii) UEE793: CAPSTONE Project

The performance criteria is used to measure the attainment of outcome ‘PO-07(B)’ by considering evaluation of the subject *UEE793: CAPSTONE Project*. Total marks reflect the communication skills between peers.

Table PO-07(B).3: Students’ performance in question targeting ‘PO-07(B)’; Course UEE793

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101204001	Aashna	4.5	5
2	101204002	Abhinav Sharma	4.5	5
3	101204003	Abhishek Jain	4.5	5
4	101204005	Akash Deep	4.5	5
5	101204006	Akash Ratna	4.5	5
6	101204009	Akshu Gupta	4.5	5
7	101204010	Aman Goyal	4.5	5
8	101204012	Amit Bansal	4.5	5
9	101204014	Anukriti Dwivedi	4.5	5
10	101204015	Arushi Nagpal	4.5	5
11	101204016	Ayush Vaid	4.5	5
12	101204018	Chahat Singla	5	5
13	101204019	Deeksha Goyal	4	5
14	101204020	Dhruv Sharma	4	5
15	101204021	Gaurav Arora	4	5
16	101204022	Gursharan Kaur	3.5	4
17	101204023	Gursimran Singh	5	5
18	101204024	Harjot Singh	4.5	5
19	101204025	Harsh Kothari	4.5	5
20	101204026	Hemanshu Garg	4	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
21	101204027	Himanshu Takkar	4.5	5
22	101204028	Iqbal Singh Garcha	4	5
23	101204030	Ishtjot Singh	5	5
24	101204031	Jasdeep Garg	4.5	5
25	101204033	Jasleen Kaur	4	5
26	101204035	Kapil Kinger	4.5	5
27	101204038	Karanveer Singh Bhango	4.5	5
28	101204039	Kartik Arora	4	5
29	101204041	Kaustubh Singh	5	5
30	101204043	Lovely Goyal	4	5
31	101204045	Manik Mittal	4	5
32	101204046	Marshall	4	5
33	101204048	Mohit Kukkar	0	1
34	101204049	Mohit Manhas	4	5
35	101204051	Nalin Kaushik	4	5
36	101204053	Nishant Arora	5	5
37	101204054	P Siddharth	4.5	5
38	101204057	Rahul Kamboj	4.5	5
39	101204060	Rajatdeep Singh	4.5	5
40	101204061	Ramanpreet Kaur	4.5	5
41	101204063	Sahil Arora	5	5
42	101204064	Sahil Mittal	4	5
43	101204065	Sanchit Goel	4	5
44	101204066	Sewak Ram	4	5
45	101204067	Sheenu	4	5
46	101204069	Shubham Bhatia	4	5
47	101204070	Shubham Goel	5	5
48	101204071	Shubham Kansal	4	5
49	101204074	Sukhdarshanpal Singh	4	5
50	101204075	Sultan Singh	4	5
51	101204076	Tejasvi Anand	4	5
52	101254003	Sachin Pathak	4	5
53	101254004	Srijan Aditya	4	5
54	101254005	Navjot Kaur	5	5
55	101254006	Milan Jain	4.5	5
56	101254008	Gaurav	4.5	5
57	101254009	Varun Khanna	4.5	5
58	101254010	Swati Srivastava	4.5	5
59	101254012	Shubham Singla	4.5	5
60	101254013	Sorabh Devgun	5	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
61	101254014	Paras Ghai	4	5
62	101254016	Sachin Gupta	4	5
63	101254017	Nakul Kumar	4	5
64	101384001	Ankur Singla	4	5
65	101384002	Gagandeep Singh	4	5
66	101384004	Himanshu Bansal	5	5
67	101384005	Navdeep Singh	4.5	5
68	101384006	Parampreet Singh	4	5
69	101384007	Saurav Goyal	4.5	5
70	101384008	Surjeet singh	4.5	5

The overall performance of students for the above criterion is summarized in Table PO-07(B).4

Table PO-07(B).4: Average score of student performance in the course UEE793 for criteria PO-07(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE793	97.1	1.4	0.0	1.4	1.4	4.93

The above data is used to evaluate weighted average student class performance (course portfolio) for criteria PO-07(B) is given in Table PO-07(B).5.

Table PO-07(B).5: Weighted Average Student class performance (course portfolio) for criteria PO-07(B)

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE791	92.86	7.14	0.00	0.00	0.00	4.93
UEE793	97.1	1.4	0.0	1.4	1.4	4.93
Weighted average score	94.98	4.27	0	0.7	0.7	4.93

b) Indirect measures for Performance criteria PO-07(B) (Surveys)

(i) Assessment Tools: Student Course Surveys

Table PO-07(B).6: Weighted average score of performance criterion 'PO-07(B)' based on student course surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE791	35.71	30.00	30.00	1.43	2.86	3.94
UEE793	36.25	31.25	26.25	1.25	5.00	3.92
Students class performance score	35.98	30.63	28.13	1.34	3.93	3.93

Assessment Tools: course survey, graduating student survey, employer survey, and alumni Survey.

Table PO-07(B).6: Weighted average score of performance criterion 'PO-07(B)' based on surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating student survey	26.67	40.00	28.89	4.44	0.00	3.89
Employer survey	53.33	46.67	0.00	0.00	0.00	3.95
Alumni survey	39.61	38.16	16.43	4.35	1.45	4.10
Other surveys score	39.87	41.61	15.11	2.93	0.48	3.98

c) Overall weighted average score of performance criterion ‘PO-07(B)’

Finally overall weighted average score of performance criterion ‘PO-07(B)’ is evaluated as given below in Table PO-07(B).7:

Table PO-07(B).7: Overall weighted average score of performance criterion ‘PO-07(B)’

Course	% of students in each score					Average Score
	5	4	3	2	1	
Average student class performance	94.98	4.27	0	0.7	0.7	4.93
Average score on course surveys	35.98	30.63	28.13	1.34	3.93	3.93
Average score surveys	39.87	41.61	15.11	2.93	0.48	3.98
Overall score	56.94	25.50	14.41	1.66	1.70	4.28

Overall assessment of program outcome PO-07 using scores of PO-07(A) and PO-07(B)

In the previous sections, each of the individual performance criteria PO-07(A) and PO-07(B) have been assessed. The performance for attainment of outcome PO-07 has been completed using the attainment values for PO-07(A) and PO-07(B) and is provided below:

Table PO-07.2 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome PO-07.

Table PO-07.2: Overall score for outcome PO-07 at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
PO-07(A)	35.80	41.60	17.73	2.73	2.15	4.00	5
PO-07(B)	56.94	25.50	14.41	1.66	1.70	4.28	5
Overall score	46.37	33.55	16.07	2.195	1.925	4.14	

The performance criteria wise assessment score distribution of outcome 'PO-07' is shown in Figure PO-07.2.

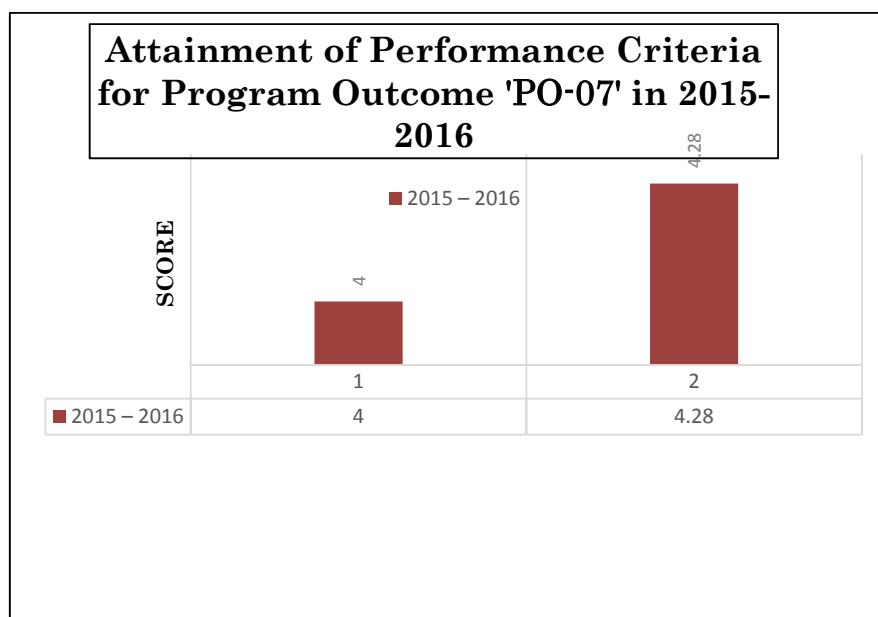


Figure PO-07.2: Performance criteria-wise assessment score distribution of outcome 'PO-07'

Assessment of Attainment of program outcome

PO-08

The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context

(2015-16)

for the
Bachelor of Engineering
in
Electrical Engineering



THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Electrical & Instrumentation Engineering Department
Thapar Institute of Engineering and Technology, Patiala
(Punjab) -INDIA

Attainment of Program Outcome ‘PO-08’

The attainment of program outcome **PO-08**: *The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context* has been measured using a standard procedure for the BE Electrical Engineering program. The program outcome ‘PO-08’ has been classified into following performance criteria:

PO-08 (A): *Aware of societal and global changes due to engineering innovations*

PO-08 (B): *Analyze economic trade-offs in engineering systems*

PO-08 (C): *Evaluates engineering solutions considering environmental constraints*

The program assessment committee identified the following courses for the assessment of program outcome ‘PO-08’:

- **UHU081: Engineering Economics**
- **UEN002: Energy and Environment**
- UHU031: Organizational Behavior
- **UEE522: Energy Auditing and Management**
- UEE303: Power Generation and Associated Economics
- **UEE804: Operation and Control of Power Systems**
- UEE601: Flexible AC Transmission Systems
- **UEE502: High Voltage Engineering**
- UEE843: Power System Planning
- UHU005: Humanities for Engineers
- UEE632: Power Generation and Economics

Outcome PO-08 has been assessed through three performance criteria PO-08 (A), PO-08 (B) and PO-08 (C). The following courses have been considered by the program assessment committee for the assessment of performance criteria ‘PO-08 (A)’, ‘PO-08 (B)’ and ‘PO-08 (C)’ for the academic year 2015-16.

Performance Criteria	Course -1	Course-2
PO-08 (A)	UHU081:Engineering Economics	UEE522:Energy Auditing and Management
PO-08 (B)	UHU081:Engineering Economics	UEE522:Energy Auditing and Management
PO-08 (C)	UEE804: Operation and Control of Power Systems	UEE502: High Voltage Engineering

The step by step methodology used to measure the attainment of program outcome 'PO-08' is shown in Fig. PO-08.1 for academic year (AY) 2015-16. The similar procedure is followed to measure the attainment of program outcome 'PO-08' for all three academic years under consideration.

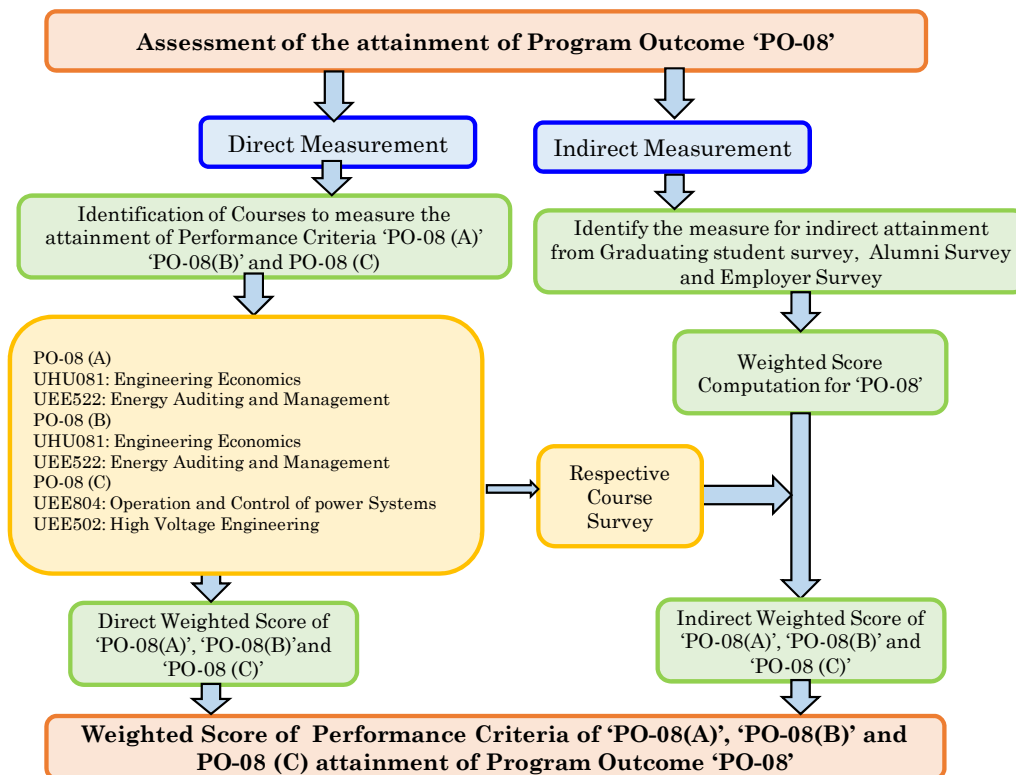


Fig. PO-08.1: Process for measurement of attainment of outcome 'PO-08' for the year 2015-16

The Rubric used to convert marks obtained by students to a Likert scale in the range of 1 to 5 is described in Table PO-08.1.

Table PO-08.1: Rubric for Outcome Measurement

S. No.	Range of Marks (%)	Score (1-5)
1	$75 \leq \text{Marks} < 100$	5
2	$60 \leq \text{Marks} < 75$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

The following sections summarize separate assessment for each of the performance criteria using the subjects mentioned.

Assessment of Outcome 'PO-08' using performance criterion PO-08 (A)

PO-08 (A): Aware of societal and global changes due to engineering innovations.

The performance criteria 'PO-08 (A)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and the other surveys (Graduating student survey, Alumni survey and Employer survey)

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UHU081: Engineering Economics* and *UEE522: Energy Auditing and Management* are used to assess performance criteria PO-08 (A) as a direct measure. The analysis for each of these courses is provided below:

UHU081: Engineering Economics

The performance of the course UHU081: Engineering Economics is used to measure the attainment of outcome 'PO-08 (A)' through the End Semester Examination (Question No. 1 (b), July-Dec. 2015, 06 marks).

Question:

Q.1	(b) U.S. winter wheat production increased dramatically in 1999 after a bumper harvest. The supply curve shifted rightward; as a result, the price decreased and the quantity demanded increased (a movement along the demand curve). The accompanying table describes what happened to prices and the quantity of wheat demanded. 1998- 1999 <table><tr><td>Quantity demanded (bushels)</td><td>1.74 billion</td><td>1.9 billion</td></tr><tr><td>Average price (per bushel)</td><td>\$3.70</td><td>\$2.72</td></tr></table> i. Using the midpoint method, calculate the price elasticity of demand for winter wheat. ii. What is the total revenue for U.S. wheat farmers in 1998 and 1999? iii. Did the bumper harvest increase or decrease the total revenue of American wheat farmers? How could you have predicted this from your answer to part 1?	Quantity demanded (bushels)	1.74 billion	1.9 billion	Average price (per bushel)	\$3.70	\$2.72	(6)
Quantity demanded (bushels)	1.74 billion	1.9 billion						
Average price (per bushel)	\$3.70	\$2.72						

The performance of the students in the above question is then summarized as given below in Table PO-08 (A).1 using rubrics defined in Table PO-08.1.

Table PO-08 (A).1: Students' performance in Project work targeting 'PO-08 (A)'; Course UHU081

S. No.	Roll No.	Name	Marks	Score (1-5)
1	101204001	Aashna	4	4
2	101204002	Abhinav Sharma	3.5	3
3	101204003	Abhishek Jain	3	3
4	101204004	Aditya Jain*	3	3
5	101204005	Akash Deep	3.5	3
6	101204006	Akash Ratna	5	5
7	101204009	Akshu Gupta	2.5	3
8	101204010	Aman Goyal	2.5	3
9	101204011	Amarpreet	4	4
10	101204012	Amit Bansal	3.5	3
11	101204013	Anshul Kumar	4	4
12	101204014	Anukriti Dwivedi	3	3
13	101204015	Arushi Nagpal	4.5	5
14	101204016	Ayush Vaid	4.5	5
15	101204018	Chahat Singla	2.5	3
16	101204019	Deeksha Goyal	3	3
17	101204020	Dhruv Sharma	5	5
18	101204021	Gaurav Arora	4	4
19	101204022	Gursharan Kaur	3	3
20	101204023	Gursimran Singh	3	3
21	101204024	Harjot Singh	3.5	3
22	101204025	Harsh Kothari	3.5	3
23	101204026	Hemanshu Garg	2.5	3
24	101204027	Himanshu Takkar	4	4
25	101204028	Iqbal Singh Garcha	2.5	3
26	101204030	Ishtjot Singh	3.5	3
27	101204031	Jasdeep Garg	4	4
28	101204033	Jasleen Kaur	3.5	3
29	101204035	Kapil Kinger	4	4
30	101204037	Karanbir Singh Kahlon	3.5	3
31	101204038	Karanveer Singh Bhangoo	3.5	3
32	101204039	Kartik Arora	3	3
33	101204040	Kashish Sethi	4.5	5
34	101204041	Kaustubh Singh	4.5	5
35	101204042	Krishnank Atrey	4	4
36	101204043	Lovely Goyal	4	4

37	101204045	Manik Mittal	4.5	5
38	101204046	Marshall	4	4
39	101204048	Mohit Kukkar	3.5	3
40	101204049	Mohit Manhas	5	5
41	101204051	Nalin Kaushik	3	3
42	101204053	Nishant Arora	3	3
43	101204054	P Siddharth	3.5	3
44	101204057	Rahul Kamboj	3	3
45	101204059	Rajat Sahore	5	5
46	101204060	Rajatdeep Singh	4.5	5
47	101204061	Ramanpreet Kaur	2.5	3
48	101204063	Sahil Arora	3	3
49	101204064	Sahil Mittal	3	3
50	101204065	Sanchit Goel	3.5	3
51	101204066	Sewak Ram	3.5	3
52	101204067	Sheenu	5	5
53	101204069	Shubham Bhatia	3.5	3
54	101204070	Shubham Goel	3	3
55	101204071	Shubham Kansal	3.5	3
56	101204074	Sukhdarshanpal Singh	3	3
57	101204075	Sultan Singh	5	5
58	101204076	Tejasvi Anand	5	5
59	101254001	Sahilpreet Singh	4	4
60	101254002	Naman Kumar	3	3
61	101254003	Sachin Pathak	3.5	3
62	101254004	Srijan Aditya	4	4
63	101254005	Navjot Kaur	4	4
64	101254006	Milan Jain	4	4
65	101254007	Mohit	3.5	3
66	101254008	Gaurav	3	3
67	101254009	Varun Khanna	3	3
68	101254010	Swati Srivastava	2.5	3
69	101254012	Shubham Singla	4	4
70	101254013	Sorabh Devgun	5	5
71	101254014	Paras Ghai	5.5	5
72	101254015	Kuldeep Singh Deora	4	4
73	101254016	Sachin Gupta	3.5	3
74	101254017	Nakul Kumar	3.5	3

The performance of students through the course UHU081 for criteria PO-08 (A) is summarized in Table PO-08 (A).2:

Table PO-08 (A).2: Average score of student performance in the course UHU081 for criteria ‘PO-08 (A)’

Course	% of students in each score					Average Score
	5	4	3	2	1	
UHU081	20.27	21.62	58.11	0.00	0.00	3.62

UEE522: Energy Auditing and Management

The performance of the course UEE522: Energy Auditing and Management is used to measure the attainment of outcome 'PO-08 (A)' through the End Semester Examination (Question No. 4 (b), July-December 2015, 05 marks).

Question:

Q.4	(b) In one of the municipal area each 250 watt HPSV lamp is proposed to be replaced by 2 numbers of 28 watts CFL lamp. What is annual saving if the lamp is operated for 3000 hours in a year? Do you recommend/reject such energy saving measure. Give reason.	(5)
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The performance of the students in the above question is then summarized as given below in Table PO-08 (A).3using rubrics defined in Table 4PO-08.1.

Table PO-08 (A).3: Students' performance in question targeting 'PO-08 (A)'; Course UEE522

S. No.	Roll No.	Name	Marks (5)	Score (1-5)
1	101304001	Aarushi Bajaj	3.5	4
2	101304002	Abhey Arora	4.5	5
3	101304003	Abhishek Taksali	4	5
4	101304004	Adhikaanshtayal	3.5	4
5	101304005	Aditi Narang	4	5
6	101304006	Aditya	4	5
7	101304007	Akshat	4	5
8	101304008	Akshay Kapoor	4	5
9	101304009	Akshay Kumar	4	5
10	101304010	Akshay Kumar Chaudhary	4.5	5
11	101304011	Akshay Sharma	4	5
12	101304012	Amandeep Kaur	1.5	2
13	101304013	Amandeep Singh	4.5	5
14	101304014	Amaninder Singh Randhawa	3.5	4
15	101304015	Angad Kapoor	4	5
16	101304016	Ankita Garg	3.5	4
17	101304018	Anmol Jawa	3	4
18	101304019	Anmolpreet Singh	4.5	5
19	101304020	Anyutitiwary	3	4
20	101304021	Arpit Sharma	4	5
21	101304022	Arshkunal	3.5	4
22	101304023	Arshbir Kaur	4.5	5

S. No.	Roll No.	Name	Marks (5)	Score (1-5)
23	101304024	Arshdeep Singh Bagga	4	5
24	101304025	Ashish	4	5
25	101304026	Ashish Rajpal	1.5	2
26	101304028	Berry Lubana	1.5	2
27	101304029	Bhanu Duggal	3.5	4
28	101304030	Bhanumarwaha	4	5
29	101304031	Chirag Gaba	0	1
30	101304032	Dipin Garg	4	5
31	101304033	Dishantvanvari	4	5
32	101304034	Divyeshpratap Singh	3.5	4
33	101304035	Elham Anwar	3.5	4
34	101304036	Gurseerat Singh Meen	4	5
35	101304037	Gursewak Singh	3.5	4
36	101304040	Hariansh Sehgal	4	5
37	101304041	Hartejdeep Singh	3.5	4
38	101304042	Himanshugoyal	4.5	5
39	101304044	Jasjit Singh	3	4
40	101304045	Jassimran Singh Julka	2	3
41	101304046	Jessica Dhaliwal	4	5
42	101304047	Kanwarpal Singh	3.5	4
43	101304048	Karan Kumar	1.5	2
44	101304049	Karanjot Singh Kochar	4	5
45	101304050	Kashish Aggarwal	4.5	5
46	101304051	Kritikasingla	4	5
47	101304052	Love Gaba	4	5
48	101304054	Manik Mittal	3.5	4
49	101304055	Maninderjit Singh	4	5
50	101304056	Mayanksingla	4	5
51	101304057	Mridulbhutani	4	5
52	101304058	Naman Garg	4	5
53	101304059	Navdeep Singh	0	1
54	101304060	Navdeep Singh	2	3
55	101304061	Nazuk Aggarwal	4	5
56	101304062	Nishant Garg	2	3
57	101304063	Nishtharaheja	3.5	4
58	101304064	Paras Bawa	4	5
59	101304065	Parth Ahuja	3.5	4
60	101304066	Parushi	2	3

S. No.	Roll No.	Name	Marks (5)	Score (1-5)
61	101304067	Pencygoyal	2	3
62	101304068	Piyush Jindal	4	5
63	101304069	Piyushtripathi	2	3
64	101304070	Prachi Garg	2	3
65	101304071	Prashant Kataria	0	1
66	101304072	Preeti Garg	4	5
67	101304073	Priyank Arora	4	5
68	101304074	Priyanka	4	5
69	101304075	Priyanka Singh	4	5
70	101304076	Priyansh Mahajan	4	5
71	101304077	Rahul Meena	1.5	2
72	101304078	Rajan	4	5
73	101304079	Rajat Sharma	4	5
74	101304080	Ratulgoyal	4	5
75	101304081	Ravinder Singh	4	5
76	101304082	Rishabhjuneja	3.5	4
77	101304083	Robin Manktala	4	5
78	101304084	Rohan Ghai	3.5	4
79	101304085	Rohan Singla	4	5
80	101304086	Rohan Wadhawan	4	5
81	101304087	Rohitgoyal	4	5
82	101304088	Rubinabamba	3.5	4
83	101304089	Sagarpulani	3.5	4
84	101304090	Sahilkataria	4	5
85	101304091	Sakshi	4	5
86	101304092	Sandal Singh Sidhu	2	3
87	101304093	Sandeep Kaur	1.5	2
88	101304094	Satripleen Kaur	4	5
89	101304095	Saurabh Mohan	2	3
90	101304096	Shagundeep Singh	2	3
91	101304097	Shailly Gupta	4	5
92	101304098	Shaina	4	5
93	101304099	Shivika Gupta	3.5	4
94	101304100	Shresth Rai	3.5	4
95	101304101	Shubhamgoyal	4	5
96	101304102	Shubham Gupta	4	5
97	101304103	Shubham Sharma	4	5
98	101304104	Shubham Sharma	4	5

S. No.	Roll No.	Name	Marks (5)	Score (1-5)
99	101304105	Shubhamsoin	4	5
100	101304106	Siddharthgoyal	4	5
101	101304107	Sidharth Garg	4	5
102	101304108	Simran Kaur	2.5	3
103	101304109	Simranjit Singh	0	1
104	101304111	Sumitdhingra	4	5
105	101304112	Sumit Kaushik	4	5
106	101304113	Tushardheer	4	5
107	101304114	Tushar Sharma	4	5
108	101304116	Utsav Chhabra	2	3
109	101304117	Vaibhav Gupta	4	5
110	101304118	Vaishali	4	5
111	101304119	Varun Bansal	4	5
112	101304120	Veni Jindal	4	5
113	101304121	Vishal Arora	4	5
114	101304122	Yugeshgoyal	4	5
115	101484001	Amandeep Singh	4	5
116	101484002	Amrinder Singh	4	5
117	101484003	Ashmeen Singh	3	4
118	101484004	Azad Singh	2	3
119	101484005	Chandan Garg	4	5
120	101484007	Deepak Singla	4	5
121	101484008	Diljeet Singh	4	5
122	101484009	Jyotikaushal	1.5	2
123	101484011	Pawan Kumar	3.5	4
124	101484012	Rajatsingla	4	5
125	101484013	Satveer Kaur	2	3
126	101484014	Saurabh Kumar Wadhawan	4	5
127	101484015	Shweta Sharma	2	3
128	101484016	Sukhjeet Singh	4	5

The overall performance of students for the above criterion is summarized in Table PO-08 (A).4

Table PO-08 (A).4: Average score of student performance in the course UEE522 for criteria PO-08 (A)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE522	60.16	19.53	11.72	5.47	3.13	4.28

The data from Table PO-08 (A).2 and Table PO-08 (A).4 is used to evaluate the weighted average of direct measure through course portfolio for criteria 'PO-08 (A)' and summarized in Table PO-08 (A).5

Table PO-08 (A).5: Weighted Average Student class performance (Course Portfolio) for criteria PO-08 (A)

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UHU081	20.27	21.62	58.11	0.00	0.00	3.62
UEE522	60.16	19.53	11.72	5.47	3.13	4.28
Weighted Average Score	40.21	20.58	34.91	2.73	1.56	3.95

b) Indirect measures:

The indirect measurement of performance criteria 'PO-08 (A)' has been assessed through Student Course Surveys and other surveys (Graduating student survey, Alumni survey and Employer survey). The weighted average score in respective surveys is summarized in Table PO-08 (A).6 and Table PO-08 (A).7.

(i) Assessment Tools: Student Course Surveys

The Course learning outcomes (CLO) as described below has been used for the measurement of attainment of 'PO-08 (A)'.

UHU081	Possess an understanding of the pre-requisites of investing and will be able to carry out and evaluate benefit/cost, breakeven analyses on one or more economic alternatives
UEE522	Decide about energy management in a more effective way

Table PO-08 (A).6: Weighted average score of performance criterion 'PO-08 (A)' based on surveys.

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UHU081	34.28	31.42	31.42	2.8	00	3.97
UEE522	24.59	27.86	30.32	13.11	4.09	3.56
Weighted Average Score	29.43	29.64	30.87	7.95	2.04	3.76

(ii) Assessment Tool: Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of Program Outcome 'PO-08' through indirect measurement using following question in the respective surveys.

Graduating Survey	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
Alumni Survey	
Employer Survey	Do our students have the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context?

Table PO-08 (A).7: Weighted average score of performance criterion 'PO-08 (A)' based on surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating student survey	17.77	37.77	35.55	6.6	2.2	3.61
Employer survey	20	73.33	6.67	00	00	4.13
Alumni survey	30.43	36.23	24.64	5.80	2.90	3.85
Weighted average score surveys	22.73	49.11	22.22	4.13	1.7	3.86

c) Overall weighted average score of performance criterion ‘PO-08 (A)’

The overall weighted average score of performance criterion ‘PO-08 (A)’ is summarized in Table PO-08 (A).8 from the data given in Table PO-08 (A).5, PO-08 (A).6 and PO-08 (A).7.

Table PO-08 (A).8: Overall weighted average score of performance criterion ‘PO-08 (A)’

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	40.21	20.58	34.91	2.73	1.56	3.95	5
Score surveys	29.43	29.64	30.87	7.95	2.04	3.76	4
Score on other surveys	22.73	49.11	22.22	4.13	1.7	3.86	3
Overall weighted score	32.24	30.73	30.39	4.82	1.75	3.86	

Assessment of Outcome 'PO-08' using performance criterion PO-08 (B)

PO-08 (B): Analyze economic trade-offs in engineering systems.

a.) Assessment Tool: Students' performance using Course Portfolio

Two courses namely UEE522: Energy Auditing and Management and UHU081: Engineering Economics were used to assess performance criteria PO-08 (B) as a direct measure. The analysis of this course is provided below:

UEE522: Energy Auditing and Management

The performance of the course UEE522: Energy Auditing and Management is used to measure the attainment of outcome 'PO-08 (B)' through the Mid Semester Examination (Question No. 3(b), September 2015, 07 marks).

Question :

Q.3	(b) An initial investment of 83,200 Rs will generate cash flow of 34,000 Rs. in the first year, 40,700 Rs. In the second year, 33,500 Rs. in the third year, and 20,500 Rs at the end of the fourth year. At the end of fourth year, the machinery will be sold for 9,000 Rs. Maintenance of the machinery would cost 3000, 4000, 5000 and 6000 respectively in the first, second, third and fourth years. (i) Calculate the present value of the investment for a discount rate of 12%. (ii) Calculate the internal rate of return to make net present value zero.	(7)
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The performance of the students in the above question is then summarized as given below in Table PO-08 (B).1 using rubrics defined in Table PO-08.1.

Table PO-08 (B).1: Student's performance in question targeting 'PO-08 (B)'; course: UEE522

S. No.	Roll No	Name	Marks (7)	Score (1-5)
1	101304001	Aarushi Bajaj	6	5
2	101304002	Abhey Arora	2.5	2
3	101304003	Abhishek Taksali	6	5
4	101304004	Adhikaansh Tayal	5.5	5
5	101304005	Aditi Narang	6	5
6	101304006	Aditya	6	5
7	101304007	Akshat	6	5
8	101304008	Akshay Kapoor	6	5
9	101304009	Akshay Kumar	7	5

S. No.	Roll No	Name	Marks (7)	Score (1-5)
10	101304010	Akshay Kumar Chaudhary	2	2
11	101304011	Akshay Sharma	6	5
12	101304012	Amandeep Kaur	2	2
13	101304013	Amandeep Singh	5.5	5
14	101304014	Amaninder Singh Randhawa	4.5	4
15	101304015	Angad Kapoor	6	5
16	101304016	Ankita Garg	5.5	5
17	101304017	Ankur Malik*	2	2
18	101304018	Anmol Jawa	5.5	5
19	101304019	Anmolpreet Singh	2	2
20	101304020	Anyuti Tiwary	2	2
21	101304021	Arpit Sharma	2	2
22	101304022	Arsh Kundal	5	4
23	101304023	Arshbir Kaur	5	4
24	101304024	Arshdeep Singh Bagga	2	2
25	101304025	Ashish	5	4
26	101304026	Ashish Rajpal	6	5
27	101304028	Berry Lubana	9	5
28	101304029	Bhanu Duggal	5.5	5
29	101304030	Bhanu Marwaha	4	3
30	101304031	Chirag Gaba	4	3
31	101304032	Dipin Garg	3.5	3
32	101304033	Dishant Vanvari	5.5	5
33	101304034	Divyesh Pratap Singh	4	3
34	101304035	Elham Anwar	0	1
35	101304036	Gurseerat Singh Meen	1.5	2
36	101304037	Gursewak Singh	5.5	5
37	101304040	Hariansh Sehgal	1	1
38	101304041	Hartejdeep Singh	3.5	3
39	101304042	Himanshu Goyal	2.5	2
40	101304044	Jasjit Singh	2	2
41	101304045	Jassimran Singh Julka	5.5	5
42	101304046	Jessica Dhaliwal	2	2
43	101304047	Kanwarpal Singh	0	1
44	101304048	Karan Kumar	2	2
45	101304049	Karanjot Singh Kochar	5.5	5
46	101304050	Kashish Aggarwal	2.5	2
47	101304051	Kritika Singla	2.5	2

S. No.	Roll No	Name	Marks (7)	Score (1-5)
48	101304052	Love Gaba	5	4
49	101304054	Manik Mittal	3	3
50	101304055	Maninderjit Singh	6	5
51	101304056	Mayank Singla	3.5	3
52	101304057	Mridul Bhutani	5.5	5
53	101304058	Naman Garg	5.5	5
54	101304059	Navdeep Singh	3	3
55	101304060	Navdeep Singh	6	5
56	101304061	Nazuk Aggarwal	5.5	5
57	101304062	Nishant Garg	6.5	5
58	101304063	Nishtha Raheja	5	4
59	101304064	Paras Bawa	5	4
60	101304065	Parth Ahuja	5	4
61	101304066	Parushi	1	1
62	101304067	Pency Goyal	4	3
63	101304068	Piyush Jindal	6	5
64	101304069	Piyush Tripathi	2	2
65	101304070	Prachi Garg	0	1
66	101304071	Prashant Kataria	4	3
67	101304072	Preeti Garg	6	5
68	101304073	Priyank Arora	3	3
69	101304074	Priyanka	2.5	2
70	101304075	Priyanka Singh	3	3
71	101304076	Priyansh Mahajan	0	1
72	101304077	Rahul Meena	2	2
73	101304078	Rajan	9	5
74	101304079	Rajat Sharma	5.5	5
75	101304080	Ratul Goyal	3	3
76	101304081	Ravinder Singh	6	5
77	101304082	Rishabh Juneja	5.5	5
78	101304083	Robin Manktala	2	2
79	101304084	Rohan Ghai	5.5	5
80	101304085	Rohan Singla	5.5	5
81	101304086	Rohan Wadhawan	4	3
82	101304087	Rohit Goyal	5.5	5
83	101304088	Rubina Bamba	5.5	5
84	101304089	Sagar Pulani	6	5
85	101304090	Sahil Kataria	5.5	5

S. No.	Roll No	Name	Marks (7)	Score (1-5)
86	101304091	Sakshi	2	2
87	101304092	Sandal Singh Sidhu	2	2
88	101304093	Sandeep Kaur	2.5	2
89	101304094	Satripleen Kaur	5	4
90	101304095	Saurabh Mohan	2	2
91	101304096	Shagundeep Singh	5.5	5
92	101304097	Shailly Gupta	3	3
93	101304098	Shaina	3	3
94	101304099	Shivika Gupta	5	4
95	101304100	Shresth Rai	2	2
96	101304101	Shubham Goyal	5	4
97	101304102	Shubham Gupta	2	2
98	101304103	Shubham Sharma	5	4
99	101304104	Shubham Sharma	6	5
100	101304105	Shubham Soin	5	4
101	101304106	Siddharth Goyal	1	1
102	101304107	Sidharth Garg	2	2
103	101304108	Simran Kaur	4	3
104	101304109	Simranjit Singh	7	5
105	101304111	Sumit Dhingra	4	3
106	101304112	Sumit Kaushik	5	4
107	101304113	Tushar Dheer	2	2
108	101304114	Tushar Sharma	2.5	2
109	101304116	Utsav Chhabra	4	3
110	101304117	Vaibhav Gupta	6	5
111	101304118	Vaishali	5	4
112	101304119	Varun Bansal	7	5
113	101304120	Veni Jindal	2	2
114	101304121	Vishal Arora	4	3
115	101304122	Yugesh Goyal	2	2
116	101484001	Amandeep Singh	5	4
117	101484002	Amrinder Singh	2	2
118	101484003	Ashmeen Singh	3	3
119	101484004	Azad Singh	9	5
120	101484005	Chandan Garg	1	1
121	101484007	Deepak Singla	5.5	5
122	101484008	Diljeet Singh	2	2
123	101484009	Jyoti Kaushal	6	5

S. No.	Roll No	Name	Marks (7)	Score (1-5)
124	101484011	Pawan Kumar	5	4
125	101484012	Rajat Singla	5.5	5
126	101484013	Satveer Kaur	6	5
127	101484014	Saurabh Kumar Wadhawan	4	3
128	101484015	Shweta Sharma	2	2
129	101484016	Sukhjeet Singh	0	1

The overall performance of the students in the course based on marks in Energy Auditing Management (UEE522) is summarized as given below in Table PO-08 (B).2 using rubrics defined in Table PO-08.1.

Table PO-08 (B).2: Average score of student performance in the course UEE522 for criteria PO-08 (B).

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE522	37.21	13.18	17.05	25.58	6.98	3.48

UHU081: Engineering Economics

The performance of the course UHU081: Engineering Economics is used to measure the attainment of outcome 'PO-08 (B)' through the End Semester Examination (Question No. 4 (c), July-December 2015, 09 marks).

Question:

Q.4 (c)	The market-determined price in a perfectly competitive industry is $P = \\$10$. Suppose that the total cost equation of an individual firm in the industry is given by the expression: $TC = 100 + 5Q + 0.02Q^2$ i. What is the firm's profit-maximizing output level? ii. Given your answer to part 1, what is the firm's total profit? iii. Diagram your answers to parts a and b.	(9)
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The overall performance of the students in the above question is then summarized as given below in Table 4.PO-08 (B).3.

Table 4.PO-08 (B).3: Student's performance in question targeting 'PO-08 (B)'; Course UHU081

S. No.	Roll No.	Name	Marks (9)	Score (1-5)
1	101204001	Aashna	6	4
2	101204002	Abhinav Sharma	5.5	4
3	101204003	Abhishek Jain	3	2

S. No.	Roll No.	Name	Marks (9)	Score (1-5)
4	101204004	Aditya Jain	5	3
5	101204005	Akash Deep	5.5	4
6	101204006	Akash Ratna	7	5
7	101204009	Akshu Gupta	4.5	3
8	101204010	Aman Goyal	4.5	3
9	101204011	Amarpreet	6	4
10	101204012	Amit Bansal	5.5	4
11	101204013	Anshul Kumar	6	4
12	101204014	Anukriti Dwivedi	5	3
13	101204015	Arushi Nagpal	6.5	4
14	101204016	Ayush Vaid	6.5	4
15	101204018	Chahat Singla	4.5	3
16	101204019	Deeksha Goyal	5	3
17	101204020	Dhruv Sharma	7	5
18	101204021	Gaurav Arora	6	4
19	101204022	Gursharan Kaur	5	3
20	101204023	Gursimran Singh	5	3
21	101204024	Harjot Singh	5.5	4
22	101204025	Harsh Kothari	5.5	4
23	101204026	Hemanshu Garg	4.5	3
24	101204027	Himanshu Takkar	6	4
25	101204028	Iqbal Singh Garcha	4.5	3
26	101204030	Ishtjot Singh	5.5	4
27	101204031	Jasdeep Garg	6	4
28	101204033	Jasleen Kaur	5.5	4
29	101204035	Kapil Kinger	6	4
30	101204037	Karanbir Singh Kahlon	5.5	4
31	101204038	Karanveer Singh Bhangoo	5.5	4
32	101204039	Kartik Arora	5	3
33	101204040	Kashish Sethi	6.5	4
34	101204041	Kaustubh Singh	6.5	4
35	101204042	Krishnank Atrey	6	4
36	101204043	Lovely Goyal	6	4
37	101204045	Manik Mittal	6.5	4
38	101204046	Marshall	6	4
39	101204048	Mohit Kukkar	5.5	4
40	101204049	Mohit Manhas	7	5
41	101204051	Nalin Kaushik	5	3

S. No.	Roll No.	Name	Marks (9)	Score (1-5)
42	101204053	Nishant Arora	5	3
43	101204054	P Siddharth	5.5	4
44	101204057	Rahul Kamboj	5	3
45	101204059	Rajat Sahore	7	5
46	101204060	Rajatdeep Singh	6.5	4
47	101204061	Ramanpreet Kaur	4.5	3
48	101204063	Sahil Arora	5	3
49	101204064	Sahil Mittal	5	3
50	101204065	Sanchit Goel	5.5	4
51	101204066	Sewak Ram	5.5	4
52	101204067	Sheenu	7	5
53	101204069	Shubham Bhatia	5.5	4
54	101204070	Shubham Goel	5	3
55	101204071	Shubham Kansal	5	3
56	101204074	Sukhdarshanpal Singh	5	3
57	101204075	Sultan Singh	6	4
58	101204076	Tejasvi Anand	6	4
59	101254001	Sahilpreet Singh	5	3
60	101254002	Naman Kumar	5	3
61	101254003	Sachin Pathak	5.5	4
62	101254004	Srijan Aditya	5.5	4
63	101254005	Navjot Kaur	6	4
64	101254006	Milan Jain	4	3
65	101254007	Mohit*	5	3
66	101254008	Gaurav	5	3
67	101254009	Varun Khanna	4.5	3
68	101254010	Swati Srivastava	4.5	3

The overall performance of the students in the above question is then summarized as given below in Table 4.PO-08 (B).4

Table 4.PO-08 (B).4 Average score of student performance in the course UHU081 for criteria PO-08 (B).

Course	% of students in each score					Average Score
	5	4	3	2	1	
UHU081	7.35	51.47	39.71	1.47	0.00	3.65

The above data is used to evaluate weighted average student class performance (course portfolio) for criteria PO-08 (B) as given below in Table PO-08 (B).5.

Table PO-08 (B).5 Weighted Average Student class performance (course portfolio) for criteria PO-08 (B)

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE522	37.21	13.18	17.05	25.58	6.98	3.48
UHU081	7.35	51.47	39.71	1.47	0.00	3.65
Weighted Average Score	22.28	32.32	28.38	13.53	3.49	3.56

b) Indirect measures for Performance criteria PO-08 (B) (Surveys)

(i) **Assessment Tools:** Student Course Surveys are used to assess the attainment of Program Outcome 'PO-08 (A)' through indirect measurement using following course learning objectives in the respective courses.

UEE522	Carry out financial management
UHU081	Be able to develop analytical skills essential for engineers to help to take decisions

Table PO-08 (B).6: Weighted average score of performance criterion 'PO-08 (B)' based on surveys.

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE522	21.31	29.50	31.14	10.65	7.37	3.47
UHU081	37.14	37.14	20	5.7	00	4.05
Weighted Average Score	29.22	33.32	25.57	8.17	3.68	3.76

(ii) **Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of Program Outcome 'PO-08' through indirect measurement is summarized in Table PO-08 (A).7.

c) Overall weighted average score of performance criterion 'PO-08 (B)'

Finally overall weighted average score of performance criterion 'PO-08 (B)' is evaluated as given below in Table PO-08 (B).7:

Table PO-08 (B).7: Overall weighted average score of performance criterion ‘PO-08 (B)’

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	22.28	32.32	28.38	13.53	3.49	3.56	5
Score surveys	29.22	33.32	25.57	8.17	3.68	3.76	4
Score on other surveys	22.73	49.11	22.22	4.13	1.7	3.86	3
Overall weighted score	24.70	36.85	25.90	9.39	3.10	3.70	

Assessment of Outcome ‘PO-08’ using performance criterion PO-08 (C)

PO-08 (C): Evaluates engineering solutions considering environmental constraints.

a.) Assessment Tool: Students’ performance using Course Portfolio

Two courses namely *UEE502: High Voltage Engineering* and *UEE804: Operation and Control of Power Systems* were used to assess performance criteria PO-08 (C) as a direct measure. The analysis of this course is provided below:

UEE502: High Voltage Engineering

The performance of the course *UEE502: High Voltage Engineering* were used to measure the attainment of outcome ‘PO-08 (C)’ through the End Semester Examination (Question No. 1(b), July-December 2015, 10 marks).

Question:

Q.1.(b)	(i) According to Paschen’s law, assuming constants ‘A’ = 12 , ‘B’ = 365 and $\gamma = 0.02$ for air; determine $(pd)_{\min}$ and $(V_{\min})$ where the symbols have the standard meaning for the Paschen’s law. (ii) An absolute electrostatic voltmeter has a movable circular plate 8 cm in diameter. If the distance between the plates during a measurement is 4 mm, determine the potential difference when the force of attraction is 0.2 gm-wt.	(10)
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The performance of the students in the above question is then summarized as given below in Table PO-08 (C).1 using rubrics defined in Table PO-08.1.

Table PO-08 (C).1: Student’s performance in question targeting ‘PO-08 (C)’; course: UEE502

S. No.	Roll No.	Name	Marks (10)	Score (1-5)
1	101304001	Aarushi Bajaj	0	1
2	101304002	Abhey Arora	0	1
3	101304003	Abhishek Taksali	5	3
4	101304004	Adhikaanshtayal	0	1
5	101304005	Aditi Narang	0	1
6	101304006	Aditya	0	1

S. No.	Roll No.	Name	Marks (10)	Score (1-5)
7	101304007	Akshat	5	3
8	101304008	Akshay Kapoor	0	1
9	101304009	Akshay Kumar	0	1
10	101304010	Akshay Kumar Chaudhary	0	1
11	101304011	Akshay Sharma	0	1
12	101304012	Amandeep Kaur	0	1
13	101304013	Amandeep Singh	0	1
14	101304014	Amaninder Singh Randhawa	1	1
15	101304015	Angad Kapoor	1	1
16	101304016	Ankita Garg	1	1
17	101304018	Anmol Jawa	5	3
18	101304019	Anmolpreet Singh	5	3
19	101304020	Anyutitiwary	0	1
20	101304021	Arpit Sharma	5	3
21	101304022	Arshkunal	0	1
22	101304023	Arshbir Kaur	0	1
23	101304024	Arshdeep Singh Bagga	0	1
24	101304025	Ashish	1	1
25	101304026	Ashish Rajpal	3	2
26	101304028	Berry Lubana	1	1
27	101304029	Bhanu Duggal	5	3
28	101304030	Bhanumarwaha	0	1
29	101304031	Chirag Gaba	5	3
30	101304032	Dipin Garg	0	1
31	101304033	Dishantvanvari	2	2
32	101304034	Divyeshpratap Singh	5	3
33	101304035	Elham Anwar	5	3
34	101304036	Gurseerat Singh Meen	0	1
35	101304037	Gurseyak Singh	0	1
36	101304040	Hariansh Sehgal	0	1
37	101304041	Hartejdeep Singh	5	3
38	101304042	Himanshugoyal	2	2
39	101304044	Jasjit Singh	0	1
40	101304045	Jassimran Singh Julka	0	1
41	101304046	Jessica Dhaliwal	5	3
42	101304047	Kanwarpal Singh	5	3
43	101304048	Karan Kumar	0	1
44	101304049	Karanjot Singh Kochar	1	1

S. No.	Roll No.	Name	Marks (10)	Score (1-5)
45	101304050	Kashish Aggarwal	10	5
46	101304051	Kritikasingla	5	3
47	101304052	Love Gaba	4	3
48	101304054	Manik Mittal	2	2
49	101304055	Maninderjit Singh	0	1
50	101304056	Mayanksingla	1	1
51	101304057	Mridulbhutani	5	3
52	101304058	Naman Garg	10	5
53	101304059	Navdeep Singh	0	1
54	101304060	Navdeep Singh	0	1
55	101304061	Nazuk Aggarwal	7.5	5
56	101304062	Nishant Garg	10	5
57	101304063	Nishtharaheja	5	3
58	101304064	Paras Bawa	0	1
59	101304065	Parth Ahuja	10	5
60	101304066	Parushi	0	1
61	101304067	Pencygoyal	0	1
62	101304068	Piyush Jindal	5	3
63	101304069	Piyushtripathi	1	1
64	101304070	Prachi Garg	4	3
65	101304071	Prashant Kataria	0	1
66	101304072	Preeti Garg	3	2
67	101304073	Priyank Arora	4	3
68	101304074	Priyanka	0	1
69	101304075	Priyanka Singh	4	3
70	101304076	Priyansh Mahajan	1	1
71	101304077	Rahul Meena	0	1
72	101304078	Rajan	0	1
73	101304079	Rajat Sharma	0	1
74	101304080	Ratulgoyal	2	2
75	101304081	Ravinder Singh	10	5
76	101304082	Rishabhjuneja	5	3
77	101304083	Robin Manktala	4	3
78	101304084	Rohan Ghai	7.5	5
79	101304085	Rohan Singla	5	3
80	101304086	Rohan Wadhawan	5	3
81	101304087	Rohitgoyal	5	3
82	101304088	Rubinabamba	10	5

S. No.	Roll No.	Name	Marks (10)	Score (1-5)
83	101304089	Sagarpulani	0	1
84	101304090	Sahilkataria	5	3
85	101304091	Sakshi	1	1
86	101304092	Sandal Singh Sidhu	1	1
87	101304093	Sandeep Kaur	1	1
88	101304094	Satripleen Kaur	5	3
89	101304095	Saurabh Mohan	1	1
90	101304096	Shagundeeep Singh	0	1
91	101304097	Shailly Gupta	5	3
92	101304098	Shaina	1	1
93	101304099	Shivika Gupta	10	5
94	101304100	Shresth Rai	4	3
95	101304101	Shubhamgoyal	5	3
96	101304102	Shubham Gupta	6	4
97	101304103	Shubham Sharma	5	3
98	101304104	Shubham Sharma	5	3
99	101304105	Shubhamsoin	5	3
100	101304106	Siddharthgoyal	0	1
101	101304107	Sidharth Garg	1	1
102	101304108	Simran Kaur	5	3
103	101304109	Simranjit Singh	0	1
104	101304111	Sumitdhingra	0	1
105	101304112	Sumit Kaushik	4	3
106	101304113	Tushardheer	1	1
107	101304114	Tushar Sharma	0	1
108	101304116	Utsav Chhabra	10	5
109	101304117	Vaibhav Gupta	0	1
110	101304118	Vaishali	2	2
111	101304119	Varun Bansal	10	5
112	101304120	Veni Jindal	4	3
113	101304121	Vishal Arora	10	5
114	101304122	Yugeshgoyal	10	5
115	101484001	Amandeep Singh	5	3
116	101484002	Amrinder Singh	5	3
117	101484003	Ashmeen Singh	0	1
118	101484004	Azad Singh	0	1
119	101484005	Chandan Garg	1	1
120	101484007	Deepak Singla	0	1

S. No.	Roll No.	Name	Marks (10)	Score (1-5)
121	101484008	Diljeet Singh	0	1
122	101484009	Jyotikaushal	4	3
123	101484011	Pawan Kumar	1	1
124	101484012	Rajatsingla	5	3
125	101484013	Satveer Kaur	1	1
126	101484014	Saurabh Kumar Wadhawan	0	1
127	101484015	Shweta Sharma	0	1
128	101484016	Sukhjeet Singh	0	1

The overall performance of the students in the course based on marks in Energy and Environment (UEE502) is summarized as given below in Table PO-08 (C).2.

Table PO-08 (C).2: Average score of student performance in the course UEE502 for criteria PO-08 (C).

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE502	10.16	0.78	31.25	5.47	52.34	2.11

UEE804: Operation and Control of Power Systems

The performance of the course UEE804: Operation and Control of Power Systems is used to measure the attainment of outcome 'PO-08 (C)' through the End Semester Examination (Question No. 1, July-December 2015, 14 marks).

Question :

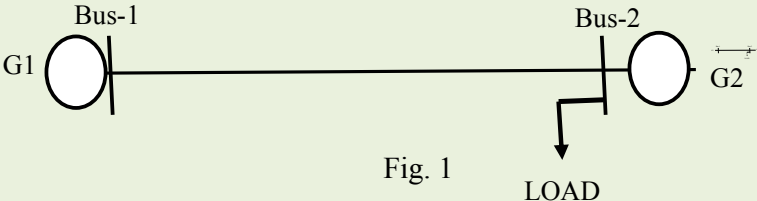
Q1.	(a) Use the method of Lagrangian multiplier to derive the operating criteria for a large number of units. (b) Two generators are coupled through a tie line system shown in Fig. 1. Load is at bus generator 2. It is known that a transfer of 100 MW from generator 1 over the tie-line means a transmission loss of 10 MW. The incremental costs are $\frac{dC_1}{dP_1} = 0.02P_1 + 16$ and $\frac{dC_2}{dP_2} = 0.04P_2 + 20$ respectively for generator 1 and generator 2. Find the optimal schedule, total generation and total load if $\lambda = 25$ Rs/MWh  Fig. 1	(14)
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Table PO-08 (C).3: Student's performance in question targeting 'PO-08 (C)'; course: UEE804

S. No.	Roll No	Name	Marks (14)	Score (1-5)
1	101104031	Kanika Lodha	7	3
2	101204001	Aashna	11	5
3	101204002	Abhinav Sharma	11	5
4	101204003	Abhishek Jain	2	1
5	101204004	Aditya Jain	3	2
6	101204005	Akash Deep	12	5
7	101204006	Akash Ratna	2	1
8	101204009	Akshu Gupta	1.5	1
9	101204010	Aman Goyal	6	3
10	101204011	Amarpreet	5	2
11	101204012	Amit Bansal	8	3
12	101204013	Anshul Kumar	9	4
13	101204014	Anukriti Dwivedi	11	5
14	101204015	Arushi Nagpal	10	4

S. No.	Roll No	Name	Marks (14)	Score (1-5)
15	101204016	Ayush Vaid	6	3
16	101204018	Chahat Singla	2.5	1
17	101204019	Deeksha Goyal	9.5	4
18	101204020	Dhruv Sharma	7	3
19	101204021	Gaurav Arora	6	3
20	101204022	Gursharan Kaur	10.5	5
21	101204023	Gursimran Singh	13.5	5
22	101204024	Harjot Singh	0	1
23	101204025	Harsh Kothari	9	4
24	101204026	Hemanshu Garg	12	5
25	101204027	Himanshu Takkar	12	5
26	101204028	Iqbal Singh Garcha	10	4
27	101204030	Ishtjot Singh	5.5	2
28	101204031	Jasdeep Garg	11	5
29	101204033	Jasleen Kaur	13	5
30	101204035	Kapil Kinger	7	3
31	101204037	Karanbir Singh Kahlon	3	2
32	101204038	Karanveer Singh Bhangoo	12	5
33	101204039	Kartik Arora	9	4
34	101204040	Kashish Sethi	8	3
35	101204041	Kaustubh Singh	12	5
36	101204042	Krishnank Atrey	9	4
37	101204043	Lovely Goyal	12	5
38	101204045	Manik Mittal	11	5
39	101204046	Marshall	5.5	2
40	101204048	Mohit Kukkar	7	3
41	101204049	Mohit Manhas	10	4
42	101204051	Nalin Kaushik	9	4
43	101204053	Nishant Arora	3.5	2
44	101204054	P Siddharth	12	5
45	101204057	Rahul Kamboj	9	4
46	101204059	Rajat Sahore	11.5	5
47	101204060	Rajatdeep Singh	12.5	5
48	101204061	Ramanpreet Kaur	12	5
49	101204063	Sahil Arora	12	5
50	101204064	Sahil Mittal	10.5	5
51	101204065	Sanchit Goel	4	2
52	101204066	Sewak Ram	10.5	5

S. No.	Roll No	Name	Marks (14)	Score (1-5)
53	101204067	Sheenu	11.5	5
54	101204070	Shubham Bhatia	15	5
55	101204071	Shubham Goel	10.5	5
56	101204074	Shubham Kansal	11	5
57	101204075	Sukhdarshanpal Singh	6	3
58	101204076	Sultan Singh	8.5	4
59	101254001	Tejasvi Anand	10	4
60	101254002	Sahilpreet Singh	10	4
61	101254003	Naman Kumar	12	5
62	101254004	Sachin Pathak	11	5
63	101254005	Srijan Aditya	11	5
64	101254006	Navjot Kaur	8	3
65	101254008	Milan Jain	12	5
66	101254009	Mohit	11	5
67	101254010	Gaurav	8	3
68	101254012	Varun Khanna	2.5	1
69	101254013	Swati Srivastava	5	2
70	101254014	Shubham Singla	14	5
71	101254015	Sorabh Devgun	6	3
72	101254016	Paras Ghai	13	5
73	101254017	Kuldeep Singh Deora	12	5
74	101384001	Sachin Gupta	11	5
75	101384002	Nakul Kumar	3	2
76	101384004	Ankur Singla	13	5
77	101384005	Gagandeep Singh	12.5	5
78	101384006	Himanshu Bansal	12	5
79	101384007	Navdeep Singh	12	5
80	101384008	Parampreet Singh	13	5

The overall performance of the students in the course based on marks in Operation and Control of Power Systems (UEE804) is summarized as given below in Table PO-08 (C).2.

Table PO-08 (C).4:Average score of student performance in the course UEE804 for criteria PO-08 (C).

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE804	48.75	16.25	16.25	11.25	7.50	3.88

The above data is used to evaluate weighted average student class performance (course portfolio) for criteria PO-08 (C) as given below in Table 4.PO-08 (C).5.

Table PO-08 (C).5:Weighted Average Student class performance (course portfolio) for criteria PO-08 (C)

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE502	10.16	0.78	31.25	5.47	52.34	2.11
UEE804	48.75	16.25	16.25	11.25	7.50	3.88
Weighted Average Score	29.45	8.51	23.75	8.36	29.92	2.99

b) Indirect measures for Performance criteria PO-08 (C) (Surveys

(i) **Assessment Tools:** Student Course Surveys are used to assess the attainment of Program Outcome 'PO-08 (A)' through indirect measurement using following course learning objectives in the respective courses.

UEE804	Decide the scheduling of thermal units and hydro-thermal units for overall economy
UEE502	Analyse the breakdown mechanism of solids, liquids and gases

Table PO-08 (C).6: Weighted average score of performance criterion 'PO-08 (C)' based on surveys.

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE502	15	26.66	51.66	6.66	00	3.50
UEE804	57.14	17.14	20	2.85	2.85	4.22
Weighted Average Score	36.07	21.9	35.83	4.75	1.42	3.86

(ii) **Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of Program outcome 'PO-08' through indirect measurement is summarized in Table PO-08 (A).7

c) Overall weighted average score of performance criterion ‘PO-08 (C)’

Finally overall weighted average score of performance criterion ‘PO-08 (C)’ is evaluated as given below in Table PO-08 (C).7

Table PO-08 (C).7: Overall weighted average score of performance criterion ‘PO-08 (C)’

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	29.45	8.51	23.75	8.36	29.92	2.99	5
Score surveys	36.07	21.9	35.83	4.75	1.42	3.86	4
Score on other surveys	22.73	49.11	22.22	4.13	1.7	3.86	3
Overall weighted score	29.97	23.11	27.39	6.09	13.36	3.49	

Overall assessment of Program outcome PO-08 using scores of PO-08 (A), PO-08 (B) and PO-08 (C)

In the previous sections, each of the individual performance criteria PO-08 (A), PO-08 (B) and PO-08 (C) have been assessed. The performance for attainment of outcome PO-08 has been completed using the attainment values for PO-08 (A), PO-08 (B) and PO-08 (C) and is provided below:

Table PO-08.2 summarizes the scores of each of the three performance criteria and these scores have been used to assess an overall score for outcome PO-08.

Table PO-08.2: Overall score for outcome PO-08 at the program level

Performance criteria	% of students in each score					Overall weighted average score
	5	4	3	2	1	
PO-08 (A)	32.24	30.73	30.39	4.82	1.75	3.86
PO-08 (B)	24.70	36.85	25.90	9.39	3.10	3.70
PO-08 (C)	29.97	23.11	27.39	6.09	13.36	3.49
Overall score	28.97	30.23	27.89	6.76	6.07	3.68

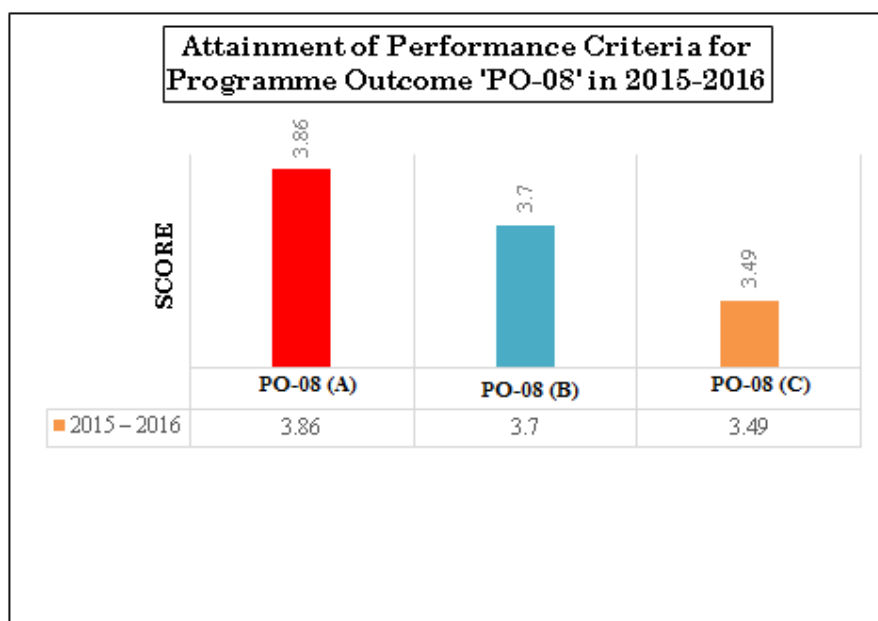


Figure PO-08.2: Performance criteria-wise assessment score distribution of outcome 'PO-08'

Assessment of Attainment of Program outcome

PO-09

A recognition of the need for, and an ability to engage in life-long learning
(2015-16)

for the
Bachelor of Engineering
in
Electrical Engineering



THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Electrical & Instrumentation Engineering Department
Thapar Institute of Engineering and Technology Patiala
(Punjab) -INDIA

Attainment of Program outcome 'PO-09'

The attainment of program outcome **PO-09** A recognition of the need for, and an ability to engage in life-long learning has been measured using a standard procedure for the BE Electrical Engineering program. The program outcome 'PO-09' has been classified into following performance criteria;

PO-09(A): *Able to use resources to adopt new technologies not included in curriculum*

PO-09(B): *Ability to identify directions for continuing education opportunities*

PO-09(C): *Recognizes the need to embrace personal responsibility for lifelong learning.*

The program assessment committee identified the following courses for the assessment of program outcome 'PO-09':

- UMA007: Numerical Analysis
- UTA008: Engineering Design I
- **UTA010: Engineering Design II**
- UMA031: Optimization Techniques
- UEE504: Power Electronics
- **UEE591: Summer Training**
- **UEE601: Flexible AC Transmission Systems**
- UEE603: Switchgear & Protection
- UEE691: Engineering Design Project
- **UEE791: Project Semester**
- **UEE793: Capstone Project**
- UEE801: Electric Drives
- UEE802: Intelligent Algorithms in Power Systems
- UEE804: Operation and Control of Power Systems
- **UEI841: Advanced Control Systems**

Outcome PO-09 has been assessed through three performance criteria PO-09(A), PO-09(B) and PO-09(C). The following courses have been considered by the program assessment committee for the assessment of performance criteria 'PO-09(A)', 'PO-09(B)' and 'PO-09(C)' in the academic year 2015-16.

Performance Criteria	Course -1	Course-2
PO-09(A)	UEE791: Project Semester	UEE793: Capstone Project
PO-09(B)	UEE601: Flexible AC Transmission Systems	UEI841: Advanced Control Systems
PO-09(C)	UEE591: Summer Training	UTA010: Engineering Design II

The step by step methodology used to measure the attainment of program outcome ‘PO-09’ is shown in Fig. PO-09.1 for academic year (AY) 2015-16. The similar procedure is followed to measure the attainment of program outcome ‘PO-09’ for all three academic years under consideration.

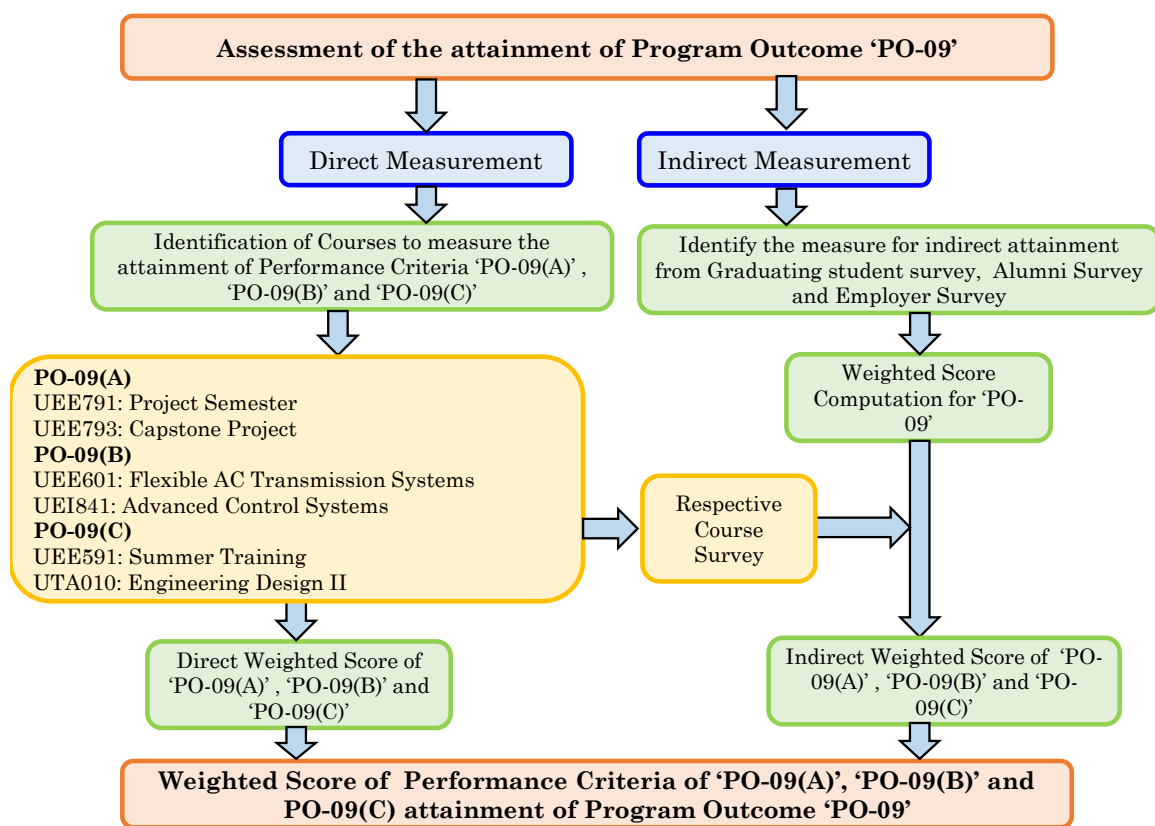


Fig. PO-09.1: Process for measurement of attainment of outcome ‘PO-09(A)’ for the year 2015-16

The following Rubric has been used to convert marks obtained by the students to a Likert scale in the range of 1 to 5 is described in Table PO-09.1(a) and PO-09.1(b) in most cases unless specifically mentioned.

Table PO-09.1(a): Rubric for Outcome Measurement

S. No.	Range of Marks (%)	Score (1-5)
1	$80 \leq \text{Marks} < 100$	5
2	$60 \leq \text{Marks} < 80$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

Table PO-09.1(b): Rubric for Outcome Measurement

S. No.	Range of Marks (%)	Score (1-5)
1	$75 \leq \text{Marks} < 100$	5
2	$60 \leq \text{Marks} < 80$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

The following sections summarize separate assessments for each of the performance criteria using the courses mentioned.

Assessment of Outcome 'PO-09' using Performance Criterion PO-09(A)

PO-09(A): *Able to use resources to adopt new technologies not included in curriculum.*

The performance criteria 'PO-09' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using course portfolio

Two courses namely *UEE 791: Project Semester* and *UEE793: Capstone Project* are used to assess performance criteria PO-09(A) as a direct measure. The analysis for each of these courses is provided below:

UEE791: Project Semester

The performance of course *UEE791: Project Semester* is used to measure the attainment of outcome 'PO-09(A)' through the **Goal Report** (Jan-June 2016, 5 marks) which includes adaptation of new ideas to do project.

The performance of the students in the above component is summarized in Table PO-09(A).1 using rubrics defined in Table PO-09.1(a).

Table PO-09(A).1: Students' performance in component targeting 'PO-09(A)': Course UEE791

S. No.	Roll No.	Name of Student	Goal Report Marks (5)	Score (1-5)
1	101204001	Aashna	3.5	4
2	101204002	Abhinav Sharma	3	4
3	101204003	Abhishek Jain	4	5
4	101204005	Akash Deep	4	5
5	101204006	Akash Ratna	4	5
6	101204009	Akshu Gupta	4	5
7	101204010	Aman Goyal	4	5
8	101204012	Amit Bansal	4	5
9	101204014	Anukriti Dwivedi	5	5
10	101204015	Arushi Nagpal	5	5
11	101204016	Ayush Vaid	4	5
12	101204018	Chahat Singla	4	5
13	101204019	Deeksha Goyal	5	5
14	101204020	Dhruv Sharma	4	5
15	101204021	Gaurav Arora	5	5
16	101204022	Gursharan Kaur	4	5

S. No.	Roll No.	Name of Student	Goal Report Marks (5)	Score (1-5)
17	101204023	Gursimran Singh	4	5
18	101204024	Harjot Singh	5	5
19	101204025	Harsh Kothari	5	5
20	101204026	Hemanshu Garg	5	5
21	101204027	Himanshu Takkar	4	5
22	101204028	Iqbal Singh Garcha	3	4
23	101204030	Ishtjot Singh	5	5
24	101204031	Jasdeep Garg	3	4
25	101204033	Jasleen Kaur	5	5
26	101204035	Kapil Kinger	3	4
27	101204038	Karanveer Singh Bhangoo	4	5
28	101204039	Kartik Arora	4	5
29	101204041	Kaustubh Singh	4	5
30	101204043	Lovely Goyal	4	5
31	101204045	Manik Mittal	3	4
32	101204046	Marshall	4	5
33	101204048	Mohit Kukkar	4	5
34	101204049	Mohit Manhas	4	5
35	101204051	Nalin Kaushik	5	5
36	101204053	Nishant Arora	5	5
37	101204054	P Siddharth	4	5
38	101204057	Rahul Kamboj	3	4
39	101204060	Rajatdeep Singh	4	5
40	101204061	Ramanpreet Kaur	3.5	4
41	101204063	Sahil Arora	3	4
42	101204064	Sahil Mittal	4	5
43	101204065	Sanchit Goel	4	5
44	101204066	Sewak Ram	4	5
45	101204067	Sheenu	5	5
46	101204069	Shubham Bhatia	5	5
47	101204070	Shubham Goel	4	5
48	101204071	Shubham Kansal	5	5
49	101204074	Sukhdarshanpal Singh	4	5
50	101204075	Sultan Singh	4	5
51	101204076	Tejasvi Anand	5	5
52	101254003	Sachin Pathak	4	5
53	101254004	Srijan Aditya	3	4
54	101254005	Navjot Kaur	5	5
55	101254006	Milan Jain	4	5
56	101254008	Gaurav	4	5

S. No.	Roll No.	Name of Student	Goal Report Marks (5)	Score (1-5)
57	101254009	Varun Khanna	4	5
58	101254010	Swati Srivastava	4	5
59	101254012	Shubham Singla	4	5
60	101254013	Sorabh Devgun	5	5
61	101254014	Paras Ghai	4	5
62	101254016	Sachin Gupta	4	5
63	101254017	Nakul Kumar	4	5
64	101384001	Ankur Singla	3.5	4
65	101384002	Gagandeep Singh	5	5
66	101384004	Himanshu Bansal	4	5
67	101384005	Navdeep Singh	4	5
68	101384006	Parampreet Singh	3.5	4
69	101384007	Saurav Goyal	4	5
70	101384008	Surjeet Singh	4	5

The performance of students through the course UEE791 for criteria 'PO-09(A)' is summarized in Table PO-09(A).2

Table PO-09(A).2: Average score of student performance in the course UEE791 for criteria 'PO-09(A)'

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE791	82.86	17.14	0.00	0.00	0.00	4.83

UEE793: Capstone Project

The performance of course *UEE793: Capstone Project* is used to measure the attainment of outcome ‘PO-09(A)’ through the ability of students for selection of new techniques and tools through **Design and Simulation of process / system component in Project Work**. (July-Dec 2015, 30 Marks).

Component of Evaluation	Poor(1)	Average(2)	Good(3-4)	Excellent(5)
Design and Simulation of process / system: Using engineering knowledge and concepts /codes / standards /design and device manuals/ literature etc. Application of software/mathematical tools	No or erroneous application of engineering principles yielding unreasonable solution. No or erroneous application of software /mathematical tools. Improper selection of devices.	Serious deficiencies in proper selection and use of engineering principles. Serious deficiencies in application of software/mathematical tools. No use of modern devices.	Effective application of engineering principles resulting in reasonable solution. Moderate application of software/ mathematical tools. Selection of modern devices.	Critical selection and application of engineering principles ensuring reasonable results. Adequate application of simulation design tools. Selection of proper device/equipment specifications, Assembly of circuit is completed.

The performance of the students in the above component is summarized in Table PO-09(A).3 using rubrics defined in Table PO-09.1(a).

Table PO-09(A).3: Students’ performance in component targeting ‘PO-09(A)’: Course UEE793

S. No.	Roll No	Name of Student	Marks (30)	Score (1-5)
1	101204057	Rahul Kamboj	25	5
2	101204059	Rajat Sahore	25	5
3	101204060	Rajatdeep Singh	25	5
4	101204064	Sahil Mittal	25	5
5	101204074	Sukhedarshan Singh	25	5
6	101204043	Lovely Goyal	25	5
7	101204071	Shubham Kansal	25	5
8	101204053	Nishant Arora	25	5
9	101204020	Dhruv Sharma	25	5
10	101204076	Tejasvi Anand	25	5
11	101254002	Naman	25	5
12	101204042	Kaustubh Singh	24	5
13	101204049	Mohit Manhas	24	5
14	101204051	Nalin	24	5
15	101204075	Sultan	24	5

S. No.	Roll No	Name of Student	Marks (30)	Score (1-5)
16	101204025	Harsh Kothari	25	5
17	101204006	Akash Ratna	25	5
18	101204009	Akshu Gupta	25	5
19	101254003	Sachin Pathak	25	5
20	101204013	Anshul Kumar	25	5
21	101204012	Amit Bansal	22	4
22	101204039	Kartik Arora	22	4
23	101204004	Aditya Jain	22	4
24	101204016	Ayush Vaid	22	4
25	101204021	Gaurav Arora	22	4
26	101204069	Shubham Bhatia	23	4
27	101254009	Varun Khanna	23	4
28	101204038	Karanvir Singh Bhangoo	23	4
29	101254001	Sahilpreet Singh	23	4
30	101204030	Ishtjot Singh	23	4
31	101204048	Mohit Kukkar	23	4
32	101204028	Iqbal Singh Garcha	23	4
33	101204035	Kapil Kinger	23	4
34	101204037	Karanbir Singh Kahlon	23	4
35	101204027	Himanshu Takkar	23	4
36	101204042	Krishnank Atrey	23	4
37	101254005	Navjot Kaur	23	4
38	101254008	Gaurav Sharma	23	4
39	101204040	Kashish Sethi	23	4
40	101204067	Sheenu Garg	23	4
41	101384006	Parampreet Singh Bawa	24	5
42	101254006	Milan Jain	24	5
43	101204031	Jasdeep Garg	24	5
44	101204001	Aashna Sharma	24	5
45	101254015	Kuldeep Singh Deora	24	5
46	101254016	Sachin Gupta	24	5
47	101204018	Chahat Singla	25	5
48	101204015	Arushi Nagpal	25	5
49	101204022	Gursharan Kaur	25	5
50	101204033	Jasleen	25	5
51	101204061	Ramanpreet Kaur	25	5
52	101254014	Paras Ghai	24	5
53	101254013	Sorabh Devgan	24	5
54	101204019	Deeksha Goyal	24	5
55	101204014	Anukriti	24	5
56	101254010	Swati Srivastav	24	5
57	101254017	Nakul Kumar	24	5
58	101204063	Sahil Arora	24	5

S. No.	Roll No	Name of Student	Marks (30)	Score (1-5)
59	101254004	Srijan	24	5
60	101204003	Abhishek Jain	24	5
61	101204002	Abhinav Sharma	24	5
62	101204070	Shubham Goel	24	5
63	101384007	Saurav Goyal	25	5
64	101384008	Surjeet Singh	25	5
65	101384004	Himanshu Bansal	25	5
66	101384005	Navdeep Singh	25	5
67	101384001	Ankur Singla	25	5
68	101384002	Gagandeep Singh	25	5
69	101204046	Marshall	24	5
70	101204045	Manik	24	5
71	101204054	Pvn Siddharth	24	5
72	101204063	Sewak Ram	24	5
73	101254012	Shubham Singla	24	5
74	101204024	Harjot Singh	24	5
75	101204023	Gursimran Singh	24	5
76	101204010	Aman Goyal	24	5
77	101204026	Hemanshu Garg	24	5
78	101204005	Akashdeep Batish	24	5
79	101204011	Amarpreet	23	4
80	101204065	Sanchit	24	5

The performance of students through the course UEE793 for criteria 'PO-09(A)' is summarized in Table PO-09(A).4

Table PO-09(A).4: Average score of student performance in the course UEE793 for criteria 'PO-09(A)'

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE793	73.75	26.25	0.00	0.00	0.00	4.74

The data from Table PO-09(A).2 and Table PO-09(A).4 is used to evaluate weighted average of direct measure through course portfolio for criteria 'PO-09(A)' and is summarised in Table PO-09(A).5.

Table PO-09(A).5: Weighted Average Student class performance (course portfolio) for criteria PO-09(A)

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE791	82.86	17.14	0.00	0.00	0.00	4.83
UEE793	73.75	26.25	0.00	0.00	0.00	4.74
Weighted Average Score	78.30	21.70	0.00	0.00	0.00	4.78

b) Indirect measures:

The indirect measurement of performance criteria 'PO-09(A)' has been assessed through Student Course Surveys and other surveys (Graduating student survey, Alumni survey and Employer survey). The weighted average score in respective surveys is summarised in Table PO-09(A).6 and Table PO-09(A).7.

(i) Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-09(A)'.

UEE791	Acquire knowledge and experience of software and hardware practices in the area of project.
UEE793	To design an electrical engineering project implementing an integrated design approach applying knowledge accrued in various professional courses.

Table PO-09(A).6: Weighted average score of performance criterion 'PO-09(A)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE791	32.86	41.43	21.43	0	4.29	3.99
UEE793	36.25	31.25	25	2.5	5	3.91
Weighted average score	34.56	36.34	23.22	1.25	4.65	3.95

(ii) Assessment Tool: Graduating Student Survey, Alumni Survey and Employer Survey
(Other surveys) are used to assess the attainment of program outcome 'PO-09' through indirect measurement using following question in the respective surveys.

Graduating Survey	A recognition of the need for, and an ability to engage in life-long learning
Alumni Survey	
Employer Survey	Do our students have recognition of the need for, and an ability to engage in life-long learning?

Table PO-09(A).7: Weighted average score of performance criterion 'PO-09(A)' based on surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating student survey	13.33	42.22	33.33	11.11	0.00	3.58
Employer survey	33.33	36.23	24.64	4.35	1.45	3.95
Alumni survey	53.33	33.33	13.33	0.00	0.00	4.40
Weighted average score surveys	33.33	37.26	23.77	5.15	0.48	3.98

c) Overall weighted average score of performance criterion ‘PO-09(A)’

The overall weighted average score of performance criterion ‘PO-09(A)’ is summarised in Table PO-09(A).8 from the data given in Tables PO-09(A).5, PO-09(A).6 and PO-09(A).7.

Table PO-09(A).8: Overall weighted average score of performance criterion ‘PO-09(A)’

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	78.30	21.70	0.00	0.00	0.00	4.78	5
Course surveys	34.56	36.34	23.22	1.25	4.65	3.95	4
Other surveys	33.33	37.26	23.77	5.15	0.48	3.98	3
Overall weighted score	52.48	30.47	13.68	1.70	1.67	4.30	

Assessment of Outcome 'PO-09' using Performance Criterion 'PO-09(B)'

PO-09(B): Ability to identify directions for continuing education opportunities.

The performance criteria 'PO-09(B)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using course portfolio

Two courses namely *UEE601: Flexible AC Transmission Systems* and *UEI841: Advanced Control Systems* are used to assess performance criteria PO-09(B) as a direct measure. The analysis for each of these courses is provided below:

UEE601: Flexible AC Transmission Systems

The performance of course *UEE601: Flexible AC Transmission Systems* is used to measure the attainment of outcome 'PO-09(B)' (Jan-June 2016, 100 marks).

The performance of the students in the above course is summarized in Table PO-09(B).1 using rubrics defined in Table PO-09.1(b).

Table PO-09(B).1: Students' performance in course targeting 'PO-09(B)': Course UEE601

S. No.	Roll No.	Name of Student	Marks (100)	Score (1-5)
1	101304102	Shubham Gupta	89	5
2	101304104	Shubham Sharma	70.5	4
3	101304108	Simran Kaur	67.25	4
4	101304112	Sumit Kaushik	80.5	5
5	101304084	Rohan Ghai	67.75	4
6	101484011	Pawan Kumar	80.25	5
7	101304076	Priyansh Mahajan	56.5	3
8	101304072	Preeti Garg	81.25	5
9	101484008	Diljeet Singh	73	4
10	101304048	Karan Kumar	38	2
11	101304045	Jassimran Singh Julka	44.5	3
12	101304060	Navdeep Singh	65.25	4
13	101304049	Karanjot Singh Kochar	73.5	4
14	101484007	Deepak Singla	68.75	4
15	101304028	Berry Lubana	55	3
16	101484002	Amrinder Singh	88	5
17	101304007	Akshat	60	4

S. No.	Roll No.	Name of Student	Marks (100)	Score (1-5)
18	101304001	Aarushi Bajaj	83.5	5
19	101304016	Ankita Garg	74.75	4
20	101304094	Satripleen Kaur	78.5	5
21	101304116	Utsav Chhabra	37.5	2
22	101304113	Tushar Dheer	55.75	3
23	101484016	Sukhjeet Singh	86.75	5
24	101484014	Saurabh Kumar Wadhawan	50.75	3
25	101304100	Shresth Rai	44.5	3
26	101304090	Sahil Kataria	87	5
27	101304098	Shaina	72.75	4
28	101304091	Sakshi	73	4
29	101304101	Shubham Goyal	69.5	4
30	101484012	Rajat Singla	62	4
31	101304080	Ratul Goyal	47.75	3
32	101304075	Priyanka Singh	69	4
33	101484004	Azad Singh	52.5	3
34	101304030	Bhanu Marwaha	57.5	3
35	101304021	Arpit Sharma	58.75	3
36	101304004	Adhikaansh Tayal	39.25	2
37	101304018	Anmol Jawa	77.5	5
38	101304009	Akshay Kumar	56.25	3
39	101304002	Abhey Arora	51	3
40	101304019	Anmolpreet Singh	75.25	5
41	101304089	Sagar Pulani	76	5
42	101304082	Rishabh Juneja	71.5	4
43	101304092	Sandal Singh Sidhu*	30.5	2
44	101304093	Sandeep Kaur	42.25	3
45	101304074	Priyanka	77.75	5
46	101304061	Nazuk Aggarwal	76.75	5
47	101304065	Parth Ahuja	73.75	4
48	101304070	Prachi Garg	68.5	4
49	101304041	Hartejdeep Singh	28.5	2
50	101304056	Mayank Singla	50	3
51	101304062	Nishant Garg	79.5	5
52	101304044	Jasjit Singh	37.25	2
53	101304033	Dishant Vanvari	52.5	3
54	101484001	Amandeep Singh	77.5	5
55	101304005	Aditi Narang	80	5
56	101304020	Anyuti Tiwary	77	5
57	101484015	Shweta Sharma	81.25	5

S. No.	Roll No.	Name of Student	Marks (100)	Score (1-5)
58	101304117	Vaibhav Gupta	76.63	5
59	101304122	Yugesh Goyal	53	3
60	101304083	Robin Manktala	58	3
61	101304069	Piyush Tripathi	56.88	3
62	101304067	Pency Goyal	44	3
63	101304071	Prashant Kataria	36	2
64	101304078	Rajan	53.69	3
65	101304054	Manik Mittal	68.75	4
66	101304031	Chirag Gaba	32.5	2
67	101304034	Divyesh Pratap Singh	70	4
68	101304035	Elham Anwar	67	4
69	101304037	Gursewak Singh	45	3
70	101304022	Arsh Kundal	49	3
71	101304011	Akshay Sharma	75.5	5
72	101304023	Arshbir Kaur	77.75	5
73	101304010	Akshay Kumar Chaudhary	31.25	2
74	101304118	Vaishali	66.25	4
75	101304103	Shubham Sharma	51	3
76	101304119	Varun Bansal	35.25	2
77	101304087	Rohit Goyal	63.25	4
78	101304096	Shagundeep Singh	27	2
79	101304077	Rahul Meena	40.5	3
80	101304047	Kanwarpal Singh	25.25	2
81	101304057	Mridul Bhutani	66	4
82	101304050	Kashish Aggarwal	78.75	5
83	101304046	Jessica Dhaliwal	85	5
84	101304040	Hariansh Sehgal	42.5	3
85	101304014	Amaninder Singh Randhawa	37.25	2
86	101304008	Akshay Kapoor	77	5
87	101304012	Amandeep Kaur	55	3
88	101484013	Satveer Kaur	83.5	5
89	101304107	Sidharth Garg	65.07	4
90	101304109	Simranjit Singh	19	1
91	101304095	Saurabh Mohan	62	4
92	101304088	Rubina Bamba	81.5	5
93	101304068	Piyush Jindal	40.5	3
94	101304051	Kritika Singla	87.75	5
95	101304058	Naman Garg	84	5
96	101484005	Chandan Garg	44.5	3
97	101304025	Ashish	55	3

S. No.	Roll No.	Name of Student	Marks (100)	Score (1-5)
98	101304015	Angad Kapoor	54.75	3
99	101484009	Jyoti Kaushal	65.75	4
100	101304121	Vishal Arora	69.75	4
101	101304114	Tushar Sharma	67.38	4
102	101304111	Sumit Dhingra	48.75	3
103	101304079	Rajat Sharma	79	5
104	101304042	Himanshu Goyal	52	3
105	101304024	Arshdeep Singh Bagga	52	3
106	101304026	Ashish Rajpal	63.75	4
107	101304003	Abhishek Taksali	24	2
108	101304105	Shubham Soin	82.25	5
109	101304120	Veni Jindal	93	5
110	101304106	Siddharth Goyal	54.25	3
111	101304086	Rohan Wadhawan	75	5
112	101304081	Ravinder Singh	80.25	5
113	101304099	Shivika Gupta	60	4
114	101304085	Rohan Singla	78	5
115	101304097	Shailly Gupta	86.5	5
116	101304063	Nishtha Raheja	83.5	5
117	101304073	Priyank Arora	81.5	5
118	101304064	Paras Bawa	55.5	3
119	101304066	Parushi	78	5
120	101304052	Love Gaba	58	3
121	101304055	Maninderjit Singh	43	3
122	101304059	Navdeep Singh	68	4
123	101304029	Bhanu Duggal	76.75	5
124	101304032	Dipin Garg	60	4
125	101304036	Gurseerat Singh Meen	28.5	2
126	101484003	Ashmeen Singh	32	2
127	101304017	Ankur Malik*	12.5	1
128	101304006	Aditya	73	4
129	101304013	Amandeep Singh	56.5	3

The performance of students through the course UEE601 for criteria 'PO-09(B)' is summarized in Table PO-09(B).2.

Table PO-09(B).2: Average score of student performance in the course UEE601 for criteria 'PO-09(B)'

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE601	31.01	25.58	29.46	12.40	1.55	3.72

UEI841: Advanced Control Systems

The performance of course *UEI841: Advanced Control Systems* is used to measure the attainment of outcome 'PO-09(B)' (Jan-June 2016, 100 marks).

The performance of the students in the above course is summarized in Table PO-09(B).3 using rubrics defined in Table PO-09.1(b).

Table PO-09(B).3: Students' performance in course targeting 'PO-09(B)': Course UEI841

S. No.	Roll No	Name of Student	Marks (100)	Score(1-5)
1	101304001	Aarushi Bajaj	84.5	5
2	101304002	Abhey Arora	47	3
3	101304003	Abhishek Taksali	30.5	2
4	101304004	Adhikaansh Tayal	12	1
5	101304005	Aditi Narang	69.5	4
6	101304006	Aditya	59.5	3
7	101304007	Akshat	43	3
8	101304008	Akshay Kapoor	70	4
9	101304009	Akshay Kumar	56	3
10	101304010	Akshay Kumar Chaudhary	19.5	1
11	101304011	Akshay Sharma	52.5	3
12	101304012	Amandeep Kaur	45	3
13	101304013	Amandeep Singh	56	3
14	101304014	Amaninder Singh Randhawa	13	1
15	101304015	Angad Kapoor	57	3
16	101304016	Ankita Garg	83	5
17	101304017	Ankur Malik	7.5	1
18	101304018	Anmol Jawa	68	4
19	101304019	Anmolpreet Singh	62.25	4
20	101304020	Anyuti Tiwary	69.5	4
21	101304021	Arpit Sharma	50	3
22	101304022	Arsh Kundal	29.25	2
23	101304023	Arshbir Kaur	69.5	4
24	101304024	Arshdeep Singh Bagga	34.75	2
25	101304025	Ashish	55	3
26	101304026	Ashish Rajpal	55.75	3
27	101304028	Berry Lubana	62.25	4
28	101304029	Bhanu Duggal	72	4
29	101304030	Bhanu Marwaha	51	3
30	101304031	Chirag Gaba	58.5	3
31	101304032	Dipin Garg	55	3
32	101304033	Dishant Vanvari	43	3
33	101304034	Divyesh Pratap Singh	60	4

S. No.	Roll No	Name of Student	Marks (100)	Score(1-5)
34	101304035	Elham Anwar	65	4
35	101304036	Gurseerat Singh Meen	23.5	2
36	101304037	Gursewak Singh	42	3
37	101304040	Hariansh Sehgal	31	2
38	101304041	Hartejdeep Singh	25	2
39	101304042	Himanshu Goyal	45	3
40	101304044	Jasjit Singh	25.5	2
41	101304045	Jassimran Singh Julka	49	3
42	101304046	Jessica Dhaliwal	78.25	5
43	101304047	Kanwarpal Singh	8	1
44	101304048	Karan Kumar	33.5	2
45	101304049	Karanjot Singh Kochar	63.5	4
46	101304050	Kashish Aggarwal	71.5	4
47	101304052	Love Gaba	55.5	3
48	101304054	Manik Mittal	53	3
49	101304055	Maninderjit Singh	16	1
50	101304056	Mayank Singla	47	3
51	101304057	Mridul Bhutani	57	3
52	101304058	Naman Garg	81.5	5
53	101304059	Navdeep Singh	63.5	4
54	101304060	Navdeep Singh	59	3
55	101304062	Nishant Garg	79.75	5
56	101304094	Satripleen Kaur	70	4
57	101484001	Amandeep Singh	61.5	4
58	101484002	Amrinder Singh	73.5	4
59	101484003	Ashmeen Singh	20.5	2
60	101484004	Azad Singh	37.5	2
61	101484005	Chandan Garg	45.5	3
62	101484007	Deepak Singla	48	3
63	101484008	Diljeet Singh	55	3

The performance of students through the course UEI841 for criteria 'PO-09(B)' is summarized in Table PO-09(B).4.

Table PO-09(B).4: Average score of student performance in the course UEI841 for criteria 'PO-09(B)'

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEI841	7.94	25.40	41.27	15.87	9.52	3.06

The data from Table PO-09(B).2 and Table PO-09(B).4 is used to evaluate weighted average of direct measure through course portfolio for criteria ‘PO-09(B)’, and is summarised in Table PO-09(B).5.

Table PO-09(B).5: Weighted Average Student class performance (course portfolio) for criteria ‘PO-09(B)’

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE601	31.01	25.58	29.46	12.40	1.55	3.72
UEI841	7.94	25.40	41.27	15.87	9.52	3.06
Weighted Average Score	19.47	25.49	35.36	14.14	5.54	3.39

b) Indirect measures:

The indirect measurement of performance criteria 'PO-09(B)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-09(B).6.

(ii) Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-09(B)'.

UEE601	- Describe the converter configuration for different power systems applications such as HVDC, FACTS etc. - Evaluate the converters, harmonics on AC and DC side and filtering. - Classify various compensators suited for various power system purposes. - Analyze power system behaviour with different shunt compensators. - Appraise series compensated power system behaviour with different series compensators. - Analyse system behaviour with hybrid shunt-series compensators.
UEI841	- Demonstrate non-linear system behavior by phase plane and describing function methods - Perform stability analysis of nonlinear systems by Lyapunov method - Develop design skills in optimal control problems - Derive discrete-time mathematical models in both time domain (difference equations, state equations) and z-domain (transfer function using z-transform). - Predict and analyze transient and steady-state responses of discrete-time control systems - Carry out stability analysis of both open-loop and closed-loop linear, time-invariant, discrete-time control systems - Acquire knowledge of state feedback in modern control systems through pole placement technique

Table PO-09(B).6: Weighted average score of performance criterion 'PO-09(B)' based on student course surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE601	27.67	16.99	25.56	8.74	21.04	3.22
UEI841	14.76	35.00	26.19	11.43	12.62	3.28
Weighted average score	21.22	26.00	25.88	10.09	16.83	3.25

(iii) Assessment Tools: Course survey, Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome ‘PO-09’ through indirect measurement using Table PO-09(A).7

c) Overall weighted average score of performance criterion ‘PO-09(B)’

The overall weighted average score of performance criterion ‘PO-09(B)’ is summarized in Table PO-09(B).7 from the data given in Tables PO-09(B).5, PO-09(B).6 and PO-09(A).7.

Table PO-09(B).7: Overall weighted average score of performance criterion ‘PO-09(B)’

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	19.47	25.49	35.36	14.14	5.54	3.39	5
Course surveys	21.22	26.00	25.88	10.09	16.83	3.25	4
Other surveys	33.33	37.26	23.77	5.15	0.48	3.98	3
Overall weighted score	23.52	28.60	29.30	10.54	8.04	3.49	

Assessment of Outcome ‘PO-09’ using Performance Criterion ‘PO-09(C)’

PO-09(C): Recognizes the need to embrace personal responsibility for lifelong learning.

The performance criteria ‘PO-09(C)’ has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students’ performance using Course Portfolio

Two courses namely *UEE591: Summer Training* and *UTA010: Engineering Design II* are used to assess performance criteria ‘PO-09(C)’ as a direct measure. The analysis for each of these courses is provided below:

UTA010: Engineering Design II

The performance criteria *UTA010: Engineering Design II* is used to measure the attainment of outcome ‘PO-09(C)’ by considering **evaluation of different hardware projects developed** by the students (Jan-June 2016, marks 100).

The performance of the students in the above course is summarized in Table PO-09(C).1 using rubrics defined in Table PO-09.1(a)

Table PO-09(C).1: Students’ performance in course targeting ‘PO-09(C)’: Course UTA010

S. No.	Roll No	Name of Student	Marks (100)	Score (1-5)
1	101404005	Abhishek Dhiman	43.8	3
2	101504002	Aastha Jain	70.9	4
3	101504004	Aayush Vohra	82.8	5
4	101504005	Aayush Rai Anand	82	5
5	101504006	Abhijeet Singh Bhatia	78.1	4
6	101504007	Abhinandan Narang	74.9	4
7	101504008	Abhishek Agarwal	77.1	4
8	101504009	Abhishek Pandey	80.4	5
9	101504010	Abhishek Prasad	76.5	4
10	101504011	Adarsh Agarwal	70.3	4
11	101504012	Aditi Mishra	71.1	4
12	101504013	Akshita Kamthan	73.1	4
13	101504014	Amandeep Singh Dhillon	79.3	4
14	101504015	Amarjot Singh	85.1	5
15	101504017	Amrit Kaler	78.1	4
16	101504018	Anahita	69.3	4

17	101504019	Ankit Gupta	81.4	5
18	101504020	Ankit Mahajan	79.3	4
19	101504021	Anmol Saluja	84.2	5
20	101504022	Anurag Dewangan	74.6	4
21	101504023	Arjun Garg	51.6	3
22	101504024	Ashish Nagpal	86	5
23	101504025	Ashish Kumar Yadav	84	5
24	101504026	Ashwini Anand Pateriya	82.5	5
25	101504027	Avantika Dhiman	72	4
26	101504028	Avinash Chaturvedi	82.5	5
27	101504029	Badshah Singh	82	5
28	101504030	Baninder Singh	87.5	5
29	101504031	Bhanu Pratap	87.5	5
30	101504032	Bhavay Gudwani	88.5	5
31	101504034	Bikram Pathania	87.5	5
32	101504035	Charika Mehta	90.5	5
33	101504036	Daman Aggarwal	91.5	5
34	101504037	Deen Dayal	87	5
35	101504038	Deepak Goyal	86	5
36	101504039	Divanshu Garg	81	5
37	101504040	Divyam Soni	87	5
38	101504041	Fiza Singh Multani	79.5	4
39	101504043	Gurjot Singh Kocher	83	5
40	101504044	Gurleen Kang	79	4
41	101504045	Gurleen Kaur	86	5
42	101504046	Gurnoor Kaur	84	5
43	101504047	Gursimratpaal Singh Sidhu	79.1	4
44	101504049	Harnishan Singh Kang	76.1	4
45	101504050	Harshit Lohaana	85.5	5
46	101504052	Harshjot Singh Pahuja	82.2	5
47	101504053	Hashmeet Singh Ganda	75.3	4
48	101504054	Himanshu Gupta	84.8	5
49	101504055	Himanshu Sahwal	81.4	5
50	101504057	Jaideep Grover	71.9	4
51	101504059	Jasjit Singh	80	5
52	101504060	Jaskirat Kaur Gill	68.8	4
53	101504061	Jatinderpal Singh	78.7	4
54	101504063	Kuljeet Singh	75.1	4
55	101504064	Kunwar Achint Singh	82.3	5
56	101504065	Lakhan Sharma	82.3	5
57	101504067	Malay Chand	76.8	4

58	101504069	Mayank Kumar	73.4	4
59	101504070	Mehul Natu	76.6	4
60	101504071	Mohit Goyal	70.2	4
61	101504073	Neha Bhargava	82.6	5
62	101504074	Neha Singla	80.3	5
63	101504075	Nihal Singh	78.9	4
64	101504076	Nikhil Sharma	74.1	4
65	101504078	Nitin Gupta	79.6	4
66	101504079	Nitish Kumar Soni	78.9	4
67	101504081	Osho	79.5	4
68	101504082	Pankaj Goyal	80.5	5
69	101504083	Parmeet Singh Sangha	77.7	4
70	101504084	Parth Gupta	76.4	4
71	101504085	Pinak Bhardwaj	76.7	4
72	101504086	Prabhav Pande	78.8	4
73	101504087	Pragati Sharma	79.9	4
74	101504088	Pranav Joshi	80.9	5
75	101504089	Pranav Mathur	77.5	4
76	101504091	Pranav Singh	24.7	2
77	101504094	Prateek Gupta	82.9	5
78	101504096	Praveen Kumar Yadav	86.6	5
79	101504097	Raghav Kumar Tiwari	80.4	5
80	101504098	Ramandeep Singh	78.6	4
81	101504099	Ramandeep Singh	81.4	5
82	101504100	Ramneet Kaur	77.3	4
83	101504101	Ravneet Sharma	84.1	5
84	101504103	Rohan Malhotra	87.6	5
85	101504104	Rohit Arora	93.3	5
86	101504105	Rushil Krishna	92.4	5
87	101504107	Sahil Bansal	93.1	5
88	101504108	Sahil Virk	93.1	5
89	101504109	Sainesh Karamchandani	87.2	5
90	101504114	Satyam Kumar	82.2	5
91	101504115	Shanun Randev	66	4
92	101504116	Shaurya Gaba	11	1
93	101504117	Sheikh Mohd Najam Ul Sehar	74.7	4
94	101504118	Shrey Arora	75.3	4
95	101504119	Shubham Gupta	81.2	5
96	101504120	Stuti Sidhu	88.8	5
97	101504121	Suhas Mahajan	77.1	4
98	101504122	Swanav Swaroop	96.8	5

99	101504124	Utkarsh Verma	2.9	1
100	101504125	Vaibhav Chawla	87.3	5
101	101504126	Vaibhav Singh	82.7	5
102	101504127	Vikram Kumawat	86.8	5
103	101504128	Viraj Baswana	77.5	4
104	101504130	Vishal Bansal	78	4
105	101504131	Vishu Jain	84.3	5
106	101504132	Abhishek Singhal	81.7	5
107	101504133	Riya Gupta	79.8	4
108	101554001	Aditya	71.2	4
109	101554002	Aditya Kumar	75.6	4
110	101554004	Apoorv Gupta	90	5
111	101554005	Archit Rawat	83.5	5
112	101554006	Bhisham Mittal	91.2	5
113	101554007	Deepika Gandhi	82.5	5
114	101554008	Evan Garg	91.2	5
115	101554009	Gayatri Bansal	88.7	5
116	101554011	Gursiddak Singh	90	5
117	101554012	Harmanjit Singh	75.7	4
118	101554013	Harshit Sethi	86.5	5
119	101554014	Himanshu Mittal	88.5	5
120	101554016	Ishan Kashyap	80.4	5
121	101554017	Kratika Agarwal	80.8	5
122	101554018	Madhurbain Singh	79.1	4
123	101554019	Mahima Goel	80	5
124	101554020	Mannat Batish	77.3	4
125	101554021	Piyush Kumar Gupta	78.7	4
126	101554022	Prabhjot Singh Saini	86.8	5
127	101554023	Prakhar Srivastava	81	5
128	101554024	Rajat Dixit	87.7	5
129	101554026	Ritunjay Gupta	88.2	5
130	101554027	Rohit Mehta	86.2	5
131	101554028	Romil Garg	90.1	5
132	101554029	Sahil Sharma	83.1	5
133	101554030	Sahil Virk	80.7	5
134	101554031	Sajan Goyal	76.1	4
135	101554032	Sanchit Sharma	79.2	4
136	101554033	Saransh Sehgal	80.4	5
137	101554034	Savi	84.5	5
138	101554035	Shishant Airon	76.9	4
139	101554036	Simran Saluja	83.6	5

140	101684019	Hitesh Gulati	81.6	5
141	101684020	Kanishk Agarwal	86.6	5
142	401504001	Abhishek Garg	76.3	4
143	401504002	Divya Kumar Gupta	83	5
144	401504007	Simarpreet Singh	86.8	5
145	401504008	Uday Bhandari	77.9	4
146	401554001	Kunal Gupta	80.2	5

The performance of students through the course UTA010 for criteria 'PO-09(C)' is summarized in Table PO-09(C).2

Table PO-09(C).2: Average score of student performance in the course UTA010 for criteria 'PO-09(C)'

Course	% of students in each score					Average Score
	5	4	3	2	1	
UTA010	56.85	39.73	1.37	0.68	1.37	4.50

UEE591: Summer Training

The performance of course *UEE591 Summer Training* is used to measure the attainment of outcome ‘PO-09(C)’ through evaluation of six weeks summer training (June-July 2015, 10 marks) which includes **Presentation of industrial experience of the candidate for lifelong learning.**

The performance of the students in the above question is summarized in Table PO-09(C).1 using rubrics defined in Table PO-09.1(a).

Table PO-09(C).3: Students’ performance in component targeting ‘PO-09(C)’: Course UEE591

S. No.	Roll No	Name of Student	Marks (10)	Score(1-5)
1	101304049	Karanjot Singh Kochar	8.75	5
2	101304030	Bhanu Marwaha	9.25	5
3	101484008	Diljeet Singh	8.75	5
4	101304020	Anyuti Tiwary	8	5
5	101304073	Priyank Arora	8.5	5
7	101304028	Berry Lubana	8.75	5
8	101304008	Akshay Kapoor	7.5	4
9	101304018	Anmol Jawa	7.5	4
10	101304026	Ashish Rajpal	7.5	4
11	101304029	Bhanu Duggal	7.75	4
12	101484011	Pawan Kumar	7.5	4
13	101304036	Gurseerat Singh Meen	7.5	4
14	101304062	Nishant Garg	8	5
15	101304013	Amandeep Singh	7.5	4
16	101304024	Arshdeep Singh Bagga	7.75	4
17	101304106	Siddharth Goyal	7.5	4
18	101304058	Naman Garg	7.5	4
19	101304023	Arshbir Kaur	6.25	4
20	101304046	Jessica Dhaliwal	7.5	4
21	101304059	Navdeep Singh	7.25	4
22	101304092	Sandal Singh Sidhu	8.25	5
23	101304095	Saurabh Mohan	8	5
24	101484015	Shweta Sharma	7.5	4
25	101304035	Elham Anwar	7.5	4
26	101304050	Kashish Aggarwal	8	5
27	101304085	Rohan Singla	8	5
28	101304100	Shresth Rai	7.5	4
29	101304107	Sidharth Garg	7	4
30	101304114	Tushar Sharma	7.75	4
31	101304108	Simran Kaur	6.75	4

32	101304112	Sumit Kaushik	7.25	4
33	101304120	Veni Jindal	7	4
34	101304122	Yugesh Goyal	7	4
35	101484013	Satveer Kaur	7	4
36	101304063	Nishtha Raheja	6.75	4
37	101304086	Rohan Wadhawan	8	5
38	101304012	Amandeep Kaur	5.5	3
39	101304019	Anmolpreet Singh	6.25	4
40	101304051	Kritika Singla	6.5	4
41	101304074	Priyanka	6.5	4
42	101304094	Satripleen Kaur	6.25	4
43	101304102	Shubham Gupta	6.25	4
44	101304104	Shubham Sharma	7	4
45	101304105	Shubham Soin	7	4
46	101484012	Rajat Singla	6.75	4
47	101304006	Aditya	6.25	4
48	101304060	Navdeep Singh	6.5	4
49	101304097	Shailly Gupta	8	5
50	101304103	Shubham Sharma	7	4
51	101484001	Amandeep Singh	6.25	4
52	101484002	Amrinder Singh	6.25	4
53	101304016	Ankita Garg	6.25	4
54	101304025	Ashish	6.5	4
55	101304042	Himanshu Goyal	6.75	4
56	101304075	Priyanka Singh	6.75	4
57	101304081	Ravinder Singh	8	5
58	101304090	Sahil Kataria	8	5
59	101304098	Shaina	7.5	4
60	101304119	Varun Bansal	6.75	4
61	101484014	Saurabh Kumar Wadhawan	8.25	5
62	101304003	Abhishek Taksali	6.25	4
63	101304021	Arpit Sharma	6.75	4
64	101304032	Dipin Garg	6.5	4
65	101304061	Nazuk Aggarwal	7	4
66	101304076	Priyansh Mahajan	7	4
67	101304093	Sandeep Kaur	7.25	4
68	101304101	Shubham Goyal	7.5	4
69	101484009	Jyoti Kaushal	6.5	4
70	101304056	Mayank Singla	7.5	4
71	101304066	Parushi	8	5
72	101304072	Preeti Garg	8	5

73	101304121	Vishal Arora	6.5	4
74	101304082	Rishabh Juneja	7.25	4
75	101304089	Sagar Pulani	6.5	4
76	101304091	Sakshi	7.5	4
77	101304116	Utsav Chhabra	6.25	4
78	101304117	Vaibhav Gupta	6.25	4
79	101304007	Akshat	6.25	4
80	101304010	Akshay Kumar Chaudhary	5.25	3
81	101304113	Tushar Dheer	6	4
82	101484016	Sukhjeet Singh	6.25	4
83	101304048	Karan Kumar	6.25	4
84	101304118	Vaishali	6	4
85	101304005	Aditi Narang	6.25	4
86	101304033	Dishant Vanvari	6.25	4
87	101304054	Manik Mittal	7	4
88	101304087	Rohit Goyal	7.5	4
89	101304096	Shagundeep Singh	6.75	4
90	101304002	Abhey Arora	6.25	4
91	101304057	Mridul Bhutani	6.25	4
92	101304068	Piyush Jindal	6.5	4
93	101304079	Rajat Sharma	4	3
94	101304031	Chirag Gaba	6.25	4
95	101304034	Divyesh Pratap Singh	6.5	4
96	101304111	Sumit Dhingra	5.5	3
97	101484003	Ashmeen Singh	5	3
98	101304069	Piyush Tripathi	5	3
99	101304044	Jasjit Singh	6.25	4
100	101304065	Parth Ahuja	6.25	4
101	101304067	Pency Goyal	6.5	4
102	101304083	Robin Manktala	6.25	4
103	101304084	Rohan Ghai	6.25	4
104	101304041	Hartejdeep Singh	5.75	3
105	101304052	Love Gaba	6	4
106	101304055	Maninderjit Singh	5.75	3
107	101304064	Paras Bawa	5.5	3
108	101304080	Ratul Goyal	5	3
109	101304071	Prashant Kataria	4.75	3
110	101304099	Shivika Gupta	6.25	4
111	101484005	Chandan Garg	6	4
112	101304037	Gursewak Singh	6	4
113	101304088	Rubina Bamba	6.25	4

114	101484007	Deepak Singla	6	4
115	101304001	Aarushi Bajaj	5	3
116	101304009	Akshay Kumar	5	3
117	101304017	Ankur Malik	4.5	3
118	101304070	Prachi Garg	5	3
119	101304004	Adhikaansh Tayal	4.5	3
120	101304011	Akshay Sharma	4.5	3
121	101304045	Jassimran Singh Julka	5.5	3
122	101304078	Rajan	6	4
123	101304047	Kanwarpal Singh	5.75	3
124	101304015	Angad Kapoor	4.5	3
125	101304014	Amaninder Singh Randhawa	4.5	3
126	101304022	Arsh Kundal	4	3
127	101304038	Gurveer Singh	3.75	2
128	101304040	Hariansh Sehgal	3.5	2
129	101484004	Azad Singh	3.75	2
130	101304077	Rahul Meena	2.75	2
131	101304109	Simranjit Singh	2.5	2

The performance of students through the course UEE591 for criteria 'PO-09(C)' is summarized in Table PO-09(C).4.

Table PO-09(C).4: Average score of student performance in the course UEE591 for criteria 'PO-09(C)'

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE591	13.85	65.38	16.92	3.85	0.00	3.89

The data from Table PO-09(C).2 and Table PO-09(C).4 is used to evaluate weighted average of direct measure through course portfolio for criteria 'PO-09(C)' and is summarised in Table PO-09(C).5.

Table PO-09(C).5: Weighted Average Student class performance (course portfolio) for criteria 'PO-09(C)'

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UTA010	56.85	39.73	1.37	0.68	1.37	4.50
UEE591	13.85	65.38	16.92	3.85	0.00	3.89
Weighted Average Score	35.35	52.56	9.15	2.27	0.68	4.20

b) Indirect Measures:

The indirect measurement of performance criteria 'PO-09(C)' has been assessed through surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-09(C).6.

(i) **Assessment Tool:** Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-09(C)'.

UTA010	Optimally design structural elements of an engineering mechanism
UEE591	Use resources to adopt latest technologies

Table PO-09(C).6: Weighted average score of performance criterion 'PO-09(C)' based on student course surveys

Course	% of students in each score					Average Score
	5	4	3	2	1	
UTA010	30.97	33.55	27.74	5.16	2.58	3.85
UEE591	33.85	25.38	33.08	6.15	1.54	3.84
Weighted average score	32.41	29.47	30.41	5.66	2.06	3.85

(ii) **Assessment Tools:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-09' through indirect measurement using Table PO-09(A).7.

c) Overall weighted average score of performance criterion 'PO-09(C)'

The overall weighted average score of performance criterion 'PO-09(C)' is summarised in Table PO-09(C).7 from the data given in Tables PO-09(C).5, PO-09(C).6 and PO-09(A).7.

Table PO-09(C).7: Overall weighted average score of performance criterion 'PO-09(C)'

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	35.35	52.56	9.15	2.27	0.68	4.20	5
Course surveys	32.41	28.82	30.74	5.66	2.39	3.84	4
Other surveys	33.33	37.26	23.77	5.15	0.48	3.98	3
Overall weighted score	33.87	41.04	19.89	4.12	1.09	4.03	

Assessment of Outcome 'PO-09' using Performance Criterion 'PO-09(A)', 'PO-09(B)' and 'PO-09(C)'

In the previous sections, each of the individual performance criteria PO-09(A), PO-09(B) and PO-09(C) have been assessed. The performance for attainment of outcome 'PO-09' has been completed using the attainment values for PO-09(A), PO-09(B) and PO-09(C) and is provided below:

Table PO-09.2 summarizes the scores of each of the three performance criteria and these scores have been used to assess an overall score for outcome PO-09.

Table PO-09.2: Overall score for outcome PO-09 at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
PO-09(A)	52.48	30.47	13.68	1.70	1.67	4.30	5
PO-09(B)	23.52	28.60	29.30	10.54	8.04	3.49	5
PO-09(C)	33.87	41.04	19.89	4.12	1.09	4.03	5
Overall score	36.62	33.37	20.96	5.45	3.60	3.94	

The performance criteria wise assessment score distribution of outcome 'PO-09' is shown in Fig. PO-09.2.

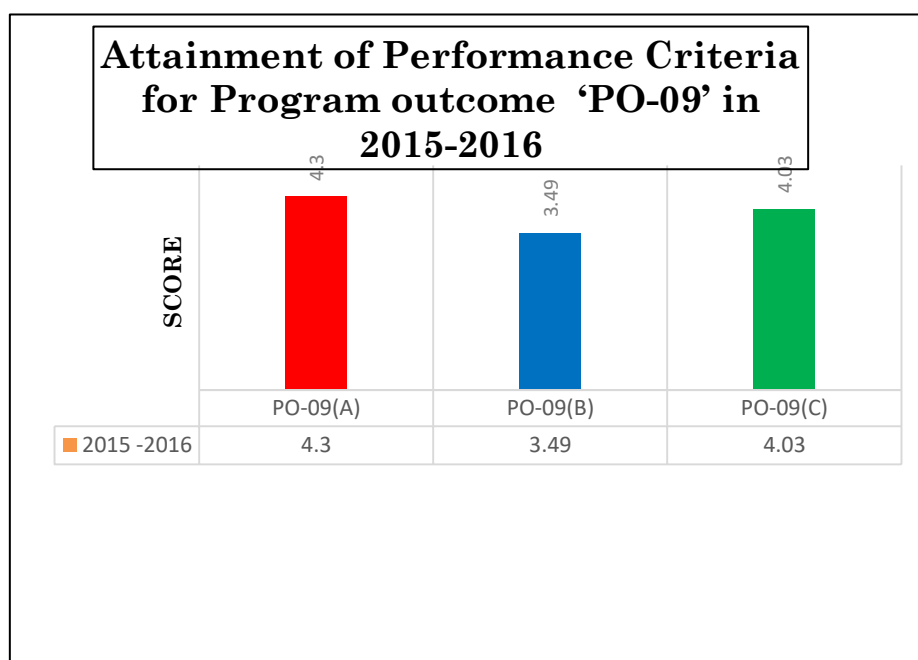


Figure PO-09.2: Performance criteria-wise assessment score distribution of outcome 'PO-09'

The data presented above pertains to the courses offered during academic year 2015-16. The attainment of the program outcome 'PO-09' through assessment of PO-09(A), PO-09(B) and PO-09(C) in the selected courses is achieved as "Good".

Assessment of Attainment of Program Outcome

PO-10

A Knowledge Of Contemporary Issues
(2015-16)

for the
Bachelor of Engineering
in
Electrical Engineering



Electrical & Instrumentation Engineering Department
Thapar Institute of Engineering and Technology, Patiala
(Punjab) -INDIA

Attainment of Program Outcome 'PO-10'

The attainment of program outcome PO-10: *A knowledge of contemporary issues* has been measured using standard procedure for the BE Electrical Engineering program. The program outcome 'PO-10' has been classified into following performance criteria :

PO-10(A): *Comprehends the relevance of contemporary issues*

PO-10(B): *Recognizes the impact of engineering decisions on energy resources and environment*

The program assessment committee identified the following courses for the assessment of program outcome 'PO-10'. The courses used for the assessment during three academic years are marked bold.

- **UEN002: Energy and Environment**
- UEE504: Power Electronics
- UEE591: Summer Training
- **UEE502 : High Voltage Engineering**
- **UEE522: Energy Auditing and Management**
- **UEE603: Switchgear and Protection**
- **UEE604: Flexible AC Transmission Systems**
- **UEE802: Intelligent Algorithms in Power Systems**
- **UEE804: Operation and Control of Power Systems**
- **UEE791: Project Semester**

Outcome PO-10 has been assessed through two performance criteria PO-10(A) and PO-10(B). The following courses have been considered by the program assessment committee for assessment of performance criteria 'PO-10(A)', 'PO-10(B)' for the academic year 2015-16.

Performance Criteria	Subject -1	Subject-2
PO-10(A)	UEE502: High Voltage Engineering	UEE802: Intelligent Algorithms in Power Systems
PO-10(B)	UEE522 : Energy Auditing and Management	UEE791: Project Semester

The step by step methodology used to measure the attainment of program outcome 'PO-10' is shown in Fig. PO-10.1 for academic year (AY) 2015-16.

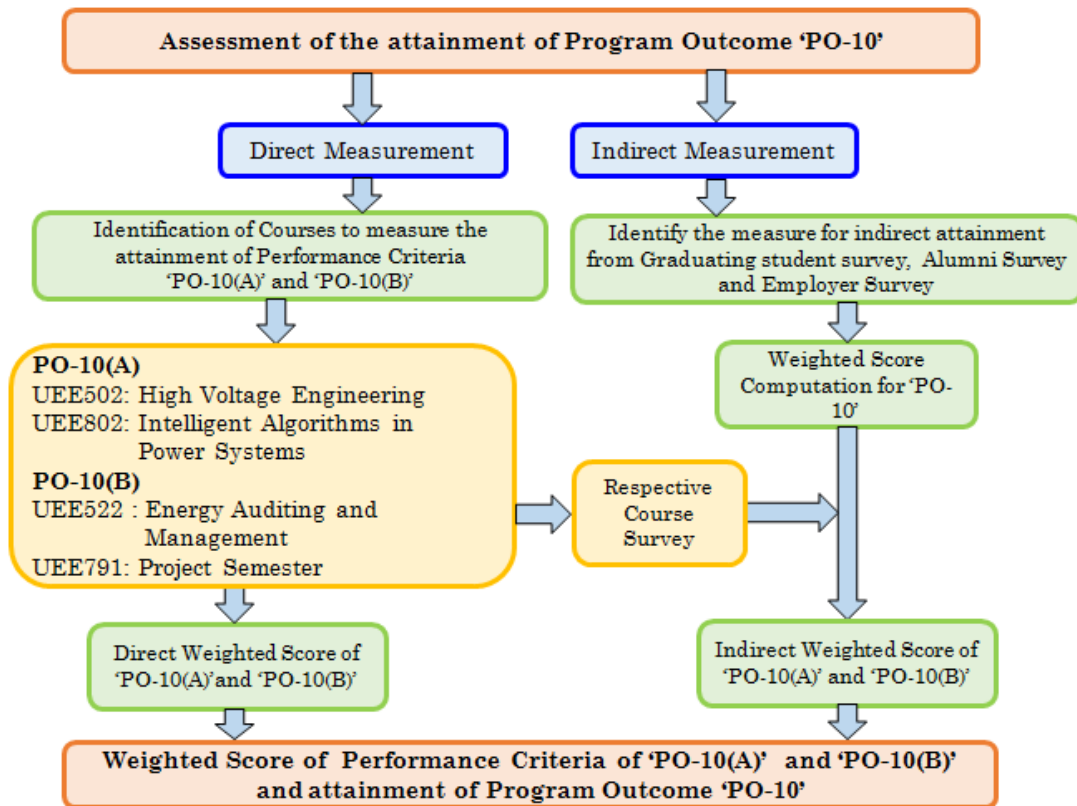


Fig. PO-10.1: Process for measurement of attainment of outcome 'PO-10(A)' for the year 2015-16

The following Rubric has been used to convert marks obtained by the students to a Likert scale in the range of 1 to 5 and is as described in Table PO-10.1(a) and PO-10.1 (b) in most cases unless specifically mentioned.

Table PO-10.1(a): Rubric for Outcome Measurement

S. No.	Range of Marks (%)	Score (1-5)
1	$75 \leq \text{Marks} < 100$	5
2	$60 \leq \text{Marks} < 75$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

Table PO-10.1 (b): Rubric for Outcome Measurement

S. No.	Range of Marks (%)	Score (1-5)
1	$80 \leq \text{Marks} < 100$	5
2	$60 \leq \text{Marks} < 80$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

The following sections summarize separate assessments for each of the performance criteria using the subjects mentioned.

Assessment of Outcome 'PO-10' using performance criterion PO-10(A)

PO-10(A): *Comprehends the relevance of contemporary issues.*

The performance criteria 'PO-10(A)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using course portfolio

Two courses namely *UEE502: High Voltage Engineering* and *UEE802: Intelligent Algorithms in Power Systems* are used to assess performance criteria PO-10(A) as a direct measure. The analysis for each of these courses is provided below:

UEE502 : High Voltage Engineering

The performance of course *UEE502 : High Voltage Engineering* is used to measure the attainment of outcome 'PO-10(A)' through End Semester Examination (Question No. 2(a), July -Dec 2015, 10 marks).

Question:

Q. 2(a)	Enumerate the classification of insulating materials as per International Electro technical Commission (IEC) mentioning two examples for each class.	(10)
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The performance of the students in the above question is summarized as given below in Table PO-10(A).1 using Rubrics defined in Table PO-10.1(a).

Table PO-10(A).1: Students' performance in Question targeting 'PO-10(A)'; Course UEE502

S. No	Roll No.	Name Student	Marks (10)	Score (1-5)
1	101304051	Kritika Singla	10	5
2	101304061	Nazuk Aggarwal	10	5
3	101304063	Nishtha Raheja	10	5
4	101304064	Paras Bawa	10	5
5	101304065	Parth Ahuja	5	3
6	101304066	Parushi	10	5
7	101304067	Peney Goyal	5	3
8	101304068	Piyush Jindal	6	4
9	101304069	Piyush Tripathi	6	4
10	101304070	Prachi Garg	9	5
11	101304071	Prashant Kataria	10	5
12	101304072	Preeti Garg	0	1
13	101304073	Priyank Arora	10	5
14	101304074	Priyanka	0	1
15	101304075	Priyanka Singh	0	1
16	101304076	Priyansh Mahajan	0	1
17	101304077	Rahul Meena	0	1

18	101304078	Rajan	0	1
19	101304079	Rajat Sharma	1	1
20	101304080	Ratul Goyal	0	1
21	101304081	Ravinder Singh	2	2
22	101304082	Rishabh Juneja	2	2
23	101304083	Robin Manktala	2	2
24	101304084	Rohan Ghai	8	5
25	101304085	Rohan Singla	3	2
26	101304086	Rohan Wadhawan	5	3
27	101304087	Rohit Goyal	2	2
28	101304088	Rubina Bamba	4	3
29	101304089	Sagar Pulani	4	3
30	101304090	Sahil Kataria	2	2
31	101304091	Sakshi	0	1
32	101304092	Sandal Singh Sidhu	1	1
33	101304093	Sandeep Kaur	10	5
34	101304095	Saurabh Mohan	2	2
35	101304096	Shagundeeep Singh	10	5
36	101304097	Shailly Gupta	1	1
37	101304098	Shaina	2	2
38	101304099	Shivika Gupta	0	1
39	101304100	Shresth Rai	10	5
40	101304101	Shubham Goyal	2	2
41	101304102	Shubham Gupta	10	5
42	101304103	Shubham Sharma	10	5
43	101304104	Shubham Sharma	10	5
44	101304105	Shubham Soin	0	1
45	101304106	Siddharth Goyal	0	1
46	101304107	Sidharth Garg	10	5
47	101304108	Simran Kaur	6	4
48	101304109	Simranjit Singh	0	1
49	101304111	Sumit Dhingra	7	4
50	101304112	Sumit Kaushik	0	1
51	101304113	Tushar Dheer	10	5
52	101304114	Tushar Sharma	5	3
53	101304116	Utsav Chhabra	0	1
54	101304117	Vaibhav Gupta	5	3
55	101304118	Vaishali	5	3
56	101304119	Varun Bansal	0	1
57	101304120	Veni Jindal	2	2
58	101304121	Vishal Arora	0	1
59	101304122	Yugesh Goyal	7	4
60	101484009	Jyoti Kaushal	10	5
61	101484011	Pawan Kumar	8	5

62	101484012	Rajat Singla	0	1
63	101484013	Satveer Kaur	0	1
64	101484014	Saurabh Kumar Wadhawan	3	2
65	101484015	Shweta Sharma	10	5
66	101484016	Sukhjeet Singh	2	2

The performance of students through the course UEE502 for the criteria 'PO-10(A)' is summarized in Table PO-10(A).2:

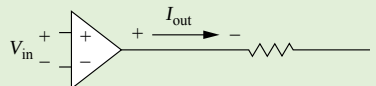
Table PO-10(A).2: Average score of student performance in the course UEE502 for criteria PO-10(A)

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE502	30.30	7.58	12.12	18.18	31.82	2.86

UEE802 : Intelligent Algorithms in Power System

The performance of course *UEE802 : Intelligent Algorithms in Power System* is used to measure the attainment of outcome ‘PO-10(A)’ through End Semester Examination (Question No. 3(a), July -Dec 2015, 10 marks).

Question:

Q. 3(a)	Establish an analogy with the crisp logic to obtain the membership for the “If A, Then B” rule for fuzzy logic. Let the amplifier shown below measures input voltage V_{in} and gives output current I_{out}. The fuzzy linguistic variables on V_{in}, I_{out} and input impedance Z are defined as: $V_{in} = \text{“small”} = \left\{ \frac{0.5}{0.10} + \frac{1}{0.20} + \frac{0.8}{0.30} + \frac{0.2}{0.40} \right\} \text{ volt;}$ $I_{out} = \text{“big”} = \left\{ \frac{0.3}{0.6} + \frac{1}{1} + \frac{0.5}{1.4} \right\} \text{ amp;}$ $Z = \text{“High impedance”} = \left\{ \frac{0}{10^4} + \frac{0.3}{10^5} + \frac{1}{10^6} + \frac{0.6}{10^7} \right\} \text{ ohm}$ Find the relations (i) $S = Z \times I_{out}$ (ii) $R = \text{If } V_{in}, \text{ Then } I_{out}$ (iii) For $I_{new} = \left\{ \frac{0.2}{0.6} + \frac{0.8}{1} + \frac{1}{1.4} \right\}$, and R; Find V_{new} using max-min composition. 	(10)
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The performance of the students in the above question is summarized as given below in Table PO-10(A).3 using Rubrics defined in Table PO-10.1(a).

Table PO-10(A).3: Students’ performance in question targeting ‘PO-10(A)’; Course UEE802

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
1	101204001	Aashna	5	3
2	101204002	Abhinav Sharma	6	4
3	101204003	Abhishek Jain	7	4
4	101204004	Aditya Jain	0	1
5	101204005	Akashdeep	6	4
6	101204006	Akash Ratna	7	4
7	101204009	Akshu Gupta	5	3
8	101204010	Aman Goyal	7	4
9	101204011	Amarpreet	0	1
10	101204012	Amit Bansal	6	4
11	101204013	Anshul Kumar	3	2
12	101204014	Anukriti Dwivedi	4	3
13	101204015	Arushi Nagpal	3	2
14	101204016	AyushVaid	6	4

15	101204018	Chahat Singla	6	4
16	101204019	Deeksha Goyal	3	2
17	101204020	Dhruv Sharma	5	3
18	101204021	Gaurav Arora	2	2
19	101204022	Gursharan Kaur	7	4
20	101204023	Gursimran Singh	7	4
21	101204024	Harjot Singh	7	4
22	101204025	Harsh Kothari	7	4
23	101204026	Hemanshu Garg	10	5
24	101204027	Himanshu Takkar	9	5
25	101204028	Iqbal Singh Garcha	3	2
26	101204030	Ishtjot Singh	6	4
27	101204031	Jasdeep Garg	6	4
28	101204033	Jasleen Kaur	4	3
29	101204035	Kapil Kinger	7	4
30	101204037	Karanbir Singh Kahlon	1	1
31	101204038	Karanveer Singh Bhangoo	3	2
32	101204039	Kartik Arora	0	1
33	101204040	Kashish Sethi	7	4
34	101204041	Kaustubh Singh	7	4
35	101204042	Krishnank Atrey	7	4
36	101204043	Lovely Goyal	5	3
37	101204045	Manik Mittal	7	4
38	101204046	Marshall	5	3
39	101204048	Mohit Kukkar	3	2
40	101204049	Mohit Manhas	5	3
41	101204051	Nalin Kaushik	3	2
42	101204053	Nishant Arora	5	3
43	101204054	P Siddharth	5	3
44	101204057	Rahul Kamboj	3	2
45	101204059	Rajat Sahore	4	3
46	101204060	Rajatdeep Singh	0	1
47	101204061	Ramanpreet Kaur	3	2
48	101204063	Sahil Arora	3	2
49	101204064	Sahil Mittal	3	2
50	101204065	Sanchit Goel	7	4
51	101204066	Sewak Ram	4	3
52	101204067	Sheenu	1	1
53	101204069	Shubham Bhatia	7	4
54	101204070	Shubham Goel	3	2
55	101204071	Shubham Kansal	0	1
56	101204074	Sukhdarshanpal Singh	7	4
57	101204075	Sultan Singh	0	1
58	101204076	Tejasvi Anand	7	4

59	101254001	Sahilpreet Singh	7	4
60	101254002	Naman Kumar	0	1
61	101254003	Sachin Pathak	7	4
62	101254004	Srijan Aditya	4	3
63	101254005	Navjot Kaur	4	3
64	101254006	Milan Jain	2	2
65	101254007	Mohit	0	1
66	101254008	Gaurav	7	4
67	101254009	Varun Khanna	2	2
68	101254010	Swati Srivastava	2	2
69	101254012	Shubham Singla	7	4
70	101254013	Sorabh Devgun	2	2
71	101254014	Paras Ghai	2	2
72	101254015	Kuldeep Singh Deora	0	1
73	101254016	Sachin Gupta	7	4
74	101254017	Nakul Kumar	3	2
75	101384001	Ankur Singla	5	3
76	101384002	Gagandeep Singh	4	3
77	101384004	Himanshu Bansal	5	3
78	101384005	Navdeep Singh	4	3
79	101384006	Parampreet Singh	7	4
80	101384007	Saurav Goyal	3	2
81	101384008	Surjeet Singh	5	3

The performance of programs through the course UEE802 for criteria 'PO-10(A)' is summarized in Table PO-10(A).4

Table PO-10(A).4: Average score of Student performance in the course UEE802 for criteria PO-10(A)

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE802	2.47	35.80	23.46	24.69	13.58	2.89

The data from Table PO-10(A).2 and Table PO-10(A).4 is used to evaluate weighted average of direct measure through course portfolio for criteria PO-10(A), and is summarised in Table PO-10(A).5.

Table PO-10(A).5: Weighted Average Student class performance (course portfolio) for criteria PO-10(A)

Course	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE502	30.30	7.58	12.12	18.18	31.82	2.86
UEE802	2.47	35.80	23.46	24.69	13.58	2.89
Weighted Average Score	16.39	21.69	17.79	21.44	22.70	2.88

b) Indirect measures

The indirect measurement of performance criteria 'PO-10(A)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-10(A).6 and Table PO-10(A).7.

(i) Assessment Tools: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-10(A)'.

UEE502	Study of insulations associated with various power system components such as transformer, rotating machines and switchgear
UEE802	Examine the fuzzy system and implement fuzzy controllers for control and classification.

Table PO-10(A).6: Weighted average score of performance criterion 'PO-10(A)' based on student course surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE502	13.33	20	53.33	11.66	1.66	3.32
UEE802	28.57	28.57	22.85	11.42	8.57	3.57
Weighted average score	20.95	24.29	38.09	11.54	5.12	3.45

(ii) Assessment Tool: Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-10' through indirect measurement using following question in the respective surveys.

Graduating Survey	A knowledge of contemporary issues.
Alumni Survey	
Employer Survey	Do our programs have knowledge of contemporary issues?

Table PO-10(A).7: Weighted average score of performance criterion 'PO-10(A)' based on other surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating student survey	29.58	46.48	23.94	00	00	4.06
Employer survey	46.67	40	13.33	00	00	4.33
Alumni survey	26.09	39.13	25.12	7.25	2.42	3.79
Weighted average score	34.11	41.87	20.79	2.41	0.80	4.06

c) Overall weighted average score of performance criterion ‘PO-10(A)’

The overall weighted average score of performance criterion ‘PO-10(A)’ is summarised in Table PO-10(A).8 from the data given in Table PO-10(A).5 , PO-10(A).6 and PO-10(A).7.

Table PO-10(A).8: Overall weighted average score of performance criterion ‘PO-10(A)’

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	16.39	21.69	17.79	21.44	22.70	2.88	5
Course surveys	20.95	24.29	38.09	11.54	5.12	3.45	4
Other surveys	34.11	41.87	20.79	2.41	0.80	4.06	3
Overall weighted score	22.34	27.6	25.3	13.38	11.36	3.36	-

Assessment of Outcome 'PO-10' using performance criterion PO-10(B)

PO-10(B): Recognizes the impact of engineering decisions on energy resources and environment

The performance criteria 'PO-10(B)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

a.) Assessment Tool: Programs' performance using course portfolio

Two courses namely *UEE522 : Energy Auditing and Management* and *UEE791: Project Semester* are used to assess performance criteria 'PO-10(B)' as a direct measure. The analysis for each of these courses is provided below:

UEE522 : Energy Auditing and Management

The performance of course *UEE522 : Energy Auditing and Management* is used to measure the attainment of outcome 'PO-10(B)' through End Semester Examination (Question No. 10, Jul-Dec 2015, 10 marks).

Question:

Q.10 (a)	Define the term EER. What is the significance of labelling and standards of room air conditioners.	(5)										
Q.10 (b)	In a Commercial building, five windows ACs each of 1.5 TR capacities were evaluated for replacement with three star labeled new ACs having Energy Efficiency Ratio (EER) of 2.50 kW/kW. The measured EER of existing ACs is shown below. Calculate the total kW saving potential if all the existing AC are replaced with 3 star labeled ACs of same capacity? Existing EER : <table><tr><td>AC. No.1</td><td>2.05</td></tr><tr><td>AC.No.2</td><td>2.19</td></tr><tr><td>AC.No.3</td><td>2.30</td></tr><tr><td>AC.No.4</td><td>2.40</td></tr><tr><td>AC.No.5</td><td>2.17</td></tr></table>	AC. No.1	2.05	AC.No.2	2.19	AC.No.3	2.30	AC.No.4	2.40	AC.No.5	2.17	(5)
AC. No.1	2.05											
AC.No.2	2.19											
AC.No.3	2.30											
AC.No.4	2.40											
AC.No.5	2.17											

The performance of the programs in the above question is summarized as given below in Table PO-10(B).1 using Rubrics defined in Table PO-10.1(a).

Table PO-10(B).1: Students' performance in Question targeting 'PO-10(B)'; Course UEE522

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
1	101304001	Aarushi Bajaj	4	3
2	101304002	Abhey Arora	6	4
3	101304003	Abhishek Taksali	7	4
4	101304004	Adhikaansh Tayal	0	1
5	101304005	Aditi Narang	4	3
6	101304006	Aditya	8	5

7	101304007	Akshat	0	1
8	101304008	Akshay Kapoor	4	3
9	101304009	Akshay Kumar	4	3
10	101304010	Akshay Kumar Chaudhary	3	2
11	101304011	Akshay Sharma	0	1
12	101304012	Amandeep Kaur	0	1
13	101304013	Amandeep Singh	8	5
14	101304014	Amaninder Singh Randhawa	6	4
15	101304015	Angad Kapoor	4	3
16	101304016	Ankita Garg	4	3
17	101304018	Anmol Jawa	9	5
18	101304019	Anmolpreet Singh	8	5
19	101304020	Anyuti Tiwary	4	3
20	101304021	Arpit Sharma	0	1
21	101304022	Arsh Kundal	3	2
22	101304023	Arshbir Kaur	8	5
23	101304024	Arshdeep Singh Bagga	2	2
24	101304025	Ashish	3	2
25	101304026	Ashish Rajpal	8	5
26	101304028	Berry Lubana	2	2
27	101304029	Bhanu Duggal	9	5
28	101304030	Bhanu Marwaha	0	1
29	101304031	Chirag Gaba	0	1
30	101304032	Dipin Garg	7	4
31	101304033	DishantVanvari	8	5
32	101304034	DivyeshPratap Singh	2	2
33	101304035	Elham Anwar	2	2
34	101304036	Gurseerat Singh Meen	2	2
35	101304037	Gursewak Singh	2	2
36	101304040	Hariansh Sehgal	7	4
37	101304041	Hartejdeep Singh	2	2
38	101304042	Himanshu Goyal	3	2
39	101304044	Jasjit Singh	2	2
40	101304045	Jassimran Singh Julka	1	1
41	101304046	Jessica Dhaliwal	9	5
42	101304047	Kanwarpal Singh	0	1
43	101304048	Karan Kumar	4	3
44	101304049	Karanjot Singh Kochar	9	5
45	101304050	Kashish Aggarwal	4	3
46	101304051	Kritika Singla	8	5
47	101304052	Love Gaba	8	5
48	101304054	Manik Mittal	0	1
49	101304055	Maninderjit Singh	4	3
50	101304056	Mayank Singla	8	5

51	101304057	Mridul Bhutani	7	4
52	101304058	Naman Garg	8	5
53	101304059	Navdeep Singh	8	5
54	101304060	Navdeep Singh	8	5
55	101304061	Nazuk Aggarwal	8	5
56	101304062	Nishant Garg	8	5
57	101304063	Nishtha Raheja	8	5
58	101304064	Paras Bawa	8	5
59	101304065	Parth Ahuja	8	5
60	101304066	Parushi	8	5
61	101304067	Pency Goyal	2	2
62	101304068	Piyush Jindal	0	1
63	101304069	PiyushTripathi	8	5
64	101304070	Prachi Garg	5	3
65	101304071	Prashant Kataria	0	1
66	101304072	Preeti Garg	8	5
67	101304073	Priyank Arora	7	4
68	101304074	Priyanka	2	2
69	101304075	Priyanka Singh	9	5
70	101304076	Priyansh Mahajan	0	1
71	101304077	Rahul Meena	2	2
72	101304078	Rajan	7	4
73	101304079	Rajat Sharma	8	5
74	101304080	Ratul Goyal	7	4
75	101304081	Ravinder Singh	3	2
76	101304082	Rishabh Juneja	0	1
77	101304083	Robin Manktala	2	2
78	101304084	Rohan Ghai	2	2
79	101304085	Rohan Singla	0	1
80	101304086	Rohan Wadhawan	8	5
81	101304087	Rohit Goyal	7	4
82	101304088	Rubina Bamba	4	3
83	101304089	SagarPulani	7	4
84	101304090	Sahil Kataria	0	1
85	101304091	Sakshi	8	5
86	101304092	Sandal Singh Sidhu	8	5
87	101304093	Sandeep Kaur	7	4
88	101304094	Satripleen Kaur	9	5
89	101304095	Saurabh Mohan	8	5
90	101304096	Shagundeeep Singh	8	5
91	101304097	Shailly Gupta	7	4
92	101304098	Shaina	6	4
93	101304099	Shivika Gupta	3	2
94	101304100	Shresth Rai	2	2

95	101304101	Shubham Goyal	5	3
96	101304102	Shubham Gupta	8	5
97	101304103	Shubham Sharma	0	1
98	101304104	Shubham Sharma	0	1
99	101304105	Shubham Soin	3	2
100	101304106	Siddharth Goyal	8	5
101	101304107	Sidharth Garg	8	5
102	101304108	Simran Kaur	8	5
103	101304109	Simranjit Singh	0	1
104	101304111	Sumit Dhingra	4	3
105	101304112	Sumit Kaushik	1	1
106	101304113	Tushar Dheer	0	1
107	101304114	Tushar Sharma	5	3
108	101304116	Utsav Chhabra	3	2
109	101304117	Vaibhav Gupta	0	1
110	101304118	Vaishali	8	5
111	101304119	Varun Bansal	8	5
112	101304120	Veni Jindal	8	5
113	101304121	Vishal Arora	8	5
114	101304122	YugeshGoyal	4	3
115	101484001	Amandeep Singh	4	3
116	101484002	Amrinder Singh	4	3
117	101484003	Ashmeen Singh	0	1
118	101484004	Azad Singh	0	1
119	101484005	Chandan Garg	0	1
120	101484007	Deepak Singla	8	5
121	101484008	Diljeet Singh	7	4
122	101484009	Jyoti Kaushal	0	1
123	101484011	Pawan Kumar	3	2
124	101484012	Rajat Singla	0	1
125	101484013	Satveer Kaur	3	2
126	101484014	Saurabh Kumar Wadhawan	3	2
127	101484015	Shweta Sharma	8	5
128	101484016	Sukhjeet Singh	4	3

The performance of students through the course UEE522 for the criterion 'PO-10(B)' is summarized in Table PO-10(B).2:

Table PO-10(B).2: Average score of student performance in the course UEE522 for criteria PO-10(B)

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE522	32.81	11.72	14.84	19.53	21.09	3.16

UEE791 : Project semester

The performance of course *UEE791: Project semester* is used to measure the attainment of outcome 'PO-10(B)' using **the approach of final design process optimized through engineering, social, environmental, ethical, economic, financial, institutional and commercial considerations**. The evaluation of the above is obtained by the marks in one of the components of industry mentor assessment (Jan-June, 2016, 5 marks).

The performance of the students in the above component is summarized as given below in Table PO-10(B).3 using Rubrics defined in Table PO-10.1(b).

Table PO-10(B).3: Students' performance in Project work targeting 'PO-10(B)'; Course UEE791

S. No	Roll No.	Name of Student	Total Marks (5)	Score (1-5)
1	101204001	Aashna	4	5
2	101204002	Abhinav Sharma	4	5
3	101204003	Abhishek Jain	4	5
4	101204005	Akash Deep	5	5
5	101204006	Akash Ratna	5	5
6	101204009	Akshu Gupta	5	5
7	101204010	Aman Goyal	4	5
8	101204012	Amit Bansal	5	5
9	101204014	Anukriti Dwivedi	5	5
10	101204015	Arushi Nagpal	5	5
11	101204016	Ayush Vaid	5	5
12	101204018	Chahat Singla	4	5
13	101204019	Deeksha Goyal	5	5
14	101204020	Dhruv Sharma	5	5
15	101204021	Gaurav Arora	4.5	5
16	101204022	Gursharan Kaur	4	5
17	101204023	Gursimran Singh	4	5
18	101204024	Harjot Singh	5	5
19	101204025	Harsh Kothari	5	5
20	101204026	Hemanshu Garg	5	5
21	101204027	Himanshu Takkar	4	5
22	101204028	Iqbal Singh Garcha	3.5	4
23	101204030	Ishjot Singh	3	4
24	101204031	Jasdeep Garg	5	5
25	101204033	Jasleen Kaur	5	5
26	101204035	Kapil Kinger	4	5
27	101204038	Karanveer Singh Bhangoo	4	5
28	101204039	Kartik Arora	4	5
29	101204041	Kaustubh Singh	4	5
30	101204043	Lovely Goyal	5	5
31	101204045	Manik Mittal	5	5
32	101204046	Marshall	4	5
33	101204048	Mohit Kukkar	3	4
34	101204049	Mohit Manhas	4	5

35	101204051	Nalin Kaushik	5	5
36	101204053	Nishant Arora	5	5
37	101204054	P Siddharth	4	5
38	101204057	Rahul Kamboj	5	5
39	101204060	Rajatdeep Singh	4	5
40	101204061	Ramanpreet Kaur	4.5	5
41	101204063	Sahil Arora	4	5
42	101204064	Sahil Mittal	5	5
43	101204065	Sanchit Goel	5	5
44	101204066	Sewak Ram	4	5
45	101204067	Sheenu	5	5
46	101204069	Shubham Bhatia	5	5
47	101204070	Shubham Goel	5	5
48	101204071	Shubham Kansal	5	5
49	101204074	Sukhdarshanpal Singh	4	5
50	101204075	Sultan Singh	4	5
51	101204076	Tejasvi Anand	5	5
52	101254003	SachinPathak	5	5
53	101254004	SrijanAditya	4	5
54	101254005	NavjotKaur	5	5
55	101254006	Milan Jain	4	5
56	101254008	Gaurav	4	5
57	101254009	Varun Khanna	4	5
58	101254010	Swati Srivastava	4	5
59	101254012	Shubham Singla	5	5
60	101254013	Sorabh Devgun	5	5
61	101254014	Paras Ghai	4	5
62	101254016	Sachin Gupta	5	5
63	101254017	Nakul Kumar	4	5
64	101384001	AnkurSingla	3.5	4
65	101384002	Gagandeep Singh	4	5
66	101384004	Himanshu Bansal	5	5
67	101384005	Navdeep Singh	3	4
68	101384006	Parampreet Singh	5	5
69	101384007	Saurav Goyal	4	5
70	101384008	Surjeet Singh	3	4

The performance of students through the course UEE791 for criteria 'PO-10(B)' is summarized in Table PO-10(B).4

Table PO-10(B).4: Average score of program performance in the course UEE791 for criteria PO-10(B)

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE791	91.43	8.57	0.00	0.00	0.00	4.91

The data from Table PO-10(B).2 and Table PO-10(B).4 is used to evaluate weighted average of direct measure through course portfolio for criteria PO-10(B), and is summarised in Table PO-10(B).5.

Table PO-10(B).5: Weighted Average Student class performance (Course Portfolio) for criteria PO-10(B)

Course	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE522	32.81	11.72	14.84	19.53	21.09	3.16
UEE791	91.43	8.57	0.00	0.00	0.00	4.91
Weighted Average Score	62.12	10.15	7.42	9.77	10.55	4.04

b) Indirect measures

The indirect measurement of performance criteria 'PO-10(B)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-10(B).6 and Table PO-10(A).7.

(i) Assessment Tools: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-10(B)'.

UEE522	Analyze about various energy related aspect of electrical system
UEE791	Demonstrate the knowledge of professional responsibilities and respect for ethics

Table PO-10(B).6: Weighted average score of performance criterion 'PO-10(B)' based on student course surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE522	18.85	34.42	28.68	12.29	5.73	3.48
UEE791	35.71	28.57	27.14	5.71	2.86	3.89
Weighted average score	27.28	31.49	27.91	9	4.29	3.68

(ii) Assessment Tool: Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-10' through indirect measurement is summarised in Table PO-10(A).7.

c) Overall weighted average score of performance criterion 'PO-10(B)'

The overall weighted average score of performance criterion 'PO-10(B)' is summarised in Table PO-10(B).8 from the data given in Table PO-10(B).5 , PO-10(B).6 and PO-10(A).7.

Table PO-10(B).8: Overall weighted average score of performance criterion 'PO-10(B)'

Assessment Tool	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance	62.12	10.15	7.42	9.77	10.55	4.04	5
Course surveys	27.28	31.49	27.91	9	4.29	3.68	4
Other surveys	34.11	41.87	20.79	2.41	0.80	4.06	3
Overall weighted score	43.5	25.19	17.59	7.67	6.02	3.95	

Overall assessment of program outcome PO-10 using scores of PO-10(A) and PO-10(B)

In the previous sections, each of the individual performance criteria PO-10(A) and PO-10(B) have been assessed. The performance for attainment of outcome PO-10 has been completed using the attainment values for PO-10(A) and PO-10(B) and is provided below:

Table PO-10.2 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome PO-10.

Table PO-10.2: Overall score for outcome PO-10 at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
PO-10(A)	22.34	27.6	25.3	13.38	11.36	3.36	5
PO-10(B)	43.5	25.19	17.59	7.67	6.02	3.95	5
Overall score	32.92	52.79	21.44	10.52	8.69	3.65	

The performance criteria wise assessment score distribution of outcome 'PO-10' is shown in Fig. PO-10.2.

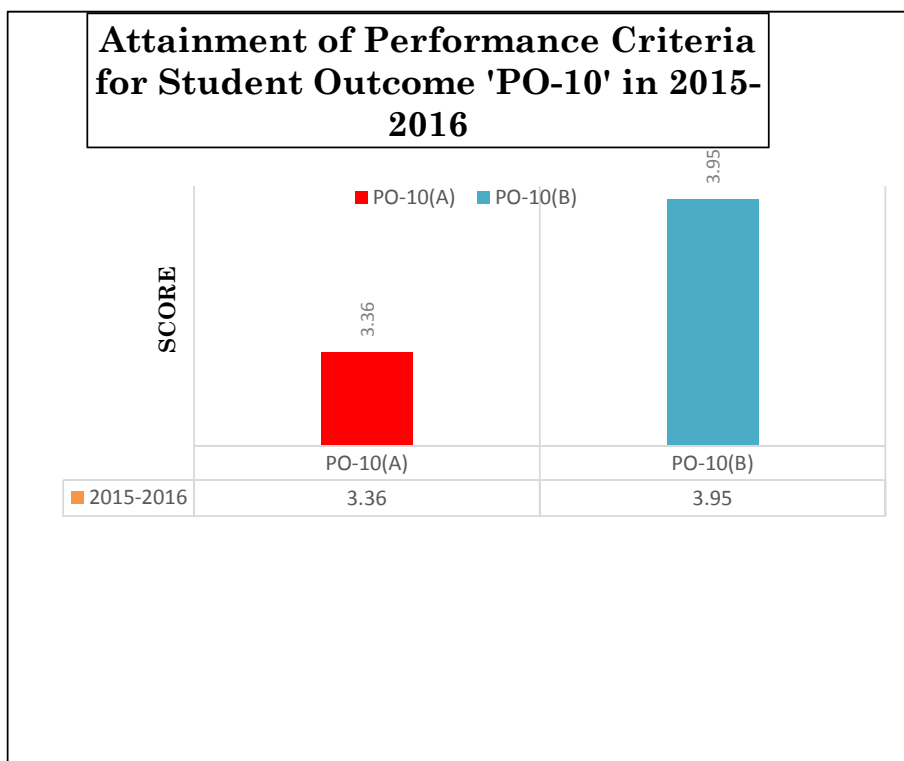


Figure PO-10.2: Performance criteria-wise assessment score distribution of outcome 'PO-10'

The data presented above pertains to the courses offered during the academic year 2015-16.

Assessment of Attainment of Program Outcome

PO-11

*An ability to use the techniques, skills, and modern engineering tools necessary
for engineering practice*

(2015-16)

for the
Bachelor of Engineering
in
Electrical Engineering



THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Electrical & Instrumentation Engineering Department
Thapar Institute of Engineering & Technology, Patiala
(Punjab) -INDIA

Attainment of Program Outcome ‘PO-11’

The attainment of program outcome **PO-11: An ability to apply knowledge of mathematics, science, and engineering** has been measured using a standard procedure for the BE Electrical Engineering program.

The Program outcome ‘PO-11’ has been classified into following performance criteria:

PO-11(A): *Able to use modern engineering techniques/equipment*

PO-11(B): *Able to develop systems for engineering applications*

PO-11(C): *Able to analyze engineering problems using software tools*

The program assessment committee identified the following courses for the assessment of program outcome ‘PO-11’:

- UMA062: Graph Theory and Applications
- **UEI201: Analog Electronic Devices and Circuits**
- **UEE502: High Voltage Engineering**
- **UEE 504: Power Electronics**
- UEI 511: Principles of Communication Engineering
- UEI512: Robotics and Related Instrumentation
- **UEE601: Flexible AC Transmission Systems**
- **UEE602: Power System Analysis and Stability**
- UEE603: Switchgear & Protection
- UEI622:Data Networks
- UEE791: Project Semester
- UEE793: Capstone Project
- **UEE802: Intelligent Algorithms in Power Systems**
- UEE804: Operation and Control of Power Systems
- UEE 841: Industrial Electronics
- UEE844: Transients in Power Systems
- UEE845: Microcontrollers and Applications

Outcome PO-11 has been assessed through three performance criteria PO-11(A), PO-11(B) and PO-11(C). The following courses have been considered by the program assessment committee for the assessment of performance criteria ‘PO-11(A)’, ‘PO-11(B)’ and ‘PO-11(C)’ for the academic year 2015-16.

Performance Criteria	Course -1	Course-2
PO-11(A)	UEE601: Flexible AC Transmission Systems	UEE502: High Voltage Engineering
PO-11(B)	UEI201: Analog Electronic Devices and Circuits	UEE504: Power Electronics
PO-11(C)	UEE802: Intelligent Algorithms in Power Systems	UEE804: Operation and control of Power Systems

The step by step methodology used to measure the attainment of program outcome 'PO-11' is shown in Fig. PO-11.1 for academic year (AY) 2015-16. The similar procedure is followed to measure the attainment of program outcome 'PO-11' for all three academic years under consideration.

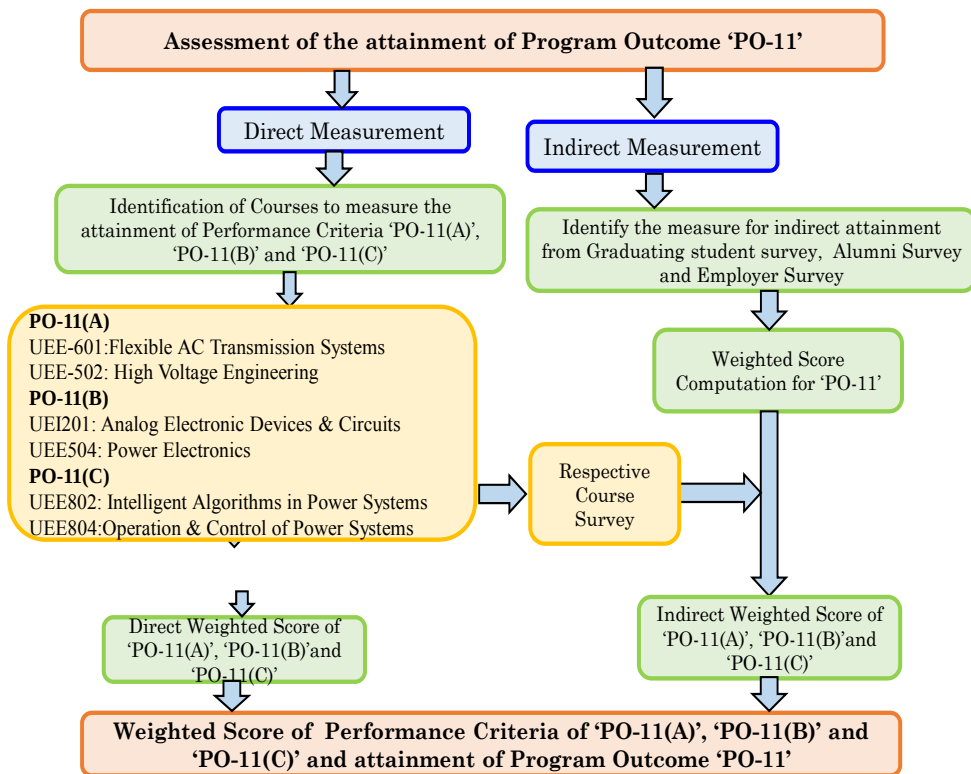


Fig. PO-11.1: Process for measurement of attainment of outcome 'PO-11' for the year 2015-16

The following Rubric has been used to convert marks obtained by the students to a Likert scale in the range of 1 to 5 and is described in Table PO-11.1(a) and Table PO-11.1(b) in most cases unless specifically mentioned.

Table PO-11.1(a): Rubric for Outcome Measurement

S. No.	Range of Marks (%)	Score (1-5)
1	$75 \leq \text{Marks} < 100$	5
2	$60 \leq \text{Marks} < 75$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

Table PO-11.1(b): Rubric for Outcome Measurement

S. No.	Range of Marks (%)	Score (1-5)
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1	$80 \leq \text{Marks} < 100$	5
2	$60 \leq \text{Marks} < 80$	4
3	$40 \leq \text{Marks} < 60$	3
4	$20 \leq \text{Marks} < 40$	2
5	$0 \leq \text{Marks} < 20$	1

The following sections summarize separate assessments for each of the performance criterion using the subjects mentioned.

Assessment of Outcome 'PO-11' using performance criterion PO-11(A)

PO-11(A): Able to use modern engineering techniques/equipment.

The performance criteria 'PO-11(A)' has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students' performance using Course Portfolio

Two courses namely *UEE601: Flexible AC Transmission Systems* and *UEE502: High Voltage Engineering* are used to assess performance criteria A1 as a direct measure. The analysis for each of these courses is provided below:

UEE601: Flexible AC Transmission Systems

The performance of course *UEE601: Flexible AC Transmission Systems* is used to measure the attainment of outcome 'PO-11(A)' through the End Semester Examination (Question No. 3, Jan-June 2016, 15 marks)

Question:

Q.3	With the help of equal area criterion explain the transient stability margin for a simple two machine system without compensation and with an ideal midpoint shunt compensation.	(15)
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The performance of the students in the above question is then summarized as given below in Table PO-11(A).1 using rubrics defined in Table PO-11.1(a).

Table PO-11(A).1: Students' performance in question targeting 'PO-11(A)'; Course UEE601

S. No	Roll No.	Name of Student	Marks (15)	Score (1-5)
1	101304001	Aarushi Bajaj	15	5
2	101304002	Abhey Arora	15	5
3	101304003	Abhishek Taksali	7	3
4	101304004	Adhikaansh Tayal	5	2
5	101304005	Aditi Narang	10	4
6	101304006	Aditya	12	5
7	101304007	Akshat	15	5
8	101304008	Akshay Kapoor	10	4
9	101304009	Akshay Kumar	10	4
10	101304010	Akshay Kumar Chaudhary	3	2
11	101304011	Akshay Sharma	2	1
12	101304012	Amandeep Kaur	6	3
13	101304013	Amandeep Singh	7	3
14	101304014	Amaninder Singh	15	5
15	101304015	Angad Kapoor	10	4
16	101304016	Ankita Garg	10	4
17	101304017	Ankur Malik	0	1
18	101304018	Anmol Jawa	14	5
19	101304019	Anmolpreet Singh	12	5
20	101304020	Anyuti Tiwary	10	4
21	101304021	Arpit Sharma	12	5
22	101304022	Arsh Kundal	10	4
23	101304023	Arshbir Kaur	15	5
24	101304024	Arshdeep Singh Bagga	2	1
25	101304025	Ashish	7	3
26	101304026	Ashish Rajpal	13	5
27	101304028	Berry Lubana	8	3
28	101304029	Bhanu Duggal	12	5
29	101304030	Bhanu Marwaha	8	3
30	101304031	Chirag Gaba	15	5
31	101304032	Dipin Garg	10.5	4
32	101304033	Dishant Vanvari	9	4
33	101304034	Divyesh Pratap Singh	12	5
34	101304035	Elham Anwar	12	5
35	101304036	Gurseerat Singh Meen	2	1
36	101304037	Gurseywak Singh	15	5
37	101304040	Hariansh Sehgal	0	1
38	101304041	Hartejdeep Singh	12	5
39	101304042	Himanshu Goyal	15	5
40	101304044	Jasjit Singh	0	1

S. No	Roll No.	Name of Student	Marks (15)	Score (1-5)
41	101304045	Jassimran Singh Julka	8	3
42	101304046	Jessica Dhaliwal	10	4
43	101304047	Kanwarpal Singh	4	2
44	101304048	Karan Kumar	10	4
45	101304049	Karanjot Singh Kochar	10	4
46	101304050	Kashish Aggarwal	12	5
47	101304052	Love Gaba	10	4
48	101304054	Manik Mittal	15	5
49	101304055	Maninderjit Singh	6	3
50	101304056	Mayank Singla	7	3
51	101304057	Mridul Bhutani	12	5
52	101304058	Naman Garg	13	5
53	101304059	Navdeep Singh	12	5
54	101304060	Navdeep Singh	15	5
55	101304062	Nishant Garg	10.5	4
56	101304094	Satripleen Kaur	12	5
57	101484001	Amandeep Singh	15	5
58	101484002	Amrinder Singh	15	5
59	101484003	Ashmeen Singh	2	1
60	101484004	Azad Singh	8	3
61	101484005	Chandan Garg	12	5
62	101484007	Deepak Singla	15	5
63	101484008	Diljeet Singh	15	5

The performance of students through the course UEE601 for criteria PO-11(A) is summarized in Table PO-11(A).2

Table PO-11(A).2: Average score of student performance in the course UEE601 for criteria PO-11(A)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE601	46.03	22.22	15.87	4.76	11.11	3.87

UEE502: High Voltage Engineering

The performance of course UEE502: High Voltage Engineering is used to measure the attainment of outcome 'PO-11(A)' through Lab Viva + Lab Performance on the basis of experiments performed on measurement of HVAC, HVDC and impulse voltage; measurement of capacitance and $\tan \delta$ for solid and liquid dielectrics and measurement of breakdown voltage test for transformer oil etc. (July-Dec 2015, 10 marks).

The performance of the students in the above question is summarized in Table PO-11(A).3 using rubrics defined in Table PO-11.1(b).

Table PO-11(A).3: Students' performance in question targeting 'PO-11(A)'; Course UEE502

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
1	101304001	Aarushi Bajaj	8	5
2	101304002	Abhey Arora	10	5
3	101304003	Abhishek Taksali	9	5
4	101304004	Adhikaansh Tayal	7	4
5	101304005	Aditi Narang	9	5
6	101304006	Aditya	9	5
7	101304007	Akshat	8	5
8	101304008	Akshay Kapoor	6	4
9	101304009	Akshay Kumar	7	4
10	101304010	Akshay Kumar Chaudhary	8	5
11	101304011	Akshay Sharma	6	4
12	101304012	Amandeep Kaur	9	5
13	101304013	Amandeep Singh	8	5
14	101304014	Amaninder Singh Randhawa	8	5
15	101304015	Angad Kapoor	8	5
16	101304016	Ankita Garg	6	4
17	101304017	Ankur Malik	6	4
18	101304018	Anmol Jawa	6	4
19	101304019	Anmolpreet Singh	6	4
20	101304020	Anyuti Tiwary	6	4
21	101304021	Arpit Sharma	10	5
22	101304022	Arsh Kundal	8	5
23	101304023	Arshbir Kaur	8	5
24	101304024	Arshdeep Singh Bagga	8	5
25	101304025	Ashish	9	5
26	101304026	Ashish Rajpal	8	5
27	101304028	Berry Lubana	8	5
28	101304029	Bhanu Duggal	9	5
29	101304030	Bhanu Marwaha	8	5
30	101304031	Chirag Gaba	7	4
31	101304032	Dipin Garg	8	5
32	101304033	Dishant Vanvari	7	4
33	101304034	Divyesh Pratap Singh	6	4
34	101304035	Elham Anwar	7	4

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
35	101304036	Gurseerat Singh Meen	6	4
36	101304037	Gursewak Singh	7	4
37	101304040	Hariansh Sehgal	8	5
38	101304041	Hartejdeep Singh	7	4
39	101304042	Himanshu Goyal	7	4
40	101304044	Jasjit Singh	8	5
41	101304045	Jassimran Singh Julka	9	5
42	101304046	Jessica Dhaliwal	6	4
43	101304047	Kanwarpal Singh	6	4
44	101304048	Karan Kumar	9	5
45	101304049	Karanjot Singh Kochar	6	4
46	101304050	Kashish Aggarwal	6	4
47	101304052	Love Gaba	8	5
48	101304054	Manik Mittal	4	3
49	101304055	Maninderjit Singh	6	4
50	101304056	Mayank Singla	8	5
51	101304057	Mridul Bhutani	8	5
52	101304058	Naman Garg	7	4
53	101304059	Navdeep Singh	7	4
54	101304060	Navdeep Singh	8	5
55	101304062	Nishant Garg	6	4
56	101304094	Satripleen Kaur	6	4
57	101484001	Amandeep Singh	10	5
58	101484002	Amrinder Singh	8	5
59	101484003	Ashmeen Singh	8	5
60	101484004	Azad Singh	6	4
61	101484005	Chandan Garg	8	5
62	101484007	Deepak Singla	7	4
63	101484008	Diljeet Singh	9	5

The performance of students through the course UEE502 for criteria PO-11(A) is summarized in Table PO-11(A).4.

Table PO-11(A).4: Average score of student performance in the course UEE502 for criteria PO-11(A)

Course	% of students in each score					Average Score
	5	4	3	2	1	

UEE502	53.97	44.44	1.59	0.0	0.0	4.52
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The data from Table PO-11(A).2 and Table PO-11(A).4 is used to evaluate weighted average of direct measure through course portfolio for criteria 'PO-11(A)', and is summarised in Table PO-11(A).5.

Table PO-11(A).5: Weighted Average Student class performance (course portfolio) for criteria PO-11(A)

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE601	46.03	22.22	15.87	4.76	11.11	3.87
UEE502	53.97	44.44	1.59	0.0	0.0	4.52
Student class performance score	50	33.33	8.73	2.38	5.56	4.19

b) Indirect Measures:

The indirect measurement of performance criteria 'PO-11(A)' has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-11(A).6 and Table PO-11(A).7.

(i) Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of 'PO-11(A)'.

UEE601	Decide the scheme for power system stability and voltage control.
UEE502	- Analyse and calculate the circuit parameters involved in generation of high voltages - Measure direct, alternating and impulse high voltage signals.

Table PO-11(A).6: Weighted average score of performance criterion 'PO-11(A)' based on student course surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE601	24.59	18.85	28.69	12.29	15.57	3.25
UEE502	15	25	43.33	14.65	2.5	3.36
Course survey score	19.79	21.93	36.01	13.47	9.03	3.31

(ii) Assessment Tool: Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'PO-11' through indirect measurement using following question in the respective surveys.

Graduating Survey	An ability to use the techniques, skills, and modern engineering tools necessary
-------------------	--

Alumni Survey	for engineering practice
Employer Survey	Do our students have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice?

Table PO-11(A).7: Weighted average score of performance criterion ‘PO-11(A)’ based on other surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating student survey	22.22	35.56	33.33	4.44	4.44	3.67
Employer survey	40.00	53.33	6.67	0.00	0.00	4.33
Alumni survey	28.02	41.06	24.64	5.31	0.97	3.90
Other surveys score	30.08	43.32	21.55	3.25	1.8	3.97

c) Overall weighted average score of performance criterion ‘PO-11(A)’

The overall weighted average score of performance criterion ‘PO-11(A)’ is summarised in Table PO-11(A).8 from the data given in Tables PO-11(A).5, PO-11(A).6 and PO-11(A).7.

Table PO-11(A).8: Overall weighted average score of performance criterion ‘PO-11(A)’

Course	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance score	50	33.33	8.73	2.38	5.56	4.19	5
Course surveys score	19.79	21.93	36.01	13.47	9.03	3.31	4
Other surveys score	30.08	43.32	21.55	3.25	1.8	3.97	3
Overall weighted score	34.95	32.03	21.03	6.29	5.78	3.84	-

Assessment of Outcome ‘PO-11’ using performance criterion PO-11(B)

PO-11(B): Able to develop systems for engineering applications.

The performance criteria ‘PO-11(B)’ has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

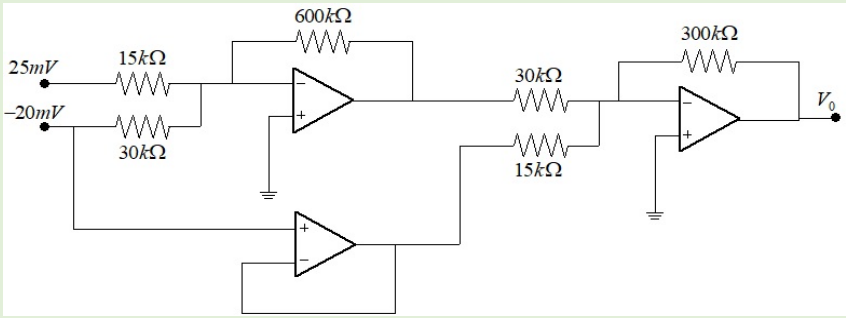
(i) Assessment Tool: Students’ performance using Course Portfolio

Two courses namely *UEI201: Analog Electronic Devices and Circuits* and *UEE504: Power Electronics* are used to assess performance criteria A1 as a direct measure. The analysis for each of these courses is provided below:

UEI201: Analog Electronic Devices and Circuits

The performance of course *UEI201: Analog Electronic Devices and Circuits* is used to measure the attainment of outcome 'PO-11(B)' through the End Semester Examination (Question No. 4 (b) and Question No. 5, July-Dec 2015, 30 marks).

Question:

Q.4 (b)	(i) Draw the circuit diagram of a shunt voltage regulator and find out the regulated voltage and circuit currents. Given $V_i=22V$, $R_s=120\Omega$, $V_Z=8.2V$, $V_{BE}=0.7V$ and $R_L=100\Omega$ (ii) Draw the circuit diagram of a RC phase shift oscillator and write down the expression for obtaining the frequency of oscillations. (iii) For an FET oscillator with circuit values $C_1=750\text{ pF}$, $C_2=2500\text{ pF}$ and $L=40\mu\text{H}$. Determine the circuit oscillation frequency.	
Q.5	Discuss the characteristics of an ideal Op-Amp. Find out the output voltage for the circuit shown below: 	(30)

The performance of the students in the above question is summarized in Table PO-11(B).1 using rubrics defined in Table PO-11.1(a).

Table PO-11(B).1: Students' performance in question targeting 'PO-11(B)'; Course UEI201

S. No	Roll No.	Name of Student	Marks (30)	Score (1-5)
1	101404001	Abhay Mahipal	16.0	3
2	101404002	Abhijit	10.5	2
3	101404004	Abhinav Arora	12.0	3
4	101404006	Abhishek Sharma	20.0	4
5	101404007	Ajay Singh	16.0	3
6	101404009	Alka Thakur	18.0	4
7	101404012	Ankush Goyal	27.5	5
8	101404013	Anmol Arjun	12.5	3
9	101404014	Anmol Goyat	21.0	4
10	101404015	Anmol Rattan kaur	20.0	4

S. No	Roll No.	Name of Student	Marks (30)	Score (1-5)
11	101404017	Anubhav	6.0	2
12	101404018	Apeksha Goel	16.0	3
13	101404019	Arnish Jain	18.5	4
14	101404020	Arshiya	12.0	3
15	101404021	Arshjot Kaur	15.0	3
16	101404023	Ayush Jain	30.0	5
17	101404024	Bhawani Singh	7.0	2
18	101404025	Chirag Jain	28.5	5
19	101404026	Davileen	26.0	5
20	101404027	Dilpreet Kaur	11.0	2
21	101404028	Divesh Kamdar	12.0	3
22	101404029	Divyam Aggrawal	19.0	4
23	101404031	Divyanshu	22.0	4
24	101404032	Garima	13.0	3
25	101404033	Garv Chahar	9.0	2
26	101404035	Gaurav Rathore	2.0	1
27	101404036	Gurpreet Singh	8.0	2
28	101404037	Gursagar Singh	20.5	4
29	101404038	Gurupinder Pal	28.0	5
30	101404039	Harmanpreet Singh	3.5	1
31	101404041	Harshit Kaushik	10.0	2
32	101404042	Harshvir	27.5	5
33	101404043	Harsimarjot	16.0	3
34	101404044	Harsimran	8.0	2
35	101404045	Hartej	15.5	3
36	101404046	Heema Gupta	6.0	2
37	101404047	Hitesh	10.5	2
38	101404048	Ishita	17.0	3
39	101404049	Jagmeet Singh	14.5	3
40	101404050	Jagnoor	22.0	4
41	101404051	Jashanpreet Singh	16.0	3
42	101404052	Jatin Bansal	20.0	4
43	101404053	Jatin Rahija	16.5	3
44	101404054	Kanishak Sharma	19.0	4
45	101404055	Karan Bajaj	16.5	3
46	101404056	Kirtish Madaan	23.0	5
47	101404057	Mahitosh Sharma	24.0	5

S. No	Roll No.	Name of Student	Marks (30)	Score (1-5)
48	101404058	Manan	30.0	5
49	101404059	Mandeep	18.5	4
50	101404060	Manisha	28.0	5
51	101404061	Manit Gupta	24.0	5
52	101404062	Manjosh Singh	29.0	5
53	101404063	Manpreet Singh	25.0	5
54	101404064	Manvir Kaur	17.5	3
55	101404065	Mehak Bhatia	13.0	3
56	101404066	Mithilesh Kumar	12.5	3
57	101404067	Mohit Goyal	28.0	5
58	101404068	Mridul Marwaha	28.0	5
59	101404069	Mudit Arora	27.0	5
60	101404070	Naveen Prashar	14.0	3
61	101404072	Nigam	10.5	2
62	101404073	Nikhil Danodia	7.0	2
63	101404074	Nishita	20.0	4
64	101404075	Nitin Gupta	26.0	5
65	101404076	Nitish Arora	27.5	5

The overall performance of students for the above criterion is summarized in Table PO-11(B).2

Table PO-11(B).2: Average score of student performance in the course UEI201 for criteria PO-11(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEI201	27.69	20.00	30.77	18.46	3.08	3.51

UEE504: Power Electronics

The performance of course UEE504: Power Electronics is used to measure the attainment of outcome 'PO-11(B)' through the End Semester Examination (Question No. 2, 3 (a), (b), July-Dec 2015, 24 marks).

Question:

Q.2	Draw the three phase power circuit and sinusoid for three phase half wave phase controlled rectifier and explain the operation at firing angle 30 degree and 60 degree also draw the output voltage waveform?	(24)
Q3	(a) A single-phase full converter is made to deliver a constant load current. For zero degree firing angle, the overlap angle is 10°. Calculate the overlap angle when firing angle is (a) 30° (b) 45° and (c) 60°.	

	(b) Draw the circuit diagram of single phase practical dual converter and explain the operation of circulating current mode?	
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The performance of the students in the above question is summarized in Table PO-11(B).3 using rubrics defined in Table PO-11.1(a).

Table PO-11(B).3: Students' performance in question targeting 'PO-11(B)'; Course UEE504

S. No	Roll No.	Name of Student	Marks (24)	Score (1-5)
1	101304051	Kritika Singla	19.5	5
2	101304061	Nazuk Agrawal	19	5
3	101304063	Nishtha Raheja	5	2
4	101304064	Paras Bawa	0	1
5	101304065	Parth Ahuja	5	2
6	101304066	Parushi	9	2
7	101304067	Pency Goyal	4	1
8	101304068	Piyush Jindal	3	1
9	101304069	Piyush Tripathi	6	2
10	101304070	Prachi Garg	13	3
11	101304071	Prashant Kataria	0.5	1
12	101304072	Preeti Garg	10	3
13	101304073	Priyank Arora	17.5	4
14	101304074	Priyanka	5	2
15	101304075	Priyanka Singh	17	4
16	101304076	Priyansh Mahajan	0.5	1
17	101304079	Rajat Sharma	18.5	5
18	101304080	Ratul Goyal	1	1
19	101304081	Ravinder Singh	17.5	4
20	101304082	Rishabh Juneja	11	3
21	101304083	Robin Manktala	5	2
22	101304084	Rohan Ghai	15.5	4
23	101304085	Rohan Singla	17	4
24	101304086	Rohan Wadhawan	9	2
25	101304087	Rohit Goyal	11	3
26	101304088	Rubina Bamba	3	1
27	101304089	Sagar Pulani	17	4
28	101304090	Sahil Kataria	17	4
29	101304091	Sakshi	4	1
30	101304092	Sandal Singh Sidhu	7	2

S. No	Roll No.	Name of Student	Marks (24)	Score (1-5)
31	101304093	Sandeep Kaur	4	1
32	101304095	Saurabh Mohan	8.5	2
33	101304097	Shailly Gupta	17	4
34	101304098	Shaina	8	2
35	101304099	Shivika Gupta	6	2
36	101304100	Shresth Rai	8	2
37	101304101	Shubham Goyal	6	2
38	101304105	Shubham Soin	10	3
39	101304106	Siddharth Goyal	8	2
40	101304107	Sidharth Garg	3	1
41	101304108	Simran Kaur	17.5	4
42	101304112	Sumit Kaushik	10.5	3
43	101304113	Tushar Dhir	6	2
44	101304116	Utsav Chhabra	6	2
45	101304119	Varun Bansal	16.5	4
46	101304121	Vishal Arora	4	1
47	101484009	Jyoti Kaushal	16	4
48	101484011	Pawan Kumar	8	2
49	101484012	Rajat Singla	9.5	2
50	101484013	Satveer Kaur	4	1
51	101484014	Saurabh Kumar	10	3
52	101484005	Chandan Garg	6	2
53	101484007	Deepak Singla	11	3
54	101484008	Diljeet Singh	10.5	3
55	101484015	Shweta Sharma	12	3

The performance of students through the course UEE504 for criteria PO-11(B) is summarized in Table PO-11(B).4.

Table PO-11(B).4: Average score of student performance in the course UEI501 for criteria PO-11(B)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE504	5.45	20.00	18.18	34.55	21.82	2.53

The data from Table PO-11(B).2 and Table PO-11(B).4 is used to evaluate weighted average of direct measure through course portfolio for criteria 'PO-11(B)', and is summarised in Table PO-11(B).5.

Table PO-11(B).5: Weighted Average Student class performance (course portfolio) for criteria PO-11(B)

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEI201	27.69	20	30.77	18.46	3.08	3.51
UEE504	5.45	20.00	18.18	34.55	21.82	2.53
Student class performance score	16.57	20	24.47	26.5	12.45	3.02

b) Indirect Measures:

The indirect measurement of performance criteria ‘PO-11(B)’ has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-11(B).6 and Table PO-11(B).7.

(iii) Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of ‘PO-11(B)’.

UEI201	Explain the working of different power supply circuits, amplifiers and oscillators.
UEE504	Analyze the operation and control of single-phase and three-phase converter circuits with application to different types of load.

Table PO-11(B).6: Weighted average score of performance criterion ‘PO-11(B)’ based on student course surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEI201	24.14	31.03	31.03	10.34	3.45	3.62
UEE504	10	11.67	38.33	23.33	16.67	2.75
Weighted average score	17.07	21.35	34.68	16.84	10.06	3.19

(iv) Assessment Tool: Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of student outcome ‘PO-11’ through indirect measurement using following question in the respective surveys.

Graduating Survey	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
Alumni Survey	
Employer Survey	Do our students have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice?

Table PO-11(B).7: Weighted average score of performance criterion ‘PO-11(B)’ based on other surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	

Graduating student survey	22.22	35.56	33.33	4.44	4.44	3.67
Employer survey	40.00	53.33	6.67	0.00	0.00	4.33
Alumni survey	28.02	41.06	24.64	5.31	0.97	3.90
Other surveys score	30.08	43.32	21.55	3.25	1.8	3.97

c) Overall weighted average score of performance criterion ‘PO-11(B)’

The overall weighted average score of performance criterion ‘PO-11(B)’ is summarised in Table PO-11(B).8 from the data given in Tables PO-11(B).5, PO-11(B).6 and PO-11(B).7.

Table PO-11(B).8: Overall weighted average score of performance criterion ‘PO-11(B)’

Course	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance score	16.57	20	24.47	26.5	12.45	3.02	5
Course surveys score	17.07	21.35	34.68	16.84	10.06	3.19	4
Other surveys score	30.08	43.32	21.55	3.25	1.8	3.97	3
Overall weighted score	20.11	26.28	27.14	17.47	8.99	3.31	-

Assessment of Outcome ‘PO-11’ using performance criterion PO-11(C)

PO-11(C): Able to analyze engineering problems using software tools.

The performance criteria ‘PO-11(C)’ has been measured through direct assessment using the course portfolio and indirect assessment using course surveys and other surveys (Graduating student survey, Alumni survey and Employer survey).

a) Direct Measures:

(i) Assessment Tool: Students’ performance using Course Portfolio

Two courses namely *UEE802: Intelligent Algorithms in Power Systems* and *UEE804: Operation and Control of Power Systems* are used to assess performance criteria PO-11(C) as a direct measure. The analysis for each of these courses is provided below:

UEE802: Intelligent Algorithms in Power Systems

The performance of course *UEE802: Intelligent Algorithms in Power Systems* is used to measure the attainment of outcome ‘PO-11(C)’ through Laboratory marks (July-Dec15, 15 marks)

The performance of the students in the above question is then summarized as given below in Table PO-11(C).1 using rubrics defined in Table PO-11.1(b).

Table PO-11(C).1: Students' performance in question targeting 'PO-11(C)'; Course UEE802

S. No	Roll No.	Name of Student	Marks (15)	Score (1-5)
1	101204001	Aashna	4	2
2	101204002	Abhinav Sharma	6	3
3	101204003	Abhishek Jain	6	3
4	101204004	Aditya Jain	4	2
5	101204005	Akash Deep	7	3
6	101204006	Akash Ratna	6	3
7	101204009	Akshu Gupta	4	2
8	101204010	Aman Goyal	4	2
9	101204011	Amarpreet	3	2
10	101204012	Amit Bansal	5	2
11	101204013	Anshul Kumar	3	2
12	101204014	Anukriti Dwivedi	8	3
13	101204015	Arushi Nagpal	9	4
14	101204016	Ayush Vaid	5	2
15	101204018	Chahat Singla	8	3
16	101204019	Deeksha Goyal	10	4
17	101204020	Dhruv Sharma	6	3
18	101204021	Gaurav Arora	4.5	2
19	101204022	Gursharan Kaur	8	3
20	101204023	Gursimran Singh	7.5	3
21	101204024	Harjot Singh	5	2
22	101204025	Harsh Kothari	5	2
23	101204026	Hemanshu Garg	6.5	3
24	101204027	Himanshu Takkar	7.5	3
25	101204028	Iqbal Singh Garcha	5.5	2
26	101204030	Ishtjot Singh	4	2
27	101204031	Jasdeep Garg	7	3
28	101204033	Jasleen Kaur	8	3
29	101204035	Kapil Kinger	7	3
30	101204037	Karanbir Singh Kahlon	6	3
31	101204038	Karanveer Singh Bhangoo	7	3
32	101204039	Kartik Arora	4	2
33	101204040	Kashish Sethi	7.5	3
34	101204041	Kaustubh Singh	5	2
35	101204042	Krishnank Atrey	7.5	3
36	101204043	Lovely Goyal	6	3
37	101204045	Manik Mittal	6	3
38	101204046	Marshall	6	3
39	101204048	Mohit Kukkar	6	3

S. No	Roll No.	Name of Student	Marks (15)	Score (1-5)
40	101204049	Mohit Manhas	6	3
41	101204051	Nalin Kaushik	6	3
42	101204053	Nishant Arora	5.5	2
43	101204054	P Siddharth	8	3
44	101204057	Rahul Kamboj	5	2
45	101204059	Rajat Sahore	4	2
46	101204060	Rajatdeep Singh	6	3
47	101204061	Ramanpreet Kaur	6	3
48	101204063	Sahil Arora	8	3
49	101204064	Sahil Mittal	5	2
50	101204065	Sanchit Goel	6	3
51	101204066	Sewak Ram	7	3
52	101204067	Sheenu	4	2
53	101204069	Shubham Bhatia	5	2
54	101204070	Shubham Goel	6.5	3
55	101204071	Shubham Kansal	5	2
56	101204074	Sukhdarshanpal Singh	5	2
57	101204075	Sultan Singh	6	3
58	101204076	Tejasvi Anand	3	2
59	101254001	Sahilpreet Singh	5.5	2
60	101254002	Naman Kumar	3	2
61	101254003	Sachin Pathak	7	3
62	101254004	Srijan Aditya	4.5	2
63	101254005	Navjot Kaur	9	4
64	101254006	Milan Jain	7	3
65	101254008	Gaurav	5	2
66	101254009	Varun Khanna	5	2
67	101254010	Swati Srivastava	5	2
68	101254012	Shubham Singla	5	2
69	101254013	Sorabh Devgun	5.5	2
70	101254014	Paras Ghai	6	3
71	101254016	Sachin Gupta	9	4
72	101254017	Nakul Kumar	6	3
73	101384001	Ankur Singla	5.5	2
74	101384002	Gagandeep Singh	3	2
75	101384004	Himanshu Bansal	6.5	3
76	101384005	Navdeep Singh	6.5	3
77	101384006	Parampreet Singh	4	2
78	101384007	Saurav Goyal	11	4
79	101384008	Surjeet Singh	5	2

The overall performance of students for the above criterion is summarized in Table PO-11(C).2

Table PO-11(C).2: Average score of student performance in the course UEE802 for criteria PO-11(C)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE802	0.00	6.33	48.10	45.57	0.00	2.61

UEE804: Operation and Control of Power Systems

The performance of course UEE804: Operation and Control of Power Systems is used to measure the attainment of outcome 'PO-11(C)' through Laboratory marks (Jan-June 2016, 10 marks).

The performance of the students in the above question is then summarized as given below in Table PO-11(C).3 using rubrics defined in Table PO-11.1(b).

Table PO-11(C).3: Students' performance in question targeting 'PO-11(C)'; Course UEE804

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
1	101104031	Kanika Lodha	8.5	5
2	101204001	Aashna	8.5	5
3	101204002	Abhinav Sharma	8.5	5
4	101204003	Abhishek Jain	8.5	5
5	101204004	Aditya Jain	6.5	4
6	101204005	Akash Deep	8.5	5
7	101204006	Akash Ratna	8.5	5
8	101204009	Akshu Gupta	8.5	5
9	101204010	Aman Goyal	8.5	5
10	101204011	Amarpreet	6.5	4
11	101204012	Amit Bansal	9	5
12	101204013	Anshul Kumar	6.5	4
13	101204014	Anukriti Dwivedi	9	5
14	101204015	Arushi Nagpal	8.5	5
15	101204016	Ayush Vaid	8.5	5
16	101204018	Chahat Singla	8.5	5
17	101204019	Deeksha Goyal	8.5	5
18	101204020	Dhruv Sharma	8.5	5
19	101204021	Gaurav Arora	8	5

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
20	101204022	Gursharan Kaur	8.5	5
21	101204023	Gursimran Singh	8.5	5
22	101204024	Harjot Singh	8.5	5
23	101204025	Harsh Kothari	8.5	5
24	101204026	Hemanshu Garg	8.5	5
25	101204027	Himanshu Takkar	8.5	5
26	101204028	Iqbal Singh Garcha	8.5	5
27	101204030	Ishtjot Singh	8.5	5
28	101204031	Jasdeep Garg	8.5	5
29	101204033	Jasleen Kaur	8.5	5
30	101204035	Kapil Kinger	6.5	4
31	101204037	Karanbir Singh Kahlon	8.5	5
32	101204038	Karanveer Singh Bhangoo	8.5	5
33	101204039	Kartik Arora	8.5	5
34	101204040	Kashish Sethi	8.5	5
35	101204041	Kaustubh Singh	8	5
36	101204042	Krishnank Atrey	8	5
37	101204043	Lovely Goyal	8	5
38	101204045	Manik Mittal	8	5
39	101204046	Marshall	8.5	5
40	101204048	Mohit Kukkar	8.5	5
41	101204049	Mohit Manhas	8.5	5
42	101204051	Nalin Kaushik	8.5	5
43	101204053	Nishant Arora	8.5	5
44	101204054	P Siddharth	8.5	5
45	101204057	Rahul Kamboj	8.5	5
46	101204059	Rajat Sahore	8.5	5
47	101204060	Rajatdeep Singh	8.5	5
48	101204061	Ramanpreet Kaur	8.5	5
49	101204063	Sahil Arora	8.5	5
50	101204064	Sahil Mittal	8.5	5
51	101204065	Sanchit Goel	8.5	5
52	101204066	Sewak Ram	8.5	5
53	101204067	Sheenu	8.5	5
54	101204069	Shubham Bhatia	8.5	5
55	101204070	Shubham Goel	8.5	5
56	101204071	Shubham Kansal	8.5	5

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
57	101204074	Sukhdarshanpal Singh	8.5	5
58	101204075	Sultan Singh	9	5
59	101204076	Tejasvi Anand	8	5
60	101254001	Sahilpreet Singh	8.5	5
61	101254002	Naman Kumar	8.5	5
62	101254003	Sachin Pathak	8.5	5
63	101254004	Srijan Aditya	8	5
64	101254005	Navjot Kaur	8.5	5
65	101254006	Milan Jain	8.5	5
66	101254008	Gaurav	8.5	5
67	101254009	Varun Khanna	8.5	5
68	101254010	Swati Srivastava	8.5	5
69	101254012	Shubham Singla	8.5	5
70	101254013	Sorabh Devgun	8	5
71	101254014	Paras Ghai	8.5	5
72	101254015	Kuldeep Singh Deora	8.5	5
73	101254016	Sachin Gupta	9	5
74	101254017	Nakul Kumar	8.5	5
75	101384001	Ankur Singla	8	5
76	101384002	Gagandeep Singh	8.5	5
77	101384004	Himanshu Bansal	8	5
78	101384005	Navdeep Singh	8	5
79	101384006	Parampreet Singh	8.5	5
80	101384007	Saurav Goyal	9	5
81	101384008	Surjeet Singh	8.5	5

The overall performance of students for the above criterion is summarized in Table PO-11(C).4:

Table PO-11(C).4: Average score of student performance in the course UEE804 for criteria PO-11(C)

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE804	95.06	4.94	0.00	0.00	0.00	4.95

The data from Table PO-11(C).2 and Table PO-11(C).4 is used to evaluate weighted average of direct measure through course portfolio for criteria 'PO-11(C)', and is summarised in Table PO-11(C).5.

Table PO-11(C).5: Weighted Average Student class performance (course portfolio) for criteria PO-11(B)

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE802	0.00	6.33	48.10	45.57	0.00	2.61
UEE804	95.06	4.94	0.00	0.00	0.00	4.95
Student class performance score	47.53	5.64	24.05	22.78	0	3.78

b) Indirect Measures

The indirect measurement of performance criteria ‘PO-11(C)’ has been assessed through Student Course Surveys and other surveys (Graduating Student Survey, Alumni Survey and Employer Survey). The weighted average score in respective surveys is summarised in Table PO-11(C).6 and Table PO-11(C).7.

(i) Assessment Tool: Student Course Surveys

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of ‘PO-11(A)’.

UEE802	• Use neural networks for application such as classification, optimization and control problems. • Obtain the optimum solution of formulated optimization problem using genetic algorithm. • Examine the fuzzy system and implement fuzzy controllers for control and classification • Examine the fuzzy system and implement fuzzy controllers for control and classification.
UEE804	• Develop small scale model of alternator, excitation and governing systems. • Design and apply control for frequency and voltage of power system represented by single or multi-area.

Table PO-11(C).6: Weighted average score of performance criterion ‘PO-11(C)’ based on student course surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE802	25	23.6	28.6	13.6	9.3	3.42
UEE804	57.14	21.43	15.85	2.86	2.86	4.27
Course survey score	41.07	22.52	22.23	8.23	6.08	3.85

(ii) Assessment Tool: Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of Program outcome ‘PO-11’ through indirect measurement using following question in the respective surveys.

Graduating Survey	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
Alumni Survey	

Employer Survey	Do our students have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice?
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Table PO-11(C).7: Weighted average score of performance criterion ‘PO-11(C)’ based on other surveys.

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating student survey	22.22	35.56	33.33	4.44	4.44	3.67
Employer survey	40.00	53.33	6.67	0.00	0.00	4.33
Alumni survey	28.02	41.06	24.64	5.31	0.97	3.90
Other surveys score	30.08	43.32	21.55	3.25	1.8	3.97

c) Overall weighted average score of performance criterion ‘PO-11(C)’

The overall weighted average score of performance criterion ‘PO-11(C)’ is summarised in Table PO-11(C).8 from the data given in Tables PO-11(C).5, PO-11(C).6 and PO-11(C).7.

Table PO-11(C).8: Overall weighted average score of performance criterion ‘PO-11(C)’

Course	% of students in each score					Average Score	Assessment Tool Weight
	5	4	3	2	1		
Student class performance score	47.53	5.64	24.05	22.78	0	3.78	5
Course surveys score	41.07	22.52	22.23	8.23	6.08	3.85	4
Other surveys score	30.08	43.32	21.55	3.25	1.8	3.97	3
Overall weighted score	40.99	20.69	22.82	13.05	2.48	3.85	-

Overall assessment of program outcome PO-11 using scores of PO-11(A), PO-11(B) and PO-11(C)

In the previous sections, each of the individual performance criteria PO-11(A), PO-11(B) and PO-11(C) have been assessed. The performance for attainment of outcome PO-11 has been completed using the attainment values for PO-11(A), PO-11(B) and PO-11(C) are given below:

Table PO-11(A) summarizes the scores of each of the three performance criteria and these scores have been used to assess an overall score for outcome PO-11.

Table PO-11.2: Overall score for outcome PO-11 at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
PO-11(A)	34.95	32.03	21.03	6.29	5.78	3.84	5
PO-11(B)	20.11	26.28	27.14	17.47	8.99	3.31	5
PO-11(C)	40.99	20.69	22.82	13.05	2.48	3.85	5

Overall score	32.02	26.33	23.66	12.27	5.75	3.67	
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The weighted average score has been represented graphically in Figure PO-11.2.

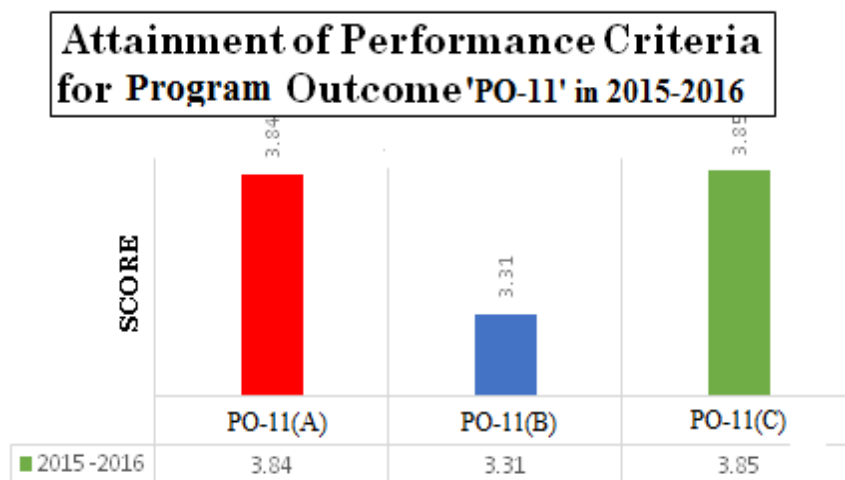


Figure PO-11.2: Performance criteria-wise assessment scores distribution of outcome 'PO-11' for AY 2015-16