

# Assessment of Attainment of Program Outcome

## PO-01

*An ability to apply knowledge of mathematics, science, and engineering*  
(2014-15)

*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-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 analyzing data*

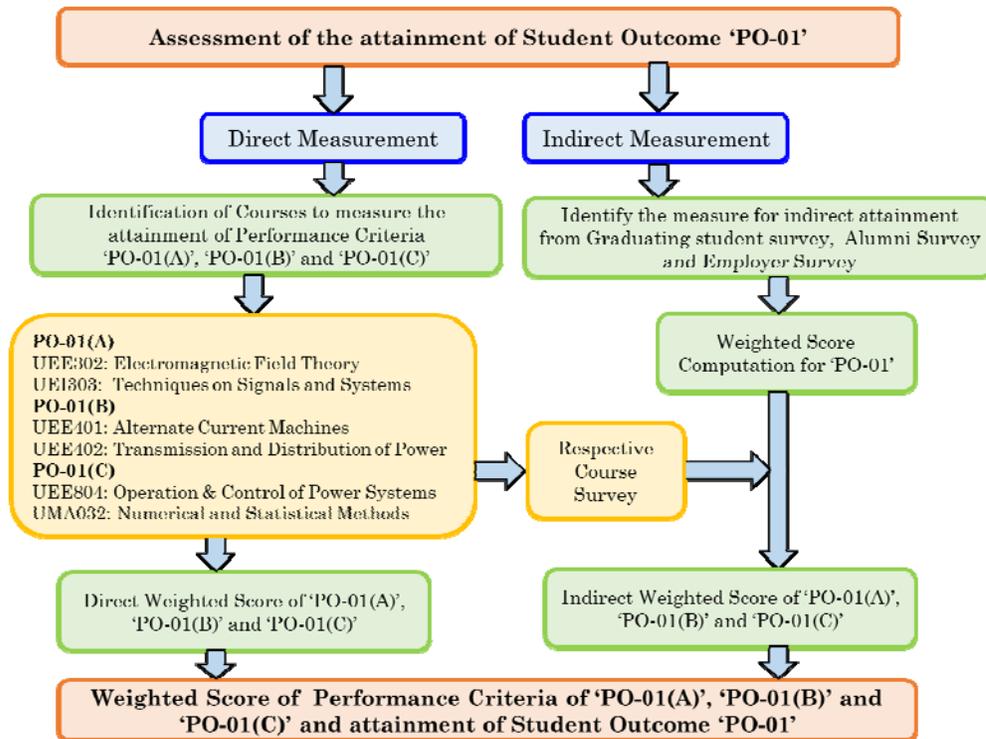
The program assessment committee identified the following courses for the assessment of program outcome ‘PO-01’. The courses used for the assessment are marked bold.

- 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
- UEE605: 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)’ for the academic year 2014-15.

Performance Criteria	Course -1	Course -2
PO-01(A)	UEE302: Electromagnetic Field Theory	UEI303: Techniques on Signals and Systems
PO-01(B)	UEE401: Alternating Current Machines	UEE402: Transmission and Distribution of Power
PO-01(C)	UEE804: Operation and Control of Power Systems	UMA032: Numerical and Statistical Methods

The step by step methodology used to measure the attainment of program outcome ‘PO-01’ is shown in Fig. PO-01.1 for academic year (AY) 2014-15. 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 2014-15**

The following Rubric has been used to convert marks obtained by 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 subjects mentioned.

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

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

The performance criteria '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 *UEE302: Electromagnetic Field Theory* and *UEI303: Techniques on Signals and Systems* are used to assess performance criteria PO-01(A) 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(A)' through the Mid Semester Examination (Question No. 1, 2 and 3, July-Dec 2014, 22 marks).

#### Questions:

Q.1	<p>(i) If <math>\vec{A} = 2\hat{a}_x + 4\hat{a}_y</math> and <math>\vec{B} = 6\hat{a}_y - 4\hat{a}_z</math>. Find the smaller angle between them using cross product. Verify it using dot product.</p> <p>(ii) If <math>\vec{A} = 2\hat{a}_x + 6\hat{a}_y - 3\hat{a}_z</math> and <math>\vec{B} = -3\hat{a}_x - 4\hat{a}_y - 5\hat{a}_z</math>. Find <math>\left[ \frac{(\vec{A} + 3\vec{B})}{ \vec{A} + 3\vec{B} } \right] \cdot \vec{B}</math></p>	(3+1)
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Q.2	<p>(i) Show that,</p> $\begin{bmatrix} \hat{a}_r \\ \hat{a}_\theta \\ \hat{a}_\phi \end{bmatrix} = \begin{bmatrix} \sin\theta & 0 & \cos\theta \\ \cos\theta & 0 & -\sin\theta \\ 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} \hat{a}_\rho \\ \hat{a}_\phi \\ \hat{a}_z \end{bmatrix}$ <p>(ii) Obtain the expression for distance between two points in spherical coordinate system.</p> <p>(iii) If <math>\vec{A} = 5\hat{a}_r + 2\hat{a}_\theta - \hat{a}_\phi</math> and <math>\vec{B} = \hat{a}_r - 3\hat{a}_\theta + 4\hat{a}_\phi</math>. Find</p> <p>(a) Unit normal vector perpendicular to the plane containing both <math>\vec{A}</math> and <math>\vec{B}</math>.</p> <p>(b) Scalar projection of <math>\vec{A}</math> along <math>\vec{B}</math>.</p> <p>(c) Vector projection of <math>\vec{B}</math> along <math>\vec{A}</math>.</p>	(3+2+3)
Q.3	<p>(i) If <math>\vec{r} = x\hat{a}_x + y\hat{a}_y + z\hat{a}_z</math> is the position vector of point <math>(x, y, z)</math>, <math>r =  \vec{r} </math>, 'n' is an integer. Evaluate</p> <p>(a) <math>\nabla \cdot r^n \vec{r}</math></p> <p>(b) <math>\nabla \times r^n \vec{r}</math></p> <p>(c) <math>\nabla(\ln.r)</math></p> <p>(d) <math>\nabla^2(\ln.r)</math></p> <p>(ii) In cylindrical coordinates, <math>\rho_v = \frac{10}{\rho}</math> pC/m<sup>3</sup>. If V=0 at <math>\rho = 1</math>m and V=100V at <math>\rho = 4</math>m due to the charge distribution, find</p> <p>(a) V at <math>\rho = 3</math>m</p> <p>(b) E at <math>\rho = 2</math>. Take <math>\epsilon = \epsilon_0</math>.</p>	(4+6)

The performance of the students in the above questions is summarized 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 UEE302**

S. No	Roll No.	Name of Student	Marks (22)	Score (1-5)
1	101304001	Aarushi Bajaj	12	3
2	101304002	Abhey Arora	20	5
3	101304003	Abhishek Taksali	14	4
4	101304004	Adhikaansh Tayal	6	2
5	101304005	Aditi Narang	17	5
6	101304006	Aditya	17	5
7	101304007	Akshat	16	4
8	101304008	Akshay Kapoor	17	5
9	101304009	Akshay Kumar	14	4
10	101304010	Akshay Kumar Chaudhary	4	1
11	101304011	Akshay Sharma	6	2
12	101304012	Amandeep Kaur	4	1
13	101304013	Amandeep Singh	10	3
14	101304014	Amaninder Singh Randhawa	14	4

S. No	Roll No.	Name of Student	Marks (22)	Score (1-5)
15	101304015	Angad Kapoor	11	3
16	101304016	Ankita Garg	12	3
17	101304017	Ankur Malik	10	3
18	101304018	Anmol Jawa	12	3
19	101304019	Anmolpreet Singh	11	3
20	101304020	Anyuti Tiwary	14	4
21	101304021	Arpit Sharma	9	3
22	101304022	Arsh Kundal	4	1
23	101304023	Arshbir Kaur	17	5
24	101304024	Arshdeep Singh Bagga	17	5
25	101304025	Ashish	17	5
26	101304026	Ashish Rajpal	18	5
27	101304028	Berry Lubana	14	4
28	101304029	Bhanu Duggal	17	5
29	101304030	Bhanu Marwaha	17	5
30	101304031	Chirag Gaba	10	3
31	101304032	Dipin Garg	17	5
32	101304033	Dishant Vanvari	6	2
33	101304034	Divyesh Pratap Singh	10	3
34	101304035	Elham Anwar	12	3
35	101304036	Gurseerat Singh Meen	3	1
36	101304037	Gursewak Singh	7	2
37	101304038	Gurveer Singh	1	1
38	101304040	Hariansh Sehgal	6	2
39	101304041	Hartejdeep Singh	5	2
40	101304042	Himanshu Goyal	7	2
41	101304044	Jasjit Singh	1	1
42	101304045	Jassimran Singh Julka	12	3
43	101304046	Jessica Dhaliwal	14	4
44	101304047	Kanwarpal Singh	9	3
45	101304048	Karan Kumar	7	2
46	101304049	Karanjot Singh Kochar	11	3
47	101304050	Kashish Aggarwal	18	5
48	101304051	Kritika Singla	17	5
49	101304052	Love Gaba	7	2
50	101304054	Manik Mittal	10	3
51	101304055	Maninderjit Singh	3	1
52	101304056	Mayank Singla	12	3
53	101304057	Mridul Bhutani	15	4
54	101304058	Naman Garg	22	5
55	101304059	Navdeep Singh	15	4
56	101304060	Navdeep Singh	14	4
57	101304061	Nazuk Aggarwal	16	4

S. No	Roll No.	Name of Student	Marks (22)	Score (1-5)
58	101304062	Nishant Garg	15	4
59	101304063	Nishtha Raheja	7	2
60	101304064	Paras Bawa	7	2
61	101304065	Parth Ahuja	14	4
62	101304066	Parushi	14	4
63	101304067	Pency Goyal	14	4
64	101304068	Piyush Jindal	7	2
65	101304069	Piyush Tripathi	5	2
66	101304070	Prachi Garg	4	1
67	101304071	Prashant Kataria	1	1
68	101304072	Preeti Garg	12	3
69	101304073	Priyank Arora	10	3
70	101304074	Priyanka	9	3
71	101304075	Priyanka Singh	17	5
72	101304076	Priyansh Mahajan	9	3
73	101304077	Rahul Meena	4	1
74	101304078	Rajan	8	2
75	101304079	Rajat Sharma	7	2
76	101304080	Ratul Goyal	7	2
77	101304081	Ravinder Singh	18	5
78	101304082	Rishabh Juneja	7	2
79	101304083	Robin Manktala	5	2
80	101304084	Rohan Ghai	17	5
81	101304085	Rohan Singla	14	4
82	101304086	Rohan Wadhawan	9	3
83	101304087	Rohit Goyal	10	3
84	101304088	Rubina Bamba	9	3
85	101304089	Sagar Pulani	18	5
86	101304090	Sahil Kataria	18	5
87	101304091	Sakshi	11	3
88	101304092	Sandal Singh Sidhu	4	1
89	101304093	Sandeep Kaur	1	1
90	101304094	Satripleen Kaur	15	4
91	101304095	Saurabh Mohan	10	3
92	101304096	Shagundeep Singh	3	1
93	101304097	Shailly Gupta	14	4
94	101304098	Shaina	17	5
95	101304099	Shivika Gupta	12	3
96	101304100	Shresth Rai	7	2
97	101304101	Shubham Goyal	6	2
98	101304102	Shubham Gupta	14	4
99	101304103	Shubham Sharma	7	2
100	101304104	Shubham Sharma	10	3

S. No	Roll No.	Name of Student	Marks (22)	Score (1-5)
101	101304105	Shubham Soin	20	5
102	101304106	Siddharth Goyal	10	3
103	101304107	Sidharth Garg	7	2
104	101304108	Simran Kaur	11	3
105	101304109	Simranjit Singh	1	1
106	101304111	Sumit Dhingra	6	2
107	101304112	Sumit Kaushik	12	3
108	101304113	Tushar Dheer	10	3
109	101304114	Tushar Sharma	14	4
110	101304116	Utsav Chhabra	3	1
111	101304117	Vaibhav Gupta	13	3
112	101304118	Vaishali	13	3
113	101304119	Varun Bansal	12	3
114	101304120	Veni Jindal	19	5
115	101304121	Vishal Arora	10	3
116	101304122	Yugesh Goyal	9	3
117	101484001	Amandeep Singh	17	5
118	101484002	Amrinder Singh	11	3
119	101484003	Ashmeen Singh	2	1
120	101484004	Azad Singh	7	2
121	101484005	Chandan Garg	7	2
122	101484007	Deepak Singla	11	3
123	101484008	Diljeet Singh	17	5
124	101484009	Jyoti Kaushal	3	1
125	101484010	Karamjeet Singh	7	2
126	101484011	Pawan Kumar	13	3
127	101484012	Rajat Singla	3	1
128	101484013	Satveer Kaur	17	5
129	101484014	Saurabh Kumar Wadhawan	17	5
130	101484015	Shweta Sharma	4	1
131	101484016	Sukhjeet Singh	8	2

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

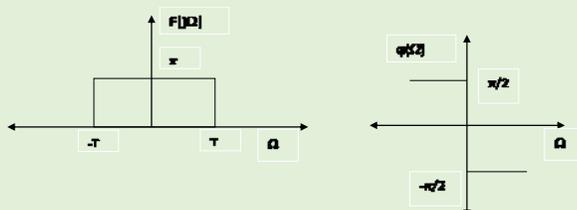
**Table PO-01(A).2: Average score of student performance in the course UEE302 for criteria 'PO-01(A)'**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE302	19.85	15.27	29.77	20.61	14.50	3.05

### UEI303: Techniques on Signals and Systems

The performance of course *UEI303: Techniques on Signals and Systems* is used to measure the attainment of outcome 'PO-01(A)' through the End Semester Examination (Question No. 10 and 11, July-Dec 2014, 10marks).

#### Questions:

Q.10	If $x(t) = 1 + \sin \omega_o t + 2 \cos \omega_o t + \cos(2\omega_o t + \frac{\pi}{4})$ having fundamental frequency $\omega_o$ . Calculate the Fourier series coefficients. Draw the magnitude and phase plot.	(5)
Q.11	<p>The magnitude <math> F(j\Omega)  = \pi, for -T \leq \Omega \leq T</math> and phase angle of <math>F(j\Omega)</math> is</p> $\phi(\Omega) = \angle F(j\Omega) = \frac{\pi}{2}, for \Omega < 0$ $= -\frac{\pi}{2}, for \Omega > 0$ $= 0, for \Omega = 0$ <p>Find f(t).</p> 	(5)

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 UEI303**

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

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
14	101304014	Amaninder Singh Randhawa	6	4
15	101304015	Angad Kapoor	4	3
16	101304016	Ankita Garg	8	5
17	101304017	Ankur Malik	5	3
18	101304018	Anmol Jawa	3	2
19	101304019	Anmolpreet Singh	5	3
20	101304020	Anyuti Tiwary	6	4
21	101304021	Arpit Sharma	3	2
22	101304022	Arsh Kundal	1	1
23	101304023	Arshbir Kaur	8	5
24	101304024	Arshdeep Singh Bagga	6	4
25	101304025	Ashish	3	2
26	101304026	Ashish Rajpal	5	3
27	101304028	Berry Lubana	5	3
28	101304029	Bhanu Duggal	9	5
29	101304030	Bhanu Marwaha	6	4
30	101304031	Chirag Gaba	3	2
31	101304032	Dipin Garg	3	2
32	101304033	Dishant Vanvari	3	2
33	101304034	Divyesh Pratap Singh	6	4
34	101304035	Elham Anwar	5	3
35	101304036	Gurseerat Singh Meen	0	1
36	101304037	Gursewak Singh	4	3
37	101304040	Hariansh Sehgal	6	4
38	101304041	Hartejdeep Singh	1	1
39	101304042	Himanshu Goyal	5	3
40	101304044	Jasjit Singh	1	1
41	101304045	Jassimran Singh Julka	4	3
42	101304046	Jessica Dhaliwal	6	4
43	101304047	Kanwarpal Singh	1	1
44	101304048	Karan Kumar	3	2
45	101304049	Karanjot Singh Kochar	6	4
46	101304050	Kashish Aggarwal	5	3
47	101304052	Love Gaba	4	3
48	101304054	Manik Mittal	6	4
49	101304055	Maninderjit Singh	3	2
50	101304056	Mayank Singla	4	3
51	101304057	Mridul Bhutani	4	3
52	101304058	Naman Garg	9	5
53	101304059	Navdeep Singh	3	2
54	101304060	Navdeep Singh	4	3
55	101304062	Nishant Garg	7	4
56	101304094	Satripleen Kaur	7	4

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
57	101484001	Amandeep Singh	5	3
58	101484002	Amrinder Singh	7	4
59	101484003	Ashmeen Singh	1	1
60	101484004	Azad Singh	4	3
61	101484005	Chandan Garg	6	4
62	101484007	Deepak Singla	3	2
63	101484008	Diljeet Singh	3	2
64	101304051	Kritika Singla	5	3
65	101304061	Nazuk Aggarwal	7	4
66	101304063	Nishtha Raheja	5	3
67	101304064	Paras Bawa	4	3
68	101304065	Parth Ahuja	6	4
69	101304066	Parushi	3	2
70	101304067	Pency Goyal	5	3
71	101304068	Piyush Jindal	5	3
72	101304069	Piyush Tripathi	4	3
73	101304070	Prachi Garg	4	3
74	101304071	Prashant Kataria	1	1
75	101304072	Preeti Garg	3	2
76	101304073	Priyank Arora	5	3
77	101304074	Priyanka	5	3
78	101304075	Priyanka Singh	5	3
79	101304076	Priyansh Mahajan	4	3
80	101304077	Rahul Meena	1	1
81	101304078	Rajan	1	1
82	101304079	Rajat Sharma	5	3
83	101304080	Ratul Goyal	4	3
84	101304081	Ravinder Singh	5	3
85	101304082	Rishabh Juneja	5	3
86	101304083	Robin Manktala	3	2
87	101304084	Rohan Ghai	8	5
88	101304085	Rohan Singla	5	3
89	101304086	Rohan Wadhawan	3	2
90	101304087	Rohit Goyal	5	3
91	101304088	Rubina Bamba	5	3
92	101304089	Sagar Pulani	8	5
93	101304090	Sahil Kataria	8	5
94	101304091	Sakshi	5	3
95	101304092	Sandal Singh Sidhu	4	3
96	101304093	Sandeep Kaur	1	1
97	101304095	Saurabh Mohan	4	3
98	101304096	Shagundeep Singh	1	1
99	101304097	Shailly Gupta	8	5

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
100	101304098	Shaina	4	3
101	101304099	Shivika Gupta	5	3
102	101304100	Shresth Rai	3	2
103	101304101	Shubham Goyal	8	5
104	101304102	Shubham Gupta	8	5
105	101304103	Shubham Sharma	4	3
106	101304104	Shubham Sharma	4	3
107	101304105	Shubham Soin	8	5
108	101304106	Siddharth Goyal	3	2
109	101304107	Sidharth Garg	5	3
110	101304108	Simran Kaur	3	2
111	101304109	Simranjit Singh	0	1
112	101304111	Sumit Dhingra	3	2
113	101304112	Sumit Kaushik	5	3
114	101304113	Tushar Dheer	5	3
115	101304114	Tushar Sharma	5	3
116	101304116	Utsav Chhabra	1	1
117	101304117	Vaibhav Gupta	5	3
118	101304118	Vaishali	3	2
119	101304119	Varun Bansal	4	3
120	101304120	Veni Jindal	8	5
121	101304121	Vishal Arora	5	3
122	101304122	Yugesh Goyal	4	3
123	101484009	Jyoti Kaushal	3	2
124	101484011	Pawan Kumar	5	3
125	101484012	Rajat Singla	4	3
126	101484013	Satveer Kaur	5	3
127	101484014	Saurabh Kumar Wadhawan	9	5
128	101484015	Shweta Sharma	4	3
129	101484016	Sukhjeet Singh	4	3

The performance of students through the course UEI303 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 UEI303 for criteria 'PO-01(A)'**

Course	% of students in each score					Average Score
	5	4	3	2	1	
<b>UEI303</b>	<b>13.18</b>	<b>13.18</b>	<b>45.74</b>	<b>17.05</b>	<b>10.85</b>	<b>3.01</b>

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 summarized 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	
UEE302	19.85	15.27	29.77	20.61	14.50	<b>3.05</b>
UEI303	13.18	13.18	45.74	17.05	10.85	<b>3.01</b>
<b>Student class performance score</b>	<b>16.51</b>	<b>14.22</b>	<b>37.75</b>	<b>18.83</b>	<b>12.68</b>	<b>3.03</b>

**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 Tools: Student Course Surveys**

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

UEE302	To calculate electric and magnetic fields in different coordinates for various charge and current configurations
UEI303	To solve different type of problems related to Fourier series and Fourier transforms

**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	
UEE302	38.23	26.54	18.28	3.03	13.65	<b>3.72</b>
UEI303	41.28	36.57	16.20	5.34	0.61	<b>4.13</b>
<b>Course survey score</b>	<b>39.76</b>	<b>31.56</b>	<b>17.24</b>	<b>4.19</b>	<b>7.13</b>	<b>3.93</b>

- (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-01.7: 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	
<b>Graduating student</b>	16.05	39.51	40.74	2.47	1.23	<b>3.67</b>

survey						
<b>Employer survey</b>	40.00	46.67	13.33	0.00	0.00	<b>4.27</b>
<b>Alumni survey</b>	25.60	34.78	30.92	6.76	1.93	<b>3.75</b>
<b>Other surveys score</b>	<b>27.22</b>	<b>40.32</b>	<b>28.33</b>	<b>3.08</b>	<b>1.05</b>	<b>3.90</b>

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

The overall weighted average score of performance criterion ‘PO-01(A)’ is summarized in Table PO-01(A).8 from the data given in Tables PO-01(A).5, PO-01(A).6 and 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		
<b>Student class performance</b>	16.51	14.22	37.75	18.83	12.68	<b>3.03</b>	5
<b>Course surveys</b>	39.76	31.56	17.24	4.19	7.13	<b>3.93</b>	4
<b>Other surveys</b>	27.22	40.32	28.33	3.08	1.05	<b>3.90</b>	3
<b>Overall weighted score</b>	<b>26.94</b>	<b>26.53</b>	<b>28.56</b>	<b>10.01</b>	<b>7.92</b>	<b>3.55</b>	

**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 criteria ‘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 *UEE401: Alternate current machines* and *UEE402: Transmission and Distribution of Power* are used to assess performance criteria PO-01(B) 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-01(B)’ through the End Semester Examination (Question No. 7 and 8, Jan-June 2015, 8 marks).

**Questions:**

Q.7	Calculate the value of resistance elements of a 5-step (or 6-stud) starter for a 3-phase, 400 V, wound-rotor induction motor. The full load slip is 2.5% and the maximum starting current is limited to its full load value. Rotor resistance per phase is 0.02 $\Omega$ .	(4)
Q.8	A 4-pole, star connected, 50 Hz, 11 kV, 40 MVA turbo generator, with a synchronous reactance of 0.8 p.u., is connected to a power network. This power network can be represented by 11 kV infinite bus with a series reactance of j0.5 $\Omega$ . A voltage regulator adjusts the field current such that alternator terminal voltage remains constant at 11 kV. The generator delivers an output of 40 MVA. Find the armature current, power factor and excitation emf.	(4)

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 UEE401**

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

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
23	101304023	Arshbir Kaur	6	5
24	101304024	Arshdeep Singh Bagga	4	3
25	101304025	Ashish	4	3
26	101304026	Ashish Rajpal	4	3
27	101304028	Berry Lubana	4	3
28	101304029	Bhanu Duggal	5	4
29	101304030	Bhanu Marwaha	3	2
30	101304031	Chirag Gaba	4	3
31	101304032	Dipin Garg	4	3
32	101304033	Dishant Vanvari	3	2
33	101304034	Divyesh Pratap Singh	5	4
34	101304035	Elham Anwar	5	4
35	101304036	Gurseerat Singh Meen	2	2
36	101304037	Gursewak Singh	3	2
37	101304040	Hariansh Sehgal	2	2
38	101304041	Hartejdeep Singh	2	2
39	101304042	Himanshu Goyal	5	4
40	101304044	Jasjit Singh	0	1
41	101304045	Jassimran Singh Julka	4	3
42	101304046	Jessica Dhaliwal	5	4
43	101304047	Kanwarpal Singh	3	2
44	101304048	Karan Kumar	2	2
45	101304049	Karanjot Singh Kochar	3	2
46	101304050	Kashish Aggarwal	4	3
47	101304052	Love Gaba	3	2
48	101304054	Manik Mittal	4	3
49	101304055	Maninderjit Singh	3	2
50	101304056	Mayank Singla	3	2
51	101304057	Mridul Bhutani	3	2
52	101304058	Naman Garg	7	5
53	101304059	Navdeep Singh	3	2
54	101304060	Navdeep Singh	5	4
55	101304062	Nishant Garg	5	4
56	101304094	Satripleen Kaur	4	3
57	101484001	Amandeep Singh	5	4
58	101484002	Amrinder Singh	6	5
59	101484003	Ashmeen Singh	2	2
60	101484004	Azad Singh	3	2
61	101484005	Chandan Garg	5	4
62	101484007	Deepak Singla	6	5
63	101484008	Diljeet Singh	5	4

The performance of students through the course UEE401 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 UEE401 for criteria ‘PO-01(B)’**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE401	11.11	20.63	30.16	33.33	4.76	3.00

### UEE402: Transmission and Distribution of Power

The performance of course *UEE402: Transmission and Distribution of Power* is used to measure the attainment of outcome ‘PO-01(B)’ through the End Semester Examination (Question No. 3(b) and 6(a), Jan-June 2015, 11 marks).

#### Questions:

Q.3 (b)	A three phase overhead line has the following general parameters: $A = 0.8705 \angle 2.3^\circ$ and $B = 187 \angle 75.1^\circ \Omega$ . Find the MVAr rating of compensating device to maintain voltages constant at 154 kV at both ends. The load at receiving end is 50 MVA at 0.85 power factor lagging. Also determine maximum load that can be transmitted.	(5)
Q.6 (a)	A three phase 132 kV transmission line is connected to a 50 MW load at a power factor of 0.85 lagging. The line constants of the 180 km long line are $Z = 96 \angle 78^\circ \Omega$ and $Y = 0.001 \angle 90^\circ$ mho. Using nominal T representation, calculate: (a) the A, B, C and D constants of the line; (b) Sending-end voltage; (c) sending-end current (d) Sending-end power and (e) Efficiency of transmission.	(6)

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: Students’ performance in question targeting ‘PO-01(B)’: Course UEE402**

S. No	Roll No.	Name of Student	Marks (11)	Score (1-5)
1	101304001	Aarushi Bajaj	7	4
2	101304002	Abhey Arora	7	4
3	101304003	Abhishek Taksali	5	3
4	101304004	Adhikaansh Tayal	2	1
5	101304005	Aditi Narang	7	4
6	101304006	Aditya	7	4
7	101304007	Akshat	5	3
8	101304008	Akshay Kapoor	7	4

S. No	Roll No.	Name of Student	Marks (11)	Score (1-5)
9	101304009	Akshay Kumar	6	3
10	101304010	Akshay Kumar Chaudhary	3	2
11	101304011	Akshay Sharma	4	2
12	101304012	Amandeep Kaur	3	2
13	101304013	Amandeep Singh	6	3
14	101304014	Amaninder Singh Randhawa	5	3
15	101304015	Angad Kapoor	6	3
16	101304016	Ankita Garg	6	3
17	101304017	Ankur Malik	0	1
18	101304018	Anmol Jawa	9	5
19	101304019	Anmolpreet Singh	5	3
20	101304020	Anyuti Tiwary	7	4
21	101304021	Arpit Sharma	4	2
22	101304022	Arsh Kundal	4	2
23	101304023	Arshbir Kaur	8	4
24	101304024	Arshdeep Singh Bagga	9	5
25	101304025	Ashish	5	3
26	101304026	Ashish Rajpal	6	3
27	101304028	Berry Lubana	5	3
28	101304029	Bhanu Duggal	9	5
29	101304030	Bhanu Marwaha	4	2
30	101304031	Chirag Gaba	6	3
31	101304032	Dipin Garg	4	2
32	101304033	Dishant Vanvari	8	4
33	101304034	Divyesh Pratap Singh	4	2
34	101304035	Elham Anwar	5	3
35	101304036	Gurseerat Singh Meen	3	2
36	101304037	Gursewak Singh	4	2
37	101304040	Hariansh Sehgal	7	4
38	101304041	Hartejdeep Singh	2	1
39	101304042	Himanshu Goyal	8	4
40	101304044	Jasjit Singh	2	1
41	101304045	Jassimran Singh Julka	6	3
42	101304046	Jessica Dhaliwal	9	5
43	101304047	Kanwarpal Singh	3	2
44	101304048	Karan Kumar	4	2
45	101304049	Karanjot Singh Kochar	7	4
46	101304050	Kashish Aggarwal	9	5
47	101304052	Love Gaba	6	3
48	101304054	Manik Mittal	8	4
49	101304055	Maninderjit Singh	0	1
50	101304056	Mayank Singla	7	4
51	101304057	Mridul Bhutani	9	5

S. No	Roll No.	Name of Student	Marks (11)	Score (1-5)
52	101304058	Naman Garg	10	5
53	101304059	Navdeep Singh	9	5
54	101304060	Navdeep Singh	6	3
55	101304062	Nishant Garg	7	4
56	101304094	Satirpleen Kaur	9	5
57	101484001	Amandeep Singh	5	3
58	101484002	Amrinder Singh	7	4
59	101484003	Ashmeen Singh	3	2
60	101484004	Azad Singh	0	1
61	101484005	Chandan Garg	5	3
62	101484007	Deepak Singla	5	3
63	101484008	Diljeet Singh	5	3
64	101304051	Kritika Singla	8	4
65	101304061	Nazuk Aggarwal	10	5
66	101304063	Nishtha Raheja	5	3
67	101304064	Paras Bawa	5	3
68	101304065	Parth Ahuja	6	3
69	101304066	Parushi	5	3
70	101304067	Pency Goyal	4	2
71	101304068	Piyush Jindal	5	3
72	101304069	Piyush Tripathi	7	4
73	101304070	Prachi Garg	5	3
74	101304071	Prashant Kataria	2	1
75	101304072	Preeti Garg	5	3
76	101304073	Priyank Arora	4	2
77	101304074	Priyanka	4	2
78	101304075	Priyanka Singh	7	4
79	101304076	Priyansh Mahajan	6	3
80	101304077	Rahul Meena	0	1
81	101304078	Rajan	3	2
82	101304079	Rajat Sharma	4	2
83	101304080	Ratul Goyal	4	2
84	101304081	Ravinder Singh	5	3
85	101304082	Rishabh Juneja	6	3
86	101304083	Robin Manktala	4	2
87	101304084	Rohan Ghai	5	3
88	101304085	Rohan Singla	6	3
89	101304086	Rohan Wadhawan	5	3
90	101304087	Rohit Goyal	5	3
91	101304088	Rubina Bamba	8	4
92	101304089	Sagar Pulani	8	4
93	101304090	Sahil Kataria	7	4
94	101304091	Sakshi	5	3

S. No	Roll No.	Name of Student	Marks (11)	Score (1-5)
95	101304092	Sandal Singh Sidhu	7	4
96	101304093	Sandeep Kaur	4	2
97	101304095	Saurabh Mohan	5	3
98	101304096	Shagundeeep Singh	2	1
99	101304097	Shailly Gupta	8	4
100	101304098	Shaina	5	3
101	101304099	Shivika Gupta	8	4
102	101304100	Shresth Rai	6	3
103	101304101	Shubham Goyal	7	4
104	101304102	Shubham Gupta	8	4
105	101304103	Shubham Sharma	2	1
106	101304104	Shubham Sharma	2	1
107	101304105	Shubham Soin	7	4
108	101304106	Siddharth Goyal	5	3
109	101304107	Sidharth Garg	6	3
110	101304108	Simran Kaur	7	4
111	101304109	Simranjit Singh	2	1
112	101304111	Sumit Dhingra	2	1
113	101304112	Sumit Kaushik	6	3
114	101304113	Tushar Dheer	4	2
115	101304114	Tushar Sharma	7	4
116	101304116	Utsav Chhabra	5	3
117	101304117	Vaibhav Gupta	7	4
118	101304118	Vaishali	5	3
119	101304119	Varun Bansal	7	4
120	101304120	Veni Jindal	9	5
121	101304121	Vishal Arora	6	3
122	101304122	Yugesh Goyal	6	3
123	101484009	Jyoti Kaushal	5	3
124	101484011	Pawan Kumar	8	4
125	101484012	Rajat Singla	7	4
126	101484013	Satveer Kaur	6	3
127	101484014	Saurabh Kumar Wadhawan	8	4
128	101484015	Shweta Sharma	5	3
129	101484016	Sukhjeet Singh	7	4

The performance of students through the course UEE402 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 UEE402 for criteria 'PO-01(B)'**

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

UEE402	8.53	27.13	37.21	17.05	10.08	3.07
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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)’**

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE401	11.11	20.63	30.16	33.33	4.76	3.00
UEE402	8.53	27.13	37.21	17.05	10.08	3.07
<b>Student class performance score</b>	<b>9.82</b>	<b>23.88</b>	<b>33.68</b>	<b>25.19</b>	<b>7.42</b>	<b>3.03</b>

**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)’.

UEE401	To analyze the steady-state performance of induction and synchronous machines and compute performance measures
UEE402	To analyze the transmission line models and evaluates its performance parameters

**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	
UEE401	35.94	36.74	21.64	1.46	4.22	3.99
UEE402	13.56	19.94	22.98	24.06	19.46	2.84
<b>Course survey score</b>	<b>24.75</b>	<b>28.34</b>	<b>22.31</b>	<b>12.76</b>	<b>11.84</b>	<b>3.42</b>

**(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 4. PO-01(B).8 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	9.82	23.88	33.68	25.19	7.42	3.03	5
Course surveys	24.75	28.34	22.31	12.76	11.84	3.42	4
Other surveys	27.22	40.32	28.33	3.08	1.05	3.90	3
Overall weighted score	19.15	29.48	28.55	15.52	7.30	3.38	-

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

#### PO-01(C): Apply numerical and statistical methods in analyzing data.

The performance criteria 'PO-01(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 *UEE804: Operation and Control of Power Systems* and *UMA032: Numerical and Statistical Methods* are used to assess performance criteria 'PO-01(C)' as a direct measure. The analysis for each of these courses is provided below:

#### 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-01(C)' through the End Semester Examination (Question No. 1, July-Dec 2014, 8 marks).

#### Questions:

Q.1 (a)	Determine the voltage stability by computing the eigenvalues of the reduced Q-V Jacobian matrix for the following cases: i) P=1500 MW, Q <sub>i</sub> =450MVAR ii) P=1900 MW, Q <sub>i</sub> =950MVAR Assume that the reactive power is supplied by a shunt capacitor.	(4)
(b)	Obtain the non-linear model of generator using d-q transformation.	(4)

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

Table PO-01(C).1: Students' performance in Project work targeting 'PO-01(C)': Course UEE804

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
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S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
1	101104001	Aakriti Singla	3	2
2	101104002	Abhay Goel	2	2
3	101104005	Achin Chetal	2	2
4	101104006	Akash Verma	2	2
5	101104007	Aman Bhatnagar	7	5
6	101104008	Amar Deep Singh	4	3
7	101104009	Ankit Bansal	3	2
8	101104010	Ankur Singhal	7	5
9	101104011	Anshuman Singh	2	2
10	101104013	Ashish Gupta	5	4
11	101104016	Chetan Baria	4	3
12	101104017	Daksh Bansal	4	3
13	101104021	Dhruv Srivastav	4	3
14	101104022	Gagandeep Singh	4	3
15	101104023	Harkaran Tiwana	2	2
16	101104024	Harnoor Singh Ahluwalia	4	3
17	101104026	Harshit Nath	5	4
18	101104027	Harwinder Singh	5	4
19	101104028	Himanshu Goel	7	5
20	101104029	Isha Jhamb	4	3
21	101104030	Jagpreet Singh	2	2
22	101104032	Kanwaljot Singh	2	2
23	101104033	Karanpreet Kaur	5	4
24	101104034	Keshav Singla	4	3
25	101104035	Ketan Joshi	5	4
26	101104036	Kriti Bansal	5	4
27	101104037	Kunal Rawat	2	2
28	101104038	Manik Budhiraja	4	3
29	101104040	Mudit Kumar	4	3
30	101104042	Nand Nandan Arora	2	2
31	101104043	Narinderpal Singh Kaleka	4	3
32	101104044	Navjot Singh	4	3
33	101104045	Navjot Singh	4	3
34	101104046	Navneet Bansal	2	2
35	101104047	Nikhil Agarwal	4	3
36	101104048	Nitin Kumar	5	4
37	101104049	Nitish Singla	5	4
38	101104050	Perry Mittal	2	2
39	101104051	Piyush Gupta	4	3
40	101104052	Piyush Jain	4	3
41	101104054	Prabhleen Kaur	4	3
42	101104055	Prashant	4	3
43	101104056	Prateek Jain	4	3

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
44	101104058	Rajan Gaur	3	2
45	101104059	Rajat Gupta	4	3
46	101104060	Ratik Mittal	4	3
47	101104062	Rishika Kukreja	4	3
48	101104063	Rubbal Maggo	2	2
49	101104066	Shaurya Chopra	2	2
50	101104067	Shish Pal	2	2
51	101104068	Shubham Ahuja	4	3
52	101104069	Shubham Garg	2	2
53	101104070	Sunny Kumar Saini	2	2
54	101104071	Sunny Maheshwary	2	2
55	101104072	Suraj Pal Singh	4	3
56	101104074	Tanya Sofat	4	3
57	101104075	Tushar Garg	3	2
58	101104077	Varun	4	3
59	101104078	Vikhyat Kansal	4	3
60	101104079	Vineet Sharma	5	4
61	101104080	Vishal Gupta	5	4
62	101104081	Vishesh Gupta	2	2
63	101104082	Vishvesh	1	1
64	101104083	Vivek Gupta	5	4
65	101104084	Harmanjasraj Grewal	4	3
66	101104085	Akhilesh Sharma	4	3
67	101154001	Anna Kathpal	4	3
68	101154002	Papiha Salhotra	3	2
69	101154004	Sandeep Singh	5	4
70	101284001	Ashish	4	3
71	101284004	Ishan Narang	1	1
72	101284006	Navneet Kumar	7	5
73	101284007	Prikshit Singla	7	5
74	101284010	Vikas Bansal	4	3

The performance of students through the course UEE804 for criteria PO-01(C) is summarized in Table PO-01(C).2.

**Table PO-01(C).2: Average score of student performance in the course UEE804 for criteria 'PO-01(C)'**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE804	6.76	16.22	43.24	31.08	2.70	2.93

### UMA032: Numerical and Statistical Methods

The performance of course *UMA032: Numerical and Statistical Methods* is used to measure the attainment of outcome 'PO-01(C)' through the Mid Semester Examination (Question No. 1, 2 and 3, July-Dec 2014, 25 marks).

#### Questions:

Q.1(A)	Find the solution of the following equation using floating-point arithmetic with 4-digit mantissa $x^2 - 1000x + 25 = 0$ .	(2.5+2.5+4.0)
(B)	Define stability and conditioning of a numerical algorithm. Discuss the conditioning of the function $f(x) = e^{2x}$ .	
(C)	Show that the following iterative formula $x_{k+1} = x_k - m \frac{f(x_k)}{f'(x_k)}$ , $k = 0, 1, \dots$ has second order convergence for finding the root $\alpha$ with multiplicity $m$ to the non-linear equation $f(x) = 0$ , assuming that $f$ is sufficiently smooth in the neighbourhood of $\alpha$ and $f'(x) \neq 0$ .	
Q.2(A)	Using the four-digit arithmetic solve the following system of equation by Gaussian elimination with partial pivoting $0.729x_1 + 0.81x_2 + 0.9x_3 = 0.6867$ $x_1 + x_2 + x_3 = 0.8338$ $1.331x_1 + 1.21x_2 + 1.1x_3 = 1.000$	(3.5+3.5)
(B)	Find the smallest eigenvalue in magnitude of the matrix $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ using four iterations of the power method by taking $x^{(0)} = [1 \ 1 \ 1]^T$ . Also obtain the corresponding eigenvector.	
Q.3(A)	Determine a fixed-point function $g$ and an appropriate interval that produces an approximation to a positive solution of $x - e^{-x} = 0$ using five iterations.	(3.0+3.0+3.0)
(B)	Let $f(x) = \ln(1+x)$ , $x_0 = 1.0$ , $x_1 = 2.0$ . Use Newton interpolation to find the approximate value of $f(1.5)$ and obtain a bound on the truncation error.	
(C)	Consider the equation $e^{-x} = \sin x$ . Find an interval $[a, b]$ that contains the smallest positive root and hence find the root correct to 2 significant digits. Also estimate the number of midpoints $c$ that needed to obtain an approximate root that is accurate within an error tolerance of $10^{-10}$ .	

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

**Table PO-01(C).3: Students' performance in question targeting 'PO-01(C)'; Course UMA032**

S. No	Roll No.	Name of Student	Marks (25)	Score (1-5)
1	101304001	Aarushi Bajaj	17.0	4
2	101304002	Abhey Arora	13.0	3
3	101304003	Abhishek Taksali	15.0	4
4	101304004	Adhikaansh Tayal	2.0	1
5	101304005	Aditi Narang	20.0	5
6	101304006	Aditya	19.0	5
7	101304007	Akshat	18.5	4
8	101304008	Akshay Kapoor	15.0	4
9	101304009	Akshay Kumar	14.0	3
10	101304010	Akshay Kumar Chaudhary	5.5	2
11	101304011	Akshay Sharma	8.0	2
12	101304012	Amandeep Kaur	5.0	2
13	101304013	Amandeep Singh	15.0	4
14	101304014	Amaninder Singh Randhawa	10.5	3
15	101304015	Angad Kapoor	9.0	2
16	101304016	Ankita Garg	19.5	5
17	101304017	Ankur Malik	7.0	2
18	101304018	Anmol Jawa	22.0	5
19	101304019	Anmolpreet Singh	12.0	3
20	101304020	Anyuti Tiwary	12.5	3
21	101304021	Arpit Sharma	21.0	5
22	101304022	Arsh Kundal	2.5	1
23	101304023	Arshbir Kaur	15.5	4
24	101304024	Arshdeep Singh Bagga	10.5	3
25	101304025	Ashish	10.5	3
26	101304026	Ashish Rajpal	15.5	4
27	101304028	Berry Lubana	13.5	3
28	101304029	Bhanu Duggal	19.5	5
29	101304030	Bhanu Marwaha	15.5	4
30	101304031	Chirag Gaba	13.0	3
31	101304032	Dipin Garg	10.5	3
32	101304033	Dishant Vanvari	7.5	2
33	101304034	Divyesh Pratap Singh	13.0	3
34	101304035	Elham Anwar	21.0	5
35	101304036	Gurseerat Singh Meen	1.0	1
36	101304037	Gursewak Singh	11.5	3
37	101304040	Hariansh Sehgal	10.5	3
38	101304041	Hartejdeep Singh	5.0	2
39	101304042	Himanshu Goyal	17.0	4
40	101304044	Jasjit Singh	2.5	1
41	101304045	Jassimran Singh Julka	11.5	3
42	101304046	Jessica Dhaliwal	17.0	4
43	101304047	Kanwarpal Singh	7.0	2

S. No	Roll No.	Name of Student	Marks (25)	Score (1-5)
44	101304048	Karan Kumar	4.0	1
45	101304049	Karanjot Singh Kochar	15.5	4
46	101304050	Kashish Aggarwal	14.0	3
47	101304052	Love Gaba	7.0	2
48	101304054	Manik Mittal	14.0	3
49	101304055	Maninderjit Singh	9.0	2
50	101304056	Mayank Singla	7.5	2
51	101304057	Mridul Bhutani	10.5	3
52	101304058	Naman Garg	21.5	5
53	101304059	Navdeep Singh	15.5	4
54	101304060	Navdeep Singh	17.0	4
55	101304062	Nishant Garg	17.0	4
56	101304094	Satripleen Kaur	22.5	5
57	101484001	Amandeep Singh	12.0	3
58	101484002	Amrinder Singh	10.0	3
59	101484003	Ashmeen Singh	1.5	1
60	101484004	Azad Singh	10.5	3
61	101484005	Chandan Garg	8.5	2
62	101484007	Deepak Singla	6.5	2
63	101484008	Diljeet Singh	10.5	3

The performance of students through the course UMA032 for criteria PO-01(C) is summarized in Table PO-01(C).4.

**Table PO-01(C).4: Average score of student performance in the course UMA032 for criteria 'PO-01(C)'**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UMA032	14.29	22.22	33.33	20.63	9.52	3.11

The data from Table PO-01(C).2 and Table PO-01(C).4 is used to evaluate weighted average of direct measure through course portfolio for criteria 'PO-01(C)', and is summarised 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	
UEE804	6.76	16.22	43.24	31.08	2.70	2.93
UMA032	14.29	22.22	33.33	20.63	9.52	3.11
<b>Student class performance score</b>	<b>10.52</b>	<b>19.22</b>	<b>38.29</b>	<b>25.86</b>	<b>6.11</b>	<b>3.02</b>

**b) Indirect Measures:**

The indirect measurement of performance criteria ‘PO-01(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-01(C).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)’.

UEE804	To Computation of small scale and voltage stability
UMA032	learn how to obtain numerical solution of nonlinear equations using Bisection, Newton – Raphson and fixed-point iteration methods

**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	
<b>UEE804</b>	15.91	25.64	32.18	14.17	12.62	<b>3.18</b>
<b>UMA032</b>	30.66	31.85	30.84	2.39	4.26	<b>3.82</b>
<b>Course survey score</b>	<b>23.29</b>	<b>28.75</b>	<b>31.51</b>	<b>8.28</b>	<b>8.44</b>	<b>3.50</b>

**(iii) Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of student 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).8 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		
<b>Student class performance</b>	10.52	19.22	38.29	25.86	6.11	<b>3.02</b>	5
<b>Course surveys</b>	23.29	28.75	31.51	8.28	8.44	<b>3.50</b>	4
<b>Other surveys</b>	27.22	40.32	28.33	3.08	1.05	<b>3.90</b>	3
<b>Overall weighted score</b>	<b>18.95</b>	<b>27.67</b>	<b>33.54</b>	<b>14.31</b>	<b>5.62</b>	<b>3.40</b>	-

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

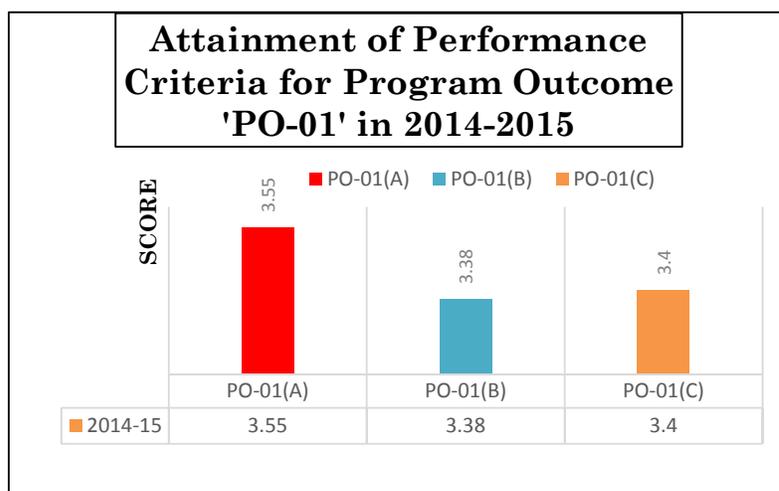
In the previous sections, each of the individual performance criteria PO-01(A), PO-01(B) and PO-01(C) have been assessed. The performance for attainment of outcome PO-01 has been completed using the attainment values for PO-01(A), PO-01(B) and PO-01(C) are provided below:

Table PO-01.1 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome PO-01.

**Table PO-01.1: 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)	26.94	26.53	28.56	10.01	7.92	<b>3.55</b>	5
PO-01(B)	19.15	29.48	28.55	15.52	7.30	<b>3.38</b>	5
PO-01(C)	18.95	27.67	33.54	14.31	5.62	<b>3.40</b>	5
<b>Overall score</b>	<b>21.68</b>	<b>27.89</b>	<b>30.22</b>	<b>13.28</b>	<b>6.95</b>	<b>3.44</b>	

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



**Figure 4. PO-01.2: Performance criteria-wise assessment score distribution of outcome ‘PO-01(A)’**

The data presented above pertains to the courses offered during academic year 2014-15. 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 “Satisfactory”.

**Assessment of Attainment of Program outcome**

**PO-02**

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

**(2014-15)**

*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*

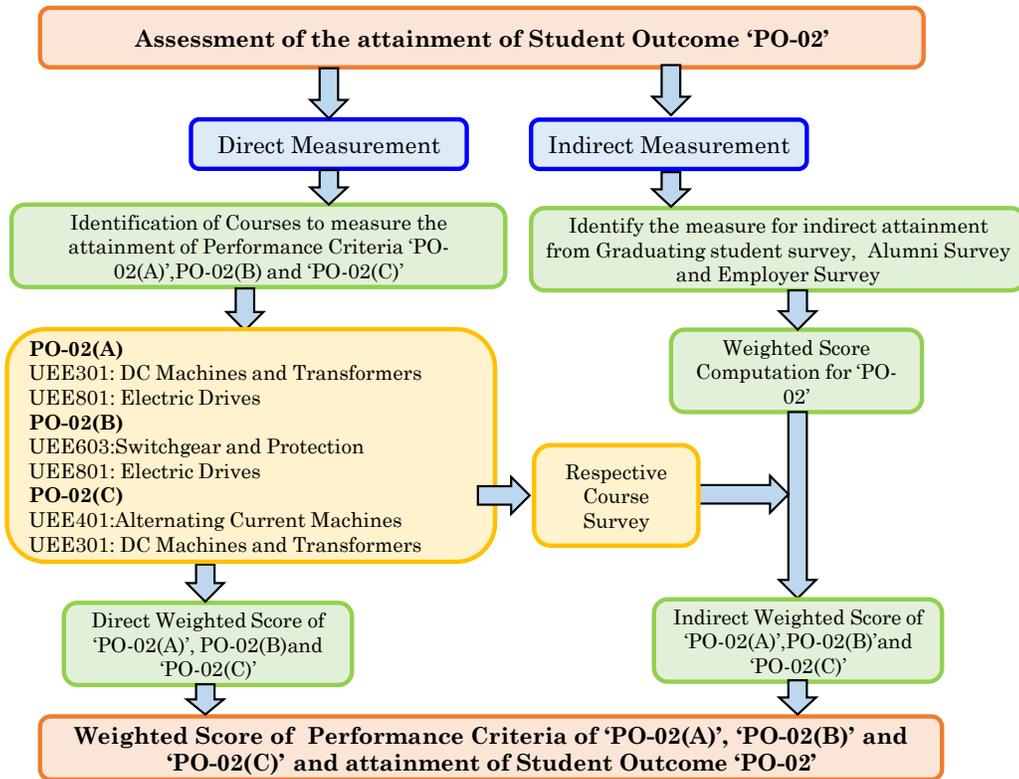
The program assessment committee identified the following courses for the assessment of program outcome 'PO-02':

- **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 2014-15.

Performance Criteria	Course -1	Course-2
PO-02(A)	UEE301: DC Machines and Transformers	UEE801: Electric Drives
PO-02(B)	UEE603: Switch gear & Protection	UEE801: Electric Drives
PO-02(C)	UEE401: Alternating Current machines	UEE301: DC Machines and Transformers

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) 2014-15. 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 2014-15**

The following Rubric has been used to convert marks obtained by students to a Likert 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 301: DC Machines and Transformers* and *UEE801: Electric Drives* are used to assess performance criteria PO-02(A) as a direct measure. The analysis for each of these courses is provided below:

**UEE 301: DC Machines and Transformers**

The performance of course *UEE 301: DC Machines and Transformers* is used to measure the attainment of outcome 'PO-02(A)' through the End Semester Examination (Question No. 2, July-Dec 2014, 15 marks).

**Question:**

Q2(a)	A 240 V , 7355 W , DC shunt motor has armature and field resistances of 0.5 $\Omega$ and 120 $\Omega$ respectively. The motor runs at a speed of 1000 rpm on full-load efficiency of 88 percent. If the speed is to be raised to 1200 rpm keeping the load torque constant, find the extra resistances to be added in the field circuit.	(8)
(b).	A 240 V DC shunt motor develops an output of 20 kW when it takes 23 kW. The armature and field resistances are 0.2 $\Omega$ and 125 $\Omega$ respectively. Find the efficiency and power input when output is 12 kW. Assume stray and friction losses remain constant.	(7)

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: UEE301**

S. No	Roll No.	Name of Student	Marks (15)	Score (1-5)
1	101304001	Aarushi Bajaj	7.5	3
2	101304002	Abhey Arora	10	4
3	101304003	Abhishek Taksali	10	4
4	101304004	Adhikaansh Tayal	3.5	2
5	101304005	Aditi Narang	9	4
6	101304006	Aditya	10	4
7	101304007	Akshat	9	4
8	101304008	Akshay Kapoor	10	4
9	101304009	Akshay Kumar	6	3
10	101304010	Akshay Kumar Chaudhary	2	1
11	101304011	Akshay Sharma	2	1
12	101304012	Amandeep Kaur	2	1
13	101304013	Amandeep Singh	6	3
14	101304014	Amaninder Singh Randhawa	7	3
15	101304015	Angad Kapoor	6.5	3
16	101304016	Ankita Garg	11.5	5
17	101304017	Ankur Malik	7	3
18	101304018	Anmol Jawa	10	4
19	101304019	Anmolpreet Singh	11	4
20	101304020	Anyuti Tiwary	8	3
21	101304021	Arpit Sharma	7.5	3
22	101304022	Arsh Kundal	2.5	1
23	101304023	Arshbir Kaur	8.5	3
24	101304024	Arshdeep Singh Bagga	5	2
25	101304025	Ashish	6.5	3
26	101304026	Ashish Rajpal	6.5	3
27	101304028	Berry Lubana	3.5	2
28	101304029	Bhanu Duggal	10	4
29	101304030	Bhanu Marwaha	10	4
30	101304031	Chirag Gaba	3	2
31	101304032	Dipin Garg	8	3
32	101304033	Dishant Vanvari	8	3
33	101304034	Divyesh Pratap Singh	7	3
34	101304035	Elham Anwar	7	3
35	101304036	Gurseerat Singh Meen	0.5	1
36	101304037	Gursewak Singh	3.5	2
37	101304040	Hariansh Sehgal	6.5	3
38	101304041	Hartejdeep Singh	3.5	2
39	101304042	Himanshu Goyal	9.5	4

S. No	Roll No.	Name of Student	Marks (15)	Score (1-5)
40	101304044	Jasjit Singh	1.5	1
41	101304045	Jassimran Singh Julka	4	2
42	101304046	Jessica Dhaliwal	6	3
43	101304047	Kanwarpal Singh	2	1
44	101304048	Karan Kumar	5	2
45	101304049	Karanjot Singh Kochar	7	3
46	101304050	Kashish Aggarwal	10	4
47	101304052	Love Gaba	7.5	3
48	101304054	Manik Mittal	6	3
49	101304055	Maninderjit Singh	8.5	3
50	101304056	Mayank Singla	4	2
51	101304057	Mridul Bhutani	7	3
52	101304058	Naman Garg	11.5	5
53	101304059	Navdeep Singh	4	2
54	101304060	Navdeep Singh	7	3
55	101304062	Nishant Garg	10	4
56	101304094	Satripleen Kaur	11.5	5
57	101484001	Amandeep Singh	7	3
58	101484002	Amrinder Singh	9.5	4
59	101484003	Ashmeen Singh	2	1
60	101484004	Azad Singh	5	2
61	101484005	Chandan Garg	11	4
62	101484007	Deepak Singla	8	3
63	101484008	Diljeet Singh	9	4
64	101304051	Kritika Singla	11.5	5
65	101304061	Nazuk Aggarwal	8	3
66	101304063	Nishtha Raheja	9	4
67	101304064	Paras Bawa	1	1
68	101304065	Parth Ahuja	7	3
69	101304066	Parushi	8	3
70	101304067	Pency Goyal	7	3
71	101304068	Piyush Jindal	4	2
72	101304069	Piyush Tripathi	5	2
73	101304070	Prachi Garg	3	2
74	101304071	Prashant Kataria	2	1
75	101304072	Preeti Garg	5	2
76	101304073	Priyank Arora	3	2
77	101304074	Priyanka	8	3
78	101304075	Priyanka Singh	8	3
79	101304076	Priyansh Mahajan	6	3
80	101304077	Rahul Meena	0	1
81	101304078	Rajan	4	2
82	101304079	Rajat Sharma	5	2

S. No	Roll No.	Name of Student	Marks (15)	Score (1-5)
83	101304080	Ratul Goyal	2	1
84	101304081	Ravinder Singh	11	4
85	101304082	Rishabh Juneja	6	3
86	101304083	Robin Manktala	6	3
87	101304084	Rohan Ghai	3	2
88	101304085	Rohan Singla	9	4
89	101304086	Rohan Wadhawan	7	3
90	101304087	Rohit Goyal	8	3
91	101304088	Rubina Bamba	8	3
92	101304089	Sagar Pulani	10	4
93	101304090	Sahil Kataria	10	4
94	101304091	Sakshi	6	3
95	101304092	Sandal Singh Sidhu	4	2
96	101304093	Sandeep Kaur	1	1
97	101304095	Saurabh Mohan	7	3
98	101304096	Shagundeep Singh	2	1
99	101304097	Shailly Gupta	9	4
100	101304098	Shaina	6	3
101	101304099	Shivika Gupta	5	2
102	101304100	Shresth Rai	6	3
103	101304101	Shubham Goyal	9	4
104	101304102	Shubham Gupta	7	3
105	101304103	Shubham Sharma	2	1
106	101304104	Shubham Sharma	6	3
107	101304105	Shubham Soin	10	4
108	101304106	Siddharth Goyal	8	3
109	101304107	Sidharth Garg	8	3
110	101304108	Simran Kaur	6	3
111	101304109	Simranjit Singh	0	1
112	101304111	Sumit Dhingra	2	1
113	101304112	Sumit Kaushik	10	4
114	101304113	Tushar Dheer	9	4
115	101484014	Saurabh Kumar Wadhawan	7	3
116	101484015	Shweta Sharma	5	2
117	101484016	Sukhjeet Singh	11	4

The performance of students through the course UEE301 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 UEE301 for criteria PO-02(A)**

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

UEE301	3.42	23.08	40.17	18.80	14.53	2.82
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### UEE 801: Electric Drives

The performance of course *UEE 801: Electric Drives* is used to measure the attainment of outcome 'PO-02(A)' through the End Semester Examination (Question No. 1(b) & 2(b), July-Dec 2014, 8 marks).

#### Question:

Q1(b)	A dc series motor is coupled to a load whose torque varies as square of speed. The motor is fed through a semi-converter from a transformer whose secondary voltage is 675V. When the firing angle is $90.5^\circ$ , the motor speed and armature current are 350rpm and 30A. It is desired to raise the speed to 500 rpm. Find armature current and firing angle of semi converter. Assume that magnetic circuit is unsaturated. Armature and field resistances are 0.22 ohm each.	(4)
Q2(b)	A 200V, 940rpm separately excited dc motor has armature resistance of 0.02 ohm. The motor is fed from single quadrant step down chopper. The input to chopper is 200V. Assume continuous conduction and find duty cycle of chopper for motoring at rated torque at 500 rpm. The rated armature current is 100A.	(4)

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 UEE801**

S. No	Roll No.	Name of Student	Total Marks (8)	Score (1-5)
1	101104001	Aakriti Singla	3.5	3
2	101104002	Abhay Goel	3.5	3
3	101104003	Abhinav Kumar Sardana	2.5	2
4	101104005	Achin Chetal	2.5	2
5	101104006	Akash Verma	4	3
6	101104007	Aman Bhatnagar	5	4
7	101104008	Amar Deep Singh	3.5	3
8	101104009	Ankit Bansal	5	4
9	101104010	Ankur Singhal	4	3
10	101104011	Anshuman Singh	4	3
11	101104012	Arunabh Choudhury	3.5	3
12	101104013	Ashish Gupta	3.5	3
13	101104016	Chetan Baria	5	4
14	101104017	Daksh Bansal	5	4
15	101104021	Dhruv Srivastav	4	3
16	101104022	Gagandeep Singh	4	3
17	101104023	Harkaran Tiwana	5	4
18	101104024	Harnoor Singh Ahluwalia	2.5	2
19	101104026	Harshit Nath	4	3
20	101104027	Harwinder Singh	5.5	4

S. No	Roll No.	Name of Student	Total Marks (8)	Score (1-5)
21	101104028	Himanshu Goel	5	4
22	101104029	Isha Jhamb	2	2
23	101104030	Jagpreet Singh	3.5	3
24	101104031	Kanika Lodha	2	2
25	101104032	Kanwaljot Singh	3.5	3
26	101104033	Karanpreet Kaur	4	3
27	101104034	Keshav Singla	5	4
28	101104035	Ketan Joshi	3	2
29	101104036	Kriti Bansal	4	3
30	101104037	Kunal Rawat	1.5	1
31	101104038	Manik Budhiraja	3	2
32	101104040	Mudit Kumar	7	5
33	101104042	Nand Nandan Arora	5	4
34	101104043	Narinderpal Singh Kaleka	5	4
35	101104044	Navjot Singh	4	3
36	101104045	Navjot Singh	4	3
37	101104046	Navneet Bansal	4	3
38	101104047	Nikhil Agarwal	5	4
39	101104048	Nitin Kumar	5	4
40	101104049	Nitish Singla	4	3
41	101104050	Perry Mittal	4	3
42	101104051	Piyush Gupta	5	4
43	101104052	Piyush Jain	3	2
44	101104054	Prabhleen Kaur	4	3
45	101104055	Prashant	3	2
46	101104056	Prateek Jain	3	2
47	101104057	Priya Saroha	2.5	2
48	101104058	Rajan Gaur	4	3
49	101104059	Rajat Gupta	3	2
50	101104060	Ratik Mittal	3.5	3
51	101104062	Rishika Kukreja	3	2
52	101104063	Rubbal Maggo	3.5	3
53	101104066	Shaurya Chopra	4	3
54	101104067	Shish Pal	3	2
55	101104068	Shubham Ahuja	4	3
56	101104069	Shubham Garg	4	3
57	101104070	Sunny Kumar Saini	2	2
58	101104071	Sunny Maheshwary	3	2
59	101104072	Suraj Pal Singh	3	2
60	101104074	Tanya Sofat	4	3
61	101104075	Tushar Garg	5	4
62	101104076	Udita Kapoor	4	3
63	101104077	Varun	4	3

S. No	Roll No.	Name of Student	Total Marks (8)	Score (1-5)
64	101104078	Vikhyat Kansal	4	3
65	101104079	Vineet Sharma	5	4
66	101104080	Vishal Gupta	5	4
67.	101104081	Vishesh Gupta	4	3
68.	101104082	Vishvesh	4	3
69.	101104083	Vivek Gupta	4	3
70.	101104084	Harmanjasraj Grewal	4	3
71.	101104085	Akhilesh Sharma	5	4
72.	101154001	Anna Kathpal	5	4
73.	101154002	Papiha Salhotra	4	3
74.	101154003	Prateek Arora	3.5	3
75.	101154004	Sandeep Singh	4	3
76.	101284002	Ashish	0	1
77.	101284004	Deepak Puri	2	2
78.	101284005	Ishan Narang	3.5	3
79.	101284006	Jatinder Singh Kapur	7	5
80.	101284007	Navneet Kumar	5	4
81.	101284008	Prikshit Singla	3.5	3
82.	101284010	Sachin Sharma	5	4

The performance of students through the course UEE801 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 UEE801 for criteria PO-02(A)**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE801	2.44	24.39	48.78	21.95	2.44	3.02

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	
UEE301	3.42	23.08	40.17	18.80	14.53	2.82
UEE801	2.44	24.39	48.78	21.95	2.44	3.02
Student class	2.93	23.73	44.48	20.38	8.48	2.92

<b>performance score</b>						
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## 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)'.

UEE301	<ul style="list-style-type: none"> <li>Select appropriate DC motor for specific purpose and can compute their steady performance.</li> <li>Thoughtfully select the speed control and starting method of DC motor.</li> </ul>
UEE801	<ul style="list-style-type: none"> <li>Develop control circuitry and devices for control of motor</li> <li>Design the converter circuit for control purpose along with its different configuration</li> </ul>

**Table PO-2(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	
UEE301	55.33	27.82	15.92	0.77	0.15	<b>4.37</b>
UEE801	31.66	28.28	29.83	29.83	5.19	<b>3.76</b>
<b>Course survey score</b>	<b>43.50</b>	<b>28.05</b>	<b>22.88</b>	<b>15.30</b>	<b>2.67</b>	<b>4.07</b>

### (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	
<b>Graduating Student Survey</b>	9.88	41.98	41.98	2.47	3.70	<b>3.51</b>
<b>Employer Survey</b>	28.02	43.48	20.77	4.83	1.93	<b>3.87</b>
<b>Alumni Survey</b>	33.33	60.00	6.67	0.00	0.00	<b>4.27</b>
<b>Other surveys score</b>	<b>23.74</b>	<b>48.49</b>	<b>23.14</b>	<b>2.43</b>	<b>1.88</b>	<b>3.88</b>

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		
<b>Student class performance</b>	2.93	23.73	44.48	20.38	8.48	<b>2.92</b>	5
<b>Course surveys</b>	43.50	28.05	22.88	15.30	2.67	<b>4.07</b>	4
<b>Other surveys</b>	23.74	48.49	23.14	2.43	1.88	<b>3.88</b>	3
<b>Overall weighted score</b>	<b>21.66</b>	<b>31.36</b>	<b>31.94</b>	<b>14.20</b>	<b>4.90</b>	<b>3.54</b>	

**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 *UEE603: Switch gear and Protection* and *UEE801: Electric Drives* are used to assess performance criteria PO-02(B) as a direct measure. The analysis for each of these courses is provided below:

**UEE603: Switch gear and Protection**

The performance of course *UEE603: Switch gear and Protection* is used to measure the attainment of outcome ‘PO-02(B)’ through the End Semester Lab performance (July-Dec 2014, 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).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: UEE603**

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101204001	Aashna	4.5	5
2	101204002	Abhinav Sharma	4	5
3	101204003	Abhishek Jain	2	3
4	101204004	Aditya Jain	4	5
5	101204005	Akash Deep	4.5	5
6	101204006	Akash Ratna	4	5
7	101204009	Akshu Gupta	3	4
8	101204010	Aman Goyal	3	4
9	101204011	Amarpreet	0	1
10	101204012	Amit Bansal	4.5	5
11	101204013	Anshul Kumar	2	3
12	101204014	Anukriti Dwivedi	3	4
13	101204015	Arushi Nagpal	3.5	4
14	101204016	Ayush Vaid	2	3
15	101204018	Chahat Singla	5	5
16	101204019	Deeksha Goyal	4.5	5
17	101204020	Dhruv Sharma	3.5	4
18	101204021	Gaurav Arora	0	1
19	101204022	Gursharan Kaur	5	5
20	101204023	Gursimran Singh	2	3
21	101204024	Harjot Singh	4	5
22	101204025	Harsh Kothari	4	5
23	101204026	Hemanshu Garg	5	5
24	101204027	Himanshu Takkar	4.5	5
25	101204028	Iqbal Singh Garcha	4.5	5
26	101204030	Ishtjot Singh	4	5
27	101204031	Jasdeep Garg	4.5	5
28	101204033	Jasleen Kaur	3.5	4
29	101204035	Kapil Kinger	3.5	4
30	101204037	Karanbir Singh Kahlon	2.5	3
31	101204038	Karanveer Singh Bhangoo	3.5	4
32	101204039	Kartik Arora	3.5	4
33	101204040	Kashish Sethi	3.5	4
34	101204041	Kaustubh Singh	4	5
35	101204042	Krishnank Atrey	2.5	3
36	101204043	Lovely Goyal	4.5	5
37	101204045	Manik Mittal	4.5	5
38	101204046	Marshall	4	5
39	101204048	Mohit Kukkar	0	1
40	101204049	Mohit Manhas	4	5
41	101204051	Nalin Kaushik	4.5	5
42	101204053	Nishant Arora	4	5
43	101204054	P Siddharth	3	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
44	101204057	Rahul Kamboj	3.5	4
45	101204059	Rajat Sahore	3.5	4
46	101204060	Rajatdeep Singh	3.5	4
47	101204061	Ramanpreet Kaur	4.5	5
48	101204063	Sahil Arora	4.5	5
49	101204064	Sahil Mittal	3	4
50	101204065	Sanchit Goel	4.5	5
51	101204066	Sewak Ram	5	5
52	101204067	Sheenu	3	4
53	101204069	Shubham Bhatia	3.5	4
54	101204070	Shubham Goel	3	4
55	101204071	Shubham Kansal	3	4
56	101204074	Sukhdarshanpal Singh	1	2
57	101204075	Sultan Singh	4	5
58	101204076	Tejasvi Anand	0	1
59	101254001	Sahilpreet Singh	3.5	4
60	101254002	Naman Kumar	0	1
61	101254003	Sachin Pathak	5	5
62	101254004	Srijan Aditya	1.5	2
63	101254005	Navjot Kaur	4	5
64	101254006	Milan Jain	4.5	5
65	101254007	Mohit	0	1
66	101254008	Gaurav	2.5	3
67	101254009	Varun Khanna	4.5	5
68	101254010	Swati Srivastava	5	5
69	101254012	Shubham Singla	3.5	4
70	101254013	Sorabh Devgun	3.5	4
71	101254014	Paras Ghai	3	4
72	101254015	Kuldeep Singh Deora	2	3
73	101254016	Sachin Gupta	4.5	5
74	101254017	Nakul Kumar	5	5
75	101384001	Ankur Singla	5	5
76	101384002	Gagandeep Singh	3	4
77	101384004	Himanshu Bansal	4	5
78	101384005	Navdeep Singh	5	5
79	101384006	Parampreet Singh	5	5
80	101384007	Saurav Goyal	4.5	5
81	101384008	Surjeet Singh	4.5	5

The performance of students through the course UEE603 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 UEE603 for criteria PO-02(B)**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE603	50.62	29.63	9.88	2.47	7.41	4.14

## UEE801: Electric Drives

The performance of course UEE801: Electric Drives is used to measure the attainment of outcome 'PO-02(B)' through the End Semester Lab performance (July-Dec 2014, 5 marks). The students were asked to perform any one experiment out of the following:

1. Single Phase Full converter to control DC drive.
2. Three Phase Bridge Semi- Converter to control DC drive.
3. Three Phase Bridge full Converter to control DC drive
4. Three phase Dual Converter to control DC drive.
5. Mc Murray Bridge Inverter to control AC drive.
6. Operation & control of Vector control AC drive.

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 UEE801**

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101104001	Aakriti Singla	4	5
2	101104002	Abhay Goel	3.5	4
3	101104003	Abhinav Kumar Sardana	2.5	3
4	101104005	Achin Chetal	3.5	4
5	101104006	Akash Verma	4	5
6	101104007	Aman Bhatnagar	3.5	4
7	101104008	Amardeep Singh	4	5
8	101104009	Ankit Bansal	4	5
9	101104010	Ankur Singhal	3	4
10	101104011	Anshuman Singh	3	4
11	101104012	Arunabh Choudhury	3	4
12	101104013	Ashish Gupta	4	5
13	101104016	Chetan Baria	3	4
14	101104017	Daksh Bansal	4	5
15	101104021	Dhruv Srivastav	4.5	5
16	101104022	Gagandeep Singh	4	5
17	101104023	Harkaran Tiwana	4	5
18	101104024	Harnoor Singh Ahluwalia	3.5	4
19	101104026	Harshit Nath	4.5	5
20	101104027	Harwinder Singh	3	4
21	101104028	Himanshu Goel	4	5
22	101104029	Isha Jhamb	3	4
23	101104030	Jagpreet Singh	4	5
24	101104031	Kanika Lodha	3	4
25	101104032	Kanwaljot Singh	3	4
26	101104033	Karanpreet Kaur	4	5
27	101104034	Keshav Singla	4	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
28	101104035	Ketan Joshi	3	4
29	101104036	Kriti Bansal	3	4
30	101104037	Kunal Rawat	2.5	3
31	101104038	Manik Budhiraja	3	4
32	101104040	Mudit Kumar	3	4
33	101104042	Nand Nandan Arora	3	4
34	101104043	Narinderpal Singh Kaleka	4	5
35	101104044	Navjot Singh	3.5	4
36	101104045	Navjot Singh	4	5
37	101104046	Navneet Bansal	4	5
38	101104047	Nikhil Agarwal	3	4
39	101104048	Nitin Kumar	4.5	5
40	101104049	Nitish Singla	3	4
41	101104050	Perry Mittal	3.5	4
42	101104051	Piyush Gupta	3	4
43	101104052	Piyush Jain	3	4
44	101104054	Prabhleen Kaur	4	5
45	101104055	Prashant	4	5
46	101104056	Prateek Jain	3.5	4
47	101104057	Priya Saroha	3.5	4
48	101104058	Rajan Gaur	4	5
49	101104059	Rajat Gupta	3	4
50	101104060	Ratik Mittal	3.5	4
51	101104062	Rishika Kukreja	4	5
52	101104063	Rubbal Maggo	3.5	4
53	101104066	Shaurya Chopra	3.5	4
54	101104067	Shish Pal	3.5	4
55	101104068	Shubham Ahuja	4	5
56	101104069	Shubham Garg	3	4
57	101104070	Sunny Kumar Saini	3.5	4
58	101104071	Sunny Maheshwary	4	5
59	101104072	Suraj Pal Singh	4	5
60	101104074	Tanya Sofat	3.5	4
61	101104075	Tushar Garg	3	4
62	101104076	Udita Kapoor	4	5
63	101104077	Varun	4	5
64	101104078	Vikhyat Kansal	4	5
65	101104079	Vineet Sharma	2.5	3
66	101104080	Vishal Gupta	3.5	4
67	101104081	Vishesh Gupta	3.5	4
68	101104082	Vishvesh	3	4
69	101104083	Vivek Gupta	4	5
70	101104084	Harmanjasraj Grewal	3.5	4
71	101104085	Akhilesh Sharma	3	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
72	101154001	Anna Kathpal	4	5
73	101154002	Papiha Salhotra	3	4
74	101154003	Prateek Arora	2.5	3
75	101154004	Sandeep Singh	4	5
76	101284001	Ashish	0	1
77	101284002	Deepak Puri	4	5
78	101284004	Ishan Narang	3	4
79	101284005	Jatinder Singh Kapur	4	5
80	101284006	Navneet Kumar	4.5	5
81	101284007	Prikshit Singla	4	5
82	101284008	Sachin Sharma	4	5
83	101284010	Vikas Bansal	3	4
84	101284011	Gurdeep Singh	4	5

The performance of students through the course UEE801 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 UEE801 for criteria PO-02(B)**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE801	44.05	50.00	4.76	0.00	1.19	4.36

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(B)', 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	
UEE603	50.62	29.63	9.88	2.47	7.41	4.14
UEE801	44.05	50.00	4.76	0.00	1.19	4.36
<b>Student class performance score</b>	<b>47.33</b>	<b>39.81</b>	<b>7.32</b>	<b>1.23</b>	<b>4.30</b>	<b>4.25</b>

## 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)'.

UEE603	<ul style="list-style-type: none"><li>Select required protections measures against over current, over voltage in transmission lines</li><li>Select suitable protection scheme for different power systems equipment</li></ul>
UEE801	<ul style="list-style-type: none"><li>Analyse the motor situation during starting and braking</li></ul>

**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	
UEE603	27.46	29.41	25.10	9.55	8.49	<b>3.58</b>
UEE801	31.66	28.28	29.83	29.83	5.19	<b>3.76</b>
Course survey score	<b>29.56</b>	<b>28.85</b>	<b>27.47</b>	<b>19.69</b>	<b>6.84</b>	<b>3.67</b>

(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	47.33	39.81	7.32	1.23	4.30	<b>4.25</b>	5
Course surveys	29.56	28.85	27.47	19.69	6.84	<b>3.67</b>	4
Other surveys	23.74	48.49	23.14	2.43	1.88	<b>3.88</b>	3
Overall weighted score	<b>35.51</b>	<b>38.33</b>	<b>17.99</b>	<b>7.69</b>	<b>4.54</b>	<b>3.96</b>	

**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 2015, 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	101004053	Pulkit Farsaiya	0	1
2	101304001	Aarushi Bajaj	3	4
3	101304002	Abhey Arora	3	4
4	101304003	Abhishek Taksali	3	4
5	101304004	Adhikaansh Tayal	1	2
6	101304005	Aditi Narang	3	4
7	101304006	Aditya	3	4
8	101304007	Akshat	4	5
9	101304008	Akshay Kapoor	3	4
10	101304009	Akshay Kumar	3	4
11	101304010	Akshay Kumar Chaudhary	2	3
12	101304011	Akshay Sharma	3	4
13	101304012	Amandeep Kaur	2	3
14	101304013	Amandeep Singh	2	3
15	101304014	Amaninder Singh Randhawa	2	3
16	101304015	Angad Kapoor	3	4
17	101304016	Ankita Garg	2	3
18	101304017	Ankur Malik	2	3
19	101304018	Anmol Jawa	3	4
20	101304019	Anmolpreet Singh	3	4
21	101304020	Anyuti Tiwary	3	4
22	101304021	Arpit Sharma	3	4
23	101304022	Arsh Kundal	2	3

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
24	101304023	Arshbir Kaur	2	3
25	101304024	Arshdeep Singh Bagga	3	4
26	101304025	Ashish	2	3
27	101304026	Ashish Rajpal	2	3
28	101304028	Berry Lubana	3	4
29	101304029	Bhanu Duggal	4	5
30	101304030	Bhanu Marwaha	2	3
31	101304031	Chirag Gaba	2	3
32	101304032	Dipin Garg	3	4
33	101304033	Dishant Vanvari	3	4
34	101304034	Divyesh Pratap Singh	3	4
35	101304035	Elham Anwar	3	4
36	101304036	Gurseerat Singh Meen	2	3
37	101304037	Gursewak Singh	2	3
38	101304040	Hariansh Sehgal	3	4
39	101304041	Hartejdeep Singh	3	4
40	101304042	Himanshu Goyal	3	4
41	101304044	Jasjit Singh	2	3
42	101304045	Jassimran Singh Julka	3	4
43	101304046	Jessica Dhaliwal	3	4
44	101304047	Kanwarpal Singh	2	3
45	101304048	Karan Kumar	3	4
46	101304049	Karanjot Singh Kochar	3	4
47	101304050	Kashish Aggarwal	3	4
48	101304052	Love Gaba	2	3
49	101304054	Manik Mittal	3	4
50	101304055	Maninderjit Singh	3	4
51	101304056	Mayank Singla	3	4
52	101304057	Mridul Bhutani	2	3
53	101304058	Naman Garg	3	4
54	101304059	Navdeep Singh	3	4
55	101304060	Navdeep Singh	2	3
56	101304062	Nishant Garg	3	4
57	101304094	Satripleen Kaur	2	3
58	101484001	Amandeep Singh	3	4
59	101484002	Amrinder Singh	4	5
60	101484003	Ashmeen Singh	2	3
61	101484004	Azad Singh	3	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
62	101484005	Chandan Garg	3	4
63	101484007	Deepak Singla	3	4
64	101484008	Diljeet Singh	3	4
65	101304051	Kritika Singla	3	4
66	101304061	Nazuk Aggarwal	3	4
67	101304063	Nishtha Raheja	3	4
68	101304064	Paras Bawa	3	4
69	101304065	Parth Ahuja	2	3
70	101304066	Parushi	3	4
71	101304067	Pency Goyal	3	4
72	101304068	Piyush Jindal	2	3
73	101304069	Piyush Tripathi	2	3
74	101304070	Prachi Garg	2	3
75	101304071	Prashant Kataria	2	3
76	101304072	Preeti Garg	2	3
77	101304073	Priyank Arora	2	3
78	101304074	Priyanka	2	3
79	101304075	Priyanka Singh	3	4
80	101304076	Priyansh Mahajan	3	4
81	101304077	Rahul Meena	2	3
82	101304078	Rajan	3	4
83	101304079	Rajat Sharma	3	4
84	101304080	Ratul Goyal	3	4
85	101304081	Ravinder Singh	3	4
86	101304082	Rishabh Juneja	2	3
87	101304083	Robin Manktala	2	3
88	101304084	Rohan Ghai	2	3
89	101304085	Rohan Singla	2	3
90	101304086	Rohan Wadhawan	3	4
91	101304087	Rohit Goyal	2	3
92	101304088	Rubina Bamba	2	3
93	101304089	Sagar Pulani	3	4
94	101304090	Sahil Kataria	3	4
95	101304091	Sakshi	3	4
96	101304092	Sandal Singh Sidhu	2	3
97	101304093	Sandeep Kaur	2	3
98	101304095	Saurabh Mohan	3	4
99	101304096	Shagundeep Singh	2	3

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
100	101304097	Shailly Gupta	3	4
101	101304098	Shaina	3	4
102	101304099	Shivika Gupta	2	3
103	101304100	Shresth Rai	2	3
104	101304101	Shubham Goyal	2	3
105	101304102	Shubham Gupta	3	4
106	101304103	Shubham Sharma	2	3
107	101304104	Shubham Sharma	3	4
108	101304105	Shubham Soin	4	5
109	101304106	Siddharth Goyal	2	3
110	101304107	Sidharth Garg	3	4
111	101304108	Simran Kaur	2	3
112	101304109	Simranjit Singh	2	3
113	101304111	Sumit Dhingra	2	3
114	101304112	Sumit Kaushik	3	4
115	101304113	Tushar Dheer	1	2
116	101304114	Tushar Sharma	2	3
117	101304116	Utsav Chhabra	2	3
118	101304117	Vaibhav Gupta	3	4
119	101304118	Vaishali	2	3
120	101304119	Varun Bansal	2	3
121	101304120	Veni Jindal	3	4
122	101304121	Vishal Arora	2	3
123	101304122	Yugesh Goyal	2	3
124	101484009	Jyoti Kaushal	2	3
125	101484011	Pawan Kumar	3	4
126	101484012	Rajat Singla	3	4
127	101484013	Satveer Kaur	3	4
128	101484014	Saurabh Kumar Wadhawan	3	4
129	101484015	Shweta Sharma	2	3
130	101484016	Sukhjeet Singh	3	4

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	

<b>UEE401</b>	<b>3.08</b>	<b>52.31</b>	<b>42.31</b>	<b>1.54</b>	<b>0.77</b>	<b>3.55</b>
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**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 lab reports (July-Dec 2014, 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	101304001	Aarushi Bajaj	4	5
2	101304002	Abhey Arora	4	5
3	101304003	Abhishek Taksali	4	5
4	101304004	AdhikaanshTayal	4	5
5	101304005	Aditi Narang	4	5
6	101304006	Aditya	5	5
7	101304007	Akshat	4	5
8	101304008	Akshay Kapoor	5	5
9	101304009	Akshay Kumar	4	5
10	101304010	Akshay Kumar Chaudhary	4	5
11	101304011	Akshay Sharma	4	5
12	101304012	Amandeep Kaur	4	5
13	101304013	Amandeep Singh	4	5
14	101304014	Amaninder Singh Randhawa	4	5
15	101304015	Angad Kapoor	4	5
16	101304016	Ankita Garg	4	5
17	101304017	Ankur Malik	4	5
18	101304018	Anmol Jawa	5	5
19	101304019	Anmolpreet Singh	5	5
20	101304020	AnyutiTiwary	4	5
21	101304021	Arpit Sharma	4	5
22	101304022	ArshKundal	4	5
23	101304023	Arshbir Kaur	4	5
24	101304024	Arshdeep Singh Bagga	4	5
25	101304025	Ashish	4	5
26	101304026	Ashish Rajpal	4	5
27	101304028	Berry Lubana	4	5
28	101304029	Bhanu Duggal	5	5
29	101304030	BhanuMarwaha	4	5
30	101304031	Chirag Gaba	4	5
31	101304032	Dipin Garg	4	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
32	101304033	DishantVanvari	4	5
33	101304034	DivyeshPratap Singh	4	5
34	101304035	Elham Anwar	4	5
35	101304036	Gurseerat Singh Meen	4	5
36	101304037	Gursewak Singh	4	5
37	101304040	HarianshSehgal	4	5
38	101304041	Hartejdeep Singh	4	5
39	101304042	HimanshuGoyal	4	5
40	101304044	Jasjit Singh	4	5
41	101304045	Jassimran Singh Julka	4	5
42	101304046	Jessica Dhaliwal	4	5
43	101304047	Kanwarpal Singh	4	5
44	101304048	Karan Kumar	4	5
45	101304049	Karanjot Singh Kochar	4	5
46	101304050	Kashish Aggarwal	4	5
47	101304051	KritikaSingla	4	5
48	101304052	Love Gaba	4	5
49	101304054	Manik Mittal	4	5
50	101304055	Maninderjit Singh	4	5
51	101304056	MayankSingla	4	5
52	101304057	MridulBhutani	4	5
53	101304058	Naman Garg	4	5
54	101304059	Navdeep Singh	5	5
55	101304060	Navdeep Singh	5	5
56	101304061	Nazuk Aggarwal	4	5
57	101304062	Nishant Garg	5	5
58	101304063	NishthaRaheja	4	5
59	101304064	Paras Bawa	4	5
60	101304065	Parth Ahuja	4	5
61	101304066	Parushi	4	5
62	101304067	PencyGoyal	4	5
63	101304068	Piyush Jindal	4	5
64	101304069	PiyushTripathi	4	5
65	101304070	Prachi Garg	4	5
66	101304071	Prashant Kataria	4	5
67	101304072	Preeti Garg	4	5
68	101304073	Priyank Arora	4	5
69	101304074	Priyanka	4	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
70	101304075	Priyanka Singh	5	5
71	101304076	Priyansh Mahajan	5	5
72	101304077	Rahul Meena	4	5
73	101304078	Rajan	3	4
74	101304079	Rajat Sharma	4	5
75	101304080	Ratul Goyal	4	5
76	101304081	Ravinder Singh	4	5
77	101304082	RishabhJuneja	4	5
78	101304083	Robin Manktala	4	5
79	101304084	Rohan Ghai	4	5
81	101304085	Rohan Singla	5	5
82	101304086	Rohan Wadhawan	5	5
83	101304087	Rohit Goyal	5	5
84	101304088	Rubina Bamba	4	5
85	101304089	Sagar Pulani	4	5
86	101304090	Sahil Kataria	4	5
87	101304091	Sakshi	4	5
88	101304092	Sandal Singh Sidhu	4	5
89	101304093	Sandeep Kaur	5	5
90	101304094	Satripleen Kaur	5	5
91	101304095	Saurabh Mohan	5	5
92	101304096	Shagundeep Singh	4	5
93	101304097	Shailly Gupta	4	5
94	101304098	Shaina	4	5
95	101304099	Shivika Gupta	4	5
96	101304100	Shresth Rai	4	5
97	101304101	ShubhamGoyal	4	5
98	101304102	Shubham Gupta	4	5
99	101304103	Shubham Sharma	4	5
100	101304104	Shubham Sharma	4	5
101	101304105	ShubhamSoin	5	5
102	101304106	SiddharthGoyal	4	5
103	101304107	Sidharth Garg	4	5
104	101304108	Simran Kaur	4	5
105	101304109	Simranjit Singh	5	5
106	101304111	SumitDhingra	4	5
107	101304112	Sumit Kaushik	0	1
108	101304113	TusharDheer	4	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
109	101304114	Tushar Sharma	4	5
110	101304116	Utsav Chhabra	4	5
111	101304117	Vaibhav Gupta	4	5
112	101304118	Vaishali	0	1
113	101304119	Varun Bansal	4	5
114	101304120	Veni Jindal	4	5
115	101304121	Vishal Arora	4	5
116	101304122	YugeshGoyal	4	5
117	101484001	Amandeep Singh	4	5
118	101484002	Amrinder Singh	4	5
119	101484003	Ashmeen Singh	4	5
120	101484004	Azad Singh	4	5
121	101484005	Chandan Garg	4	5
122	101484007	Deepak Singla	5	5
123	101484008	Diljeet Singh	5	5
124	101484009	Jyoti Kaushal	4	5
125	101484011	Pawan Kumar	0	1
126	101484012	RajatSingla	4	5
127	101484013	Satveer Kaur	5	5
128	101484014	Saurabh Kumar Wadhawan	5	5
129	101484015	Shweta Sharma	5	5
130	101484016	Sukhjeet Singh	5	5

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	
<b>UEE301</b>	<b>96.90</b>	<b>0.78</b>	<b>0.00</b>	<b>0.00</b>	<b>2.33</b>	<b>4.90</b>

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	
<b>UEE401</b>	3.08	52.31	42.31	1.54	0.77	<b>3.55</b>

<b>UEE301</b>	96.90	0.78	0.00	0.00	2.33	<b>4.90</b>
<b>Student class performance score</b>	<b>49.99</b>	<b>26.54</b>	<b>21.15</b>	<b>0.77</b>	<b>1.55</b>	<b>4.23</b>

### 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	<ul style="list-style-type: none"> <li>• Simulate the steady-state and transient state performance of induction and synchronous machines.</li> <li>• Validate and identify the machine parameters.</li> <li>• Select the appropriate AC motor for different large power application.</li> <li>• Analyse the stability of single machine – infinite bus system and form the grid to supply large load.</li> <li>• Choose the appropriate fractional horse power motor as per the usage in daily life</li> </ul>
UEE301	<ul style="list-style-type: none"> <li>• Test the transformer and calculate its efficiency and performance in distribution system.</li> <li>• Scrutinize three-phase transformer connections and use special purpose transformer for measurement and protection</li> <li>• Select appropriate DC motor for specific purpose and can compute their steady performance.</li> <li>• Compute the performance with DC generators and can supply increasing load with parallel operation.</li> <li>• Thoughtfully select the speed control and starting method of DC motor.</li> </ul>

**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	
<b>UEE401</b>	34.3	60.4	3.0	0	2.2	<b>4.25</b>
<b>UEE301</b>	5.06	58.22	32.91	3.79	0	<b>3.64</b>
<b>Course survey score</b>	<b>19.68</b>	<b>59.31</b>	<b>17.96</b>	<b>1.90</b>	<b>1.10</b>	<b>3.95</b>

(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	49.99	26.54	21.15	0.77	1.55	<b>4.23</b>	5
Course surveys	19.68	59.31	17.96	1.90	1.10	<b>3.95</b>	4
Other surveys	23.74	48.49	23.14	2.43	1.88	<b>3.88</b>	3
<b>Overall weighted score</b>	<b>33.32</b>	<b>42.95</b>	<b>20.58</b>	<b>1.56</b>	<b>1.48</b>	<b>4.05</b>	-

**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 PO-02 has been completed using the attainment values for PO-02(A), PO-02(B) and PO-02(C) and is given below:

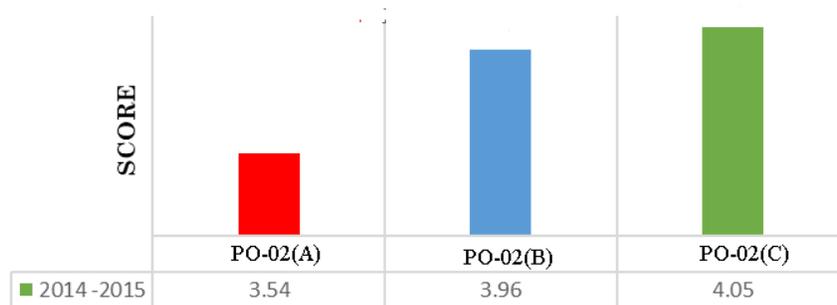
Table PO-02.2 summarizes the scores of each of the three performance criteria and these scores have been used to assess an overall score for outcome PO-02.

**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)	21.66	31.36	31.94	14.20	4.90	<b>3.54</b>	5
PO-02(B)	35.51	38.33	17.99	7.69	4.54	<b>3.96</b>	5
PO-02(C)	33.32	42.95	20.58	1.56	1.48	<b>4.05</b>	5
<b>Overall score</b>	<b>30.16</b>	<b>37.55</b>	<b>23.50</b>	<b>7.82</b>	<b>3.64</b>	<b>3.85</b>	

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 2014-2015



**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 2014-15. 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*

**(2014-15)**

*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*

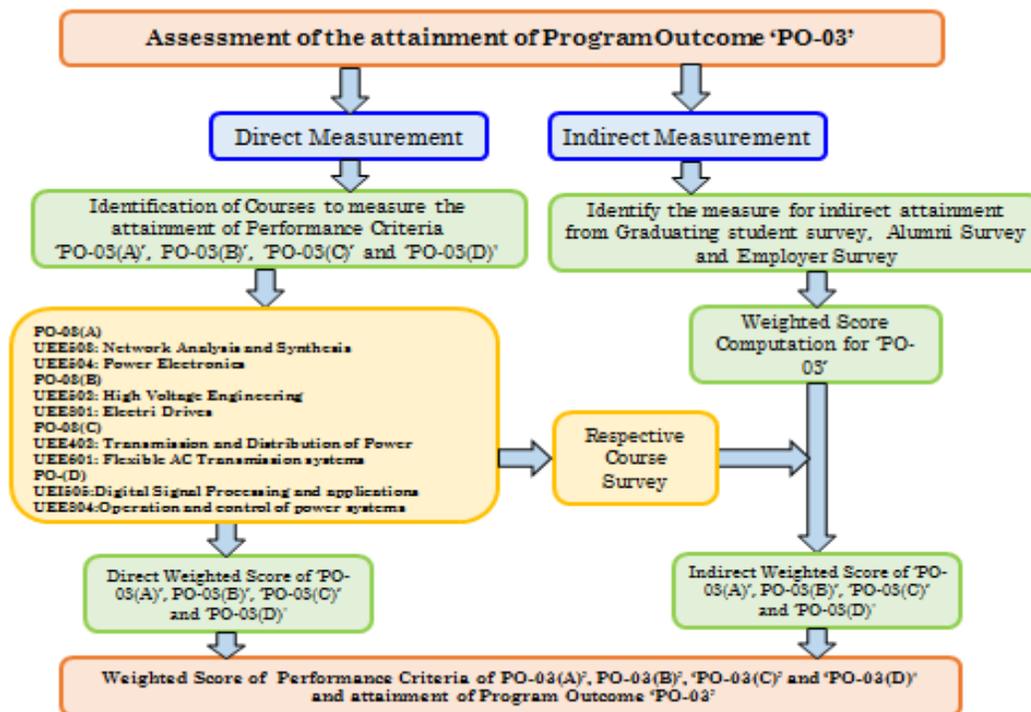
The program assessment committee identified the following courses for the assessment of Program Outcome 'PO-03'. The courses used for the assessment during three academic years are **marked bold**.

- **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-03 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 2014-15.

Performance Criteria	Course -1	Course-2
PO-03(A)	UEE503: Network Analysis and Synthesis	UEE504: Power Electronics
PO-03(B)	UEE502: High Voltage Engineering	UEE801: Electric Drives
PO-03(C)	UEE402: Transmission and Distribution of Power	UEE601: Flexible AC Transmission Systems
PO-03(D)	UEI503: Digital Signal Processing and Applications	UEE804: Operation and Control of Power Systems

The step by step methodology used to measure the attainment of Program Outcome ‘PO-03’ is shown in Fig. PO-03.1 for academic year (AY) 2014-15. The similar procedure is followed to measure the attainment of Program Outcome ‘PO-03’ for all three academic years under consideration.



**Fig. PO-03.1: Process for measurement of attainment of outcome 'PO-03' for the year 2014-15**

The Rubric used to convert marks obtained by students to a scale in the range of 1 to 5 is described in Table PO-03.1 (a) and Table PO-03.1 (b) for theoretical and other sessional component respectively.

**Table PO-03.1(a): Rubric for Outcome Measurement of Theoretical Components**

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-03.1(b): Rubric for Outcome Measurement of Sessional Components**

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:**

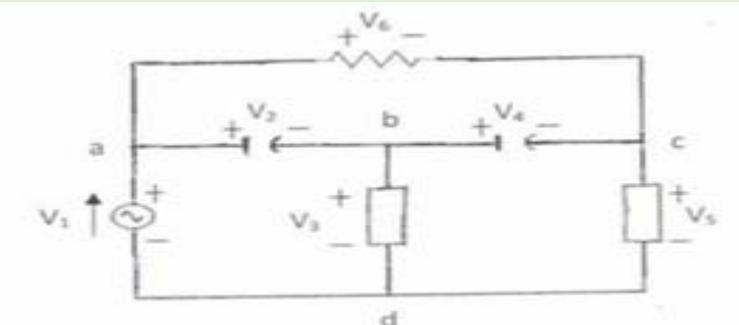
**(i) Assessment Tool: Students' performance using Course Portfolio**

Two courses namely *UEE503: Network Analysis and Synthesis* and *UEE504: Power Electronics* are used to assess performance criteria PO-03(A) as a direct measure. The analysis for each of these courses is provided below:

**UEE503: Network Analysis and Synthesis**

The performance of course *UEE503: Control Systems* is used to measure the attainment of outcome 'PO-03(A)' through the Mid Semester Examination (Question No. 1, Sept 2014, weightage 5 marks).

**Question:**

Q.1	<p>(a) State and prove 'Tellegen's Theorem' (2)</p> <p>(b) For the circuit shown in Figure-1, verify Tellegen's Theorem.                  Branch voltages are <math>V_1 = 10\text{ V}</math>, <math>V_2 = 4\text{ V}</math>, <math>V_3 = 6\text{ V}</math>, <math>V_4 = 4\text{ V}</math>, <math>V_5 = 2\text{ V}</math>, <math>V_6 = 8\text{ V}</math>.                  Branch currents are <math>i_1 = 1\text{ A}</math> (a to d), <math>i_2 = 2\text{ A}</math> (a to b), <math>i_3 = 4\text{ A}</math> (b to d), <math>i_4 = -2\text{ A}</math> (b to c), <math>i_5 = -5\text{ A}</math> (c to d), <math>i_6 = -3\text{ A}</math> (a to c) (3)</p> <div style="text-align: center;">  <p>Figure-1</p> </div>	(5)
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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-03.1(a).

**Table PO-03(A).1: Students' performance in question targeting 'PO-03(A)': Course UEE503**

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101204001	Aashna	1	2
2	101204002	Abhinav Sharma	2	3
3	101204003	Abhishek Jain	2	3
4	101204004	Aditya Jain	0	1
5	101204005	Akash Deep	2	3
6	101204006	AkashRatna	2	3
7	101204009	Akshu Gupta	2	3
8	101204010	AmanGoyal	2	3
9	101204011	Amarpreet	1	2
10	101204012	AmitBansal	2	3
11	101204013	Anshul Kumar	0	1
12	101204014	AnukritiDwivedi	2	3
13	101204015	ArushiNagpal	2	3
14	101204016	AyushVaid	1	2
15	101204018	ChahatSingla	3	4
16	101204019	DeekshaGoyal	2	3
17	101204020	Dhruv Sharma	2	3
18	101204021	GauravArora	1	2
19	101204022	GursharanKaur	3	4
20	101204023	Gursimran Singh	3	4
21	101204024	Harjot Singh	3	4
22	101204025	Harsh Kothari	2	3
23	101204026	HemanshuGarg	3	4
24	101204027	HimanshuTakkar	2	3
25	101204028	Iqbal Singh Garcha	3	4
26	101204030	Ishtjot Singh	1	2
27	101204031	JasdeepGarg	3	4
28	101204033	JasleenKaur	2	3
29	101204035	KapilKinger	1	2
30	101204037	Karanbir Singh Kahlon	1	2
31	101204038	Karanveer Singh Bhangoo	1	2
32	101204039	KartikArora	1	2
33	101204040	KashishSethi	1	2
34	101204041	Kaustubh Singh	3	4
35	101204042	KrishnankAtrey	1	2
36	101204043	Lovely Goyal	1	2
37	101204045	Manik Mittal	1	2
38	101204046	Marshall	1	2
39	101204048	MohitKukkar	2	3

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
40	101204049	MohitManhas	1	2
41	101204051	NalinKaushik	2	3
42	101204053	NishantArora	2	3
43	101204054	P Siddharth	2	3
44	101204057	Rahul Kamboj	2	3
45	101204059	RajatSahore	3	4
46	101204060	Rajatdeep Singh	1	2
47	101204061	RamanpreetKaur	2	3
48	101204063	SahilArora	2	3
49	101204064	Sahil Mittal	2	3
50	101204065	SanchitGoel	1	2
51	101204066	Sewak Ram	1	2
52	101204067	Sheenu	2	3
53	101204069	Shubham Bhatia	2	3
54	101204070	ShubhamGoel	3	4
55	101204071	ShubhamKansal	2	3
56	101204074	Sukhdarshanpal Singh	1	2
57	101204075	Sultan Singh	3	4
58	101204076	TejasviAnand	3	4
59	101205033	Manish Tripathi	2	3
60	101254001	Sahilpreet Singh	0	1
61	101254002	Naman Kumar	1	2
62	101254003	Sachin Pathak	2	3
63	101254004	SrijanAditya	1	2
64	101254005	NavjotKaur	1	2
65	101254006	Milan Jain	2	3
66	101254008	Gaurav	2	3
67	101254009	VarunKhanna	2	3
68	101254010	Swati Srivastava	1	2
69	101254012	ShubhamSingla	2	3
70	101254013	SorabhDevgun	1	2
71	101254014	ParasGhai	2	3
72	101254015	Kuldeep Singh Deora	0	1
73	101254016	Sachin Gupta	2	3
74	101254017	Nakul Kumar	3	4
75	101384001	AnkurSingla	3	4
76	101384002	Gagandeep Singh	2	3
77	101384004	HimanshuBansal	2	3
78	101384005	Navdeep Singh	1	2
79	101384006	Parampreet Singh	4	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
80	101384007	SauravGoyal	3	4
81	101384008	Surjeet Singh	1	2

The performance of students through the course UEE503 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 UEE503 for criteria 'PO-03(A)'**

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE503	1.23	18.52	43.21	32.10	4.94	2.79

### UEE504: Power Electronics

The performance of course UEE504: Power Electronics is used to measure the attainment of outcome 'PO-03(A)' through the End Semester Examination (No. 3, December 2014, weightage 12 marks).

#### Question:

Q.3	<p>(a) Explain various modes of operation of resonant pulse commutated chopper with</p> <p>(i) Summarized list of its features</p> <p>(ii) relevant waveforms</p> <p>(iii) Appropriate design of commutation circuit.</p> <p>(iv) For the given chopper parameters as <math>V_s = 220\text{ V}</math>, load circuit parameters = <math>0.5\Omega</math>, <math>2\text{ mH}</math>, <math>40\text{ V}</math>, commutation circuit parameters: <math>L=20\mu\text{H}</math> and <math>C=50\mu\text{ F}</math>, <math>T_{on}= 800\ \mu\text{s}</math>, <math>T=2000\ \mu\text{s}</math> compute the effective on period, peak currents through main thyristor <math>T_1</math> and auxiliary thyristor <math>T_A</math>, total commutation interval, Capacitor Voltage <math>150\ \mu\text{s}</math> after <math>T_A</math> is triggered, time needed to recharge the capacitor to voltage <math>V_s</math>. Assume the load current of <math>70\text{ A}</math> is constant and ripple free.</p>	(12)
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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-03.1(a).

**Table PO-03(A).3: Students' performance in question targeting 'PO-03(A)': Course UEE504**

S. No	Roll No.	Name of Student	Marks (12)	Score (1-5)
1	101204001	Aashna	4	2
2	101204002	Abhinav	6	3
3	101204003	Abhishek	4	2
4	101204004	Aditya	4	2
5	101204005	Akash Deep	4	2
6	101204006	Akash	6	3

7	101204009	Akshu	4	2
8	101204010	Aman	6	3
9	101204011	Amarpreet	0	1
10	101204012	Amit	2	1
11	101204013	Anshul	2	1
12	101204014	Anukriti	6	3
13	101204015	Arushi	6	3
14	101204016	AyushVaid	2	1
15	101204018	ChahatSingla	8	4
16	101204019	DeekshaGoyal	6	3
17	101204020	Dhruv Sharma	6	3
18	101204021	GauravArora	2	1
19	101204022	GursharanKaur	10	5
20	101204023	Gursimran Singh	8	4
21	101204024	Harjot Singh	8	4
22	101204025	Harsh Kothari	6	3
23	101204026	Hemanshu	6	3
24	101204027	HimanshuTakkar	4	2
25	101204028	Iqbal Singh	10	5
26	101204030	Ishtjot Singh	2	1
27	101204031	JasdeepGarg	8	4
28	101204033	JasleenKaur	6	3
29	101204035	KapilKinger	4	2
30	101204037	Karanbir Singh	4	2
31	101204038	Karanveer Singh	2	1
32	101204039	KartikArora	4	2
33	101204040	KashishSethi	4	2
34	101204041	Kaustubh Singh	6	3
35	101204042	KrishnankAtrey	2	1
36	101204043	Lovely Goyal	4	2
37	101204045	Manik Mittal	6	3
38	101204046	Marshall	2	1
39	101204048	MohitKukkar	4	2
40	101204051	NalinKaushik	6	3
41	101204053	NishantArora	6	3
42	101204054	P Siddharth	6	3
43	101204057	Rahul Kamboj	6	3
44	101204059	RajatSahore	2	1
45	101204060	Rajatdeep Singh	6	3
46	101204063	SahilArora	8	4
47	101204064	Sahil Mittal	4	2

48	101204065	SanchitGoel	4	2
49	101204066	Sewak Ram	4	2
50	101204067	Sheenu	4	2
51	101204069	Shubham Bhatia	2	1
52	101204070	ShubhamGoel	6	3
53	101204071	ShubhamKansal	6	3
54	101204074	Sukhdarshanpal S	4	2
55	101204075	Sultan Singh	6	3
56	101204076	TejasviAnand	6	3
57	101254001	Sahilpreet Singh	4	2
58	101254002	Naman Kumar	2	1
59	101254003	Sachin Pathak	6	3
60	101254004	SrijanAditya	6	3
61	101254005	NavjotKaur	0	1
62	101254006	Milan Jain	6	3
63	101254007	Mohit	2	1
64	101254008	Gaurav	6	3
65	101254009	VarunKhanna	6	3
66	101254010	Swati Srivastava	2	1
67	101254012	ShubhamSingla	8	4
68	101254013	SorabhDevgun	4	2
69	101254014	ParasGhai	2	1
70	101254015	Kuldeep Singh	4	2
71	101254016	Sachin Gupta	8	4
72	101254017	Nakul Kumar	8	4
73	101384001	AnkurSingla	6	3
74	101384002	Gagandeep Singh	6	3
75	101384004	HimanshuBansal	8	4
76	101384005	Navdeep Singh	4	2
77	101384006	Parampreet Singh	10	5
78	101384007	SauravGoyal	8	4
79	101384008	Surjeet Singh	2	1

The performance of students through the course UEE504 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 UEE504 for criteria PO-03(A)**

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

<b>UEE504</b>	3.80	12.66	35.44	26.58	21.52	<b>2.51</b>
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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)'**

<b>Courses</b>	<b>% of Students in each Score</b>					<b>Average Score</b>
	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	
<b>UEE503</b>	1.23	18.52	43.21	32.10	4.94	<b>2.79</b>
<b>UEE504</b>	3.80	12.66	35.44	26.58	21.52	<b>2.51</b>
<b>Student Class Performance Score</b>	<b>2.52</b>	<b>15.59</b>	<b>39.33</b>	<b>29.34</b>	13.23	<b>2.65</b>

**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.

**(i) 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)’.

<b>UEE503</b>	Describe the underlying concepts of AC electric networks
<b>UEE504</b>	Select and design appropriate converter configuration / topology for typical power application such as DC drive, AC drive, HVDC and FACTS.

**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	
<b>UEE503</b>	49.81	14.45	20.67	5.61	9.45	<b>3.90</b>
<b>UEE504</b>	50.94	20.43	13.39	2.95	12.28	<b>3.95</b>
<b>Course Survey Score</b>	<b>50.38</b>	<b>17.44</b>	<b>17.03</b>	<b>4.28</b>	<b>10.87</b>	<b>3.93</b>

**(ii) 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.

<b>Graduating Survey</b>	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.
<b>Alumni Survey</b>	
<b>Employer Survey</b>	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	
<b>Graduating student survey</b>	29.58	40.85	29.58	0.00	0.00	<b>4.00</b>
<b>Employer survey</b>	26.67	53.33	20.00	0.00	0.00	<b>4.07</b>
<b>Alumni survey</b>	34.30	31.88	26.09	5.80	1.93	<b>3.91</b>
<b>Other Survey Score</b>	<b>30.18</b>	<b>42.02</b>	<b>25.22</b>	<b>1.93</b>	<b>0.64</b>	<b>3.99</b>

**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	2.52	15.59	39.33	29.34	13.23	<b>2.65</b>	5
Course Survey	50.38	17.44	17.03	4.28	10.87	<b>3.93</b>	4
Other Surveys	30.18	42.02	25.22	1.93	0.64	<b>3.99</b>	3
Overall Score	<b>25.39</b>	<b>22.81</b>	<b>28.37</b>	<b>14.13</b>	<b>9.30</b>	<b>3.41</b>	-

## 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 *UEE502: High Voltage Engineering* and *UEE801: Electric Drives* are used to assess performance criteria PO-03(B) 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-03(B)' through the End Semester Examination (Question No. 4, 2015, weightage 9 marks).

#### Question:

Q.4	(a) Explain how a sphere gap can be used to measure the peak value of voltages. What are the parameters and factors that influences such voltage measurement? (b) Explain resistance potential divider for very low impulse voltages with circuit diagram? Why compensated resistance potential divider is used explain it with circuit diagram? (c) A generating voltmeter is to read 250 kV with an indicating meter having a range of (0-20) $\mu\text{A}$ calibrated accordingly. Calculate the capacitance of the generating voltmeter when the driving motor rotates at a constant speed of 1500 rpm.	(9)
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The performance of the students in the above question is summarized in Table PO-03(B).1 using rubrics defined in Table PO-03.1 (b).

**Table PO-03(B).1: Students' performance in question targeting 'PO-03(B)': Course UEE502**

S. No	Roll No.	Name of Student	Marks (9)	Score (1-5)
1	100904083	BrahmRoop Singh	2	2
2	101004076	Harshobit Singh	0	1
3	101204001	Aashna	5	3
4	101204002	Abhinav Sharma	6	4
5	101204003	Abhishek Jain	7	5
6	101204004	Aditya Jain	4	3
7	101204005	Akash Deep	8	5
8	101204006	AkashRatna	8	5
9	101204009	Akshu Gupta	8	5

S. No	Roll No.	Name of Student	Marks (9)	Score (1-5)
10	101204010	AmanGoyal	7	5
11	101204011	Amarpreet	2	2
12	101204012	AmitBansal	7	5
13	101204013	Anshul Kumar	4	3
14	101204014	AnukritiDwivedi	8	5
15	101204015	ArushiNagpal	9	5
16	101204016	AyushVaid	4	3
17	101204018	ChahatSingla	8	5
18	101204019	DeekshaGoyal	8	5
19	101204020	Dhruv Sharma	6	4
20	101204021	GauravArora	5	3
21	101204022	GursharanKaur	8	5
22	101204023	Gursimran Singh	8	5
23	101204024	Harjot Singh	8	5
24	101204025	Harsh Kothari	7	5
25	101204026	HemanshuGarg	7	5
26	101204027	HimanshuTakkar	8	5
27	101204028	Iqbal Singh Garcha	8	5
28	101204030	Ishtjot Singh	4	3
29	101204031	JasdeepGarg	6	4
30	101204033	JasleenKaur	8	5
31	101204035	KapilKinger	6	4
32	101204037	Karanbir Singh Kahlon	3	2
33	101204038	Karanveer Singh Bhangoo	6	4
34	101204039	KartikArora	6	4
35	101204040	KashishSethi	3	2
36	101204041	Kaustubh Singh	6	4
37	101204042	KrishnankAtrey	4	3
38	101204043	Lovely Goyal	7	5
39	101204045	Manik Mittal	6	4
40	101204046	Marshall	4	3
41	101204048	MohitKukkar	5	3
42	101204049	MohitManhas	6	4
43	101204051	NalinKaushik	7	5
44	101204053	NishantArora	7	5
45	101204054	P Siddharth	4	3
46	101204057	Rahul Kamboj	6	4
47	101204059	RajatSahore	6	4
48	101204060	Rajatdeep Singh	6	4
49	101204061	RamanpreetKaur	7	5

S. No	Roll No.	Name of Student	Marks (9)	Score (1-5)
50	101204063	SahilArora	8	5
51	101204064	Sahil Mittal	8	5
52	101204065	SanchitGoel	7	5
53	101204066	Sewak Ram	6	4
54	101204067	Sheenu	7	5
55	101204069	Shubham Bhatia	3	2
56	101204070	ShubhamGoel	8	5
57	101204071	ShubhamKansal	4	3
58	101204074	Sukhdarshanpal Singh	5	3
59	101204075	Sultan Singh	6	4
60	101204076	TejasviAnand	7	5
61	101254001	Sahilpreet Singh	4	3
62	101254002	Naman Kumar	5	3
63	101254003	Sachin Pathak	7	5
64	101254004	SrijanAditya	3	2
65	101254005	NavjotKaur	5	3
66	101254006	Milan Jain	8	5
67	101254008	Gaurav	6	4
68	101254009	VarunKhanna	7	5
69	101254010	Swati Srivastava	6	4
70	101254012	ShubhamSingla	5	3
71	101254013	SorabhDevgun	6	4
72	101254014	ParasGhai	6	4
73	101254015	Kuldeep Singh Deora	6	4
74	101254016	Sachin Gupta	8	5
75	101254017	Nakul Kumar	7	5
76	101384001	AnkurSingla	7	5
77	101384002	Gagandeep Singh	0	1
78	101384004	HimanshuBansal	6	4
79	101384005	Navdeep Singh	7	5
80	101384006	Parampreet Singh	9	5
81	101384007	SauravGoyal	9	5
82	101384008	Surjeet Singh	6	4

The performance of students through the course UEE502 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 UEE502 for criteria ‘PO-03(B)’**

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE502	45.12	25.61	19.51	7.32	2.44	4.04

### UEE801: Electric Drives

The performance of course *UEE801: Electric Drives* is used to measure the attainment of outcome ‘PO-03(B)’ through the End Semester Examination (Question No. 3, 2015, weightage 7 marks).

#### Question:

Q.3	<p>(a) Calculate the starting and plugging time analytically for Induction motor under no load condition in terms of mechanical time constant and the slip at which maximum torque occurs. (3)</p> <p>(b) A 400 V, 50 Hz, 8-pole, three phase star connected induction motor has following parameters. <math>R_1 = R_2 = 0.1\Omega</math>, <math>X_1 = X_2 = 0.4\Omega</math>, The inertia of motor is <math>10 \text{ kg} - \text{m}^2</math>. Find the starting time. (4)</p>	(7)
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The performance of the students in the above question is summarized in Table PO-03(B).3 using rubrics defined in Table PO-03(a).

**Table PO-03(B).3: Students’ performance in question targeting ‘PO-03(B)’: Course UEE801**

S. No	Roll No.	Name of Student	Marks (7)	Score (1-5)
1	101104001	AakritiSingla	2	2
2	101104002	AbhayGoel	3	3
3	101104003	Abhinav Kumar Sardana	2	2
4	101104005	AchinChetal	2	2
5	101104006	AkashVerma	3	3
6	101104007	AmanBhatnagar	5	4
7	101104008	Amar Deep Singh	2	2
8	101104009	AnkitBansal	4	3
9	101104010	AnkurSinghal	4	3
10	101104011	Anshuman Singh	3	3

S. No	Roll No.	Name of Student	Marks (7)	Score (1-5)
11	101104012	ArunabhChoudhury	2	2
12	101104013	Ashish Gupta	3	3
13	101104016	ChetanBaria	4	3
14	101104017	DakshBansal	3	3
15	101104021	DhruvSrivastav	3	3
16	101104022	Gagandeep Singh	4	3
17	101104023	HarkaranTiwana	4	3
18	101104024	Harnoor Singh Ahluwalia	2	2
19	101104026	HarshitNath	4	3
20	101104027	Harwinder Singh	3	3
21	101104028	HimanshuGoel	4	3
22	101104029	IshaJhamb	2	2
23	101104030	Jagpreet Singh	2	2
24	101104031	KanikaLodha	0	1
25	101104032	Kanwaljot Singh	2	2
26	101104033	KaranpreetKaur	4	3
27	101104034	KeshavSingla	3	3
28	101104035	Ketan Joshi	3	3
29	101104036	KritiBansal	4	3
30	101104037	KunalRawat	1	1
31	101104038	ManikBudhiraja	2	2
32	101104040	Mudit Kumar	5	4
33	101104042	NandNandanArora	3	3
34	101104043	Narinderpal Singh Kaleka	4	3
35	101104044	Navjot Singh	3	3
36	101104045	Navjot Singh	3	3
37	101104046	NavneetBansal	3	3
38	101104047	Nikhil Agarwal	3	3
39	101104048	Nitin Kumar	4	3
40	101104049	NitishSingla	3	3
41	101104050	Perry Mittal	2	2
42	101104051	Piyush Gupta	5	4
43	101104052	Piyush Jain	2	2
44	101104054	PrabhleenKaur	3	3
45	101104055	Prashant	3	3
46	101104056	Prateek Jain	2	2
47	101104057	PriyaSarooha	2	2
48	101104058	Rajan Gaur	3	3
49	101104059	Rajat Gupta	3	3
50	101104060	Ratik Mittal	3	3

S. No	Roll No.	Name of Student	Marks (7)	Score (1-5)
51	101104062	RishikaKukreja	2	2
52	101104063	RubbalMaggo	2	2
53	101104066	Shaurya Chopra	3	3
54	101104067	Shish Pal	3	3
55	101104068	ShubhamAhuja	4	3
56	101104069	ShubhamGarg	3	3
57	101104070	Sunny Kumar Saini	2	2
58	101104071	Sunny Maheshwary	2	2
59	101104072	Suraj Pal Singh	3	3
60	101104074	Tanya Sofat	4	3
61	101104075	TusharGarg	5	4
62	101104076	UditaKapoor	2	2
63	101104077	Varun	4	3
64	101104078	VikhyatKansal	3	3
65	101104079	Vineet Sharma	5	4
66	101104080	Vishal Gupta	5	4
67	101104081	Vishesh Gupta	3	3
68	101104082	Vishvesh	2	2
69	101104083	Vivek Gupta	4	3
70	101104084	HarmanjasrajGrewal	3	3
71	101104085	Akhilesh Sharma	4	3
72	101154001	Anna Kathpal	4	3
73	101154002	PapihaSalhotra	3	3
74	101154003	PrateekArora	0	1
75	101154004	Sandeep Singh	3	3
76	101284002	Ashish	0	1
77	101284004	Deepak Puri	1	1
78	101284005	IshanNarang	3	3
79	101284006	Jatinder Singh Kapur	5	4
80	101284007	Navneet Kumar	3	3
81	101284008	PrikshitSingla	2	2

The performance of students through the course UEE801 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 UEE801 for criteria PO-03(B)**

Course	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE801	0.00	8.64	59.26	25.93	6.17	2.70

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	
<b>UEE502</b>	45.12	25.61	19.51	7.32	2.44	<b>4.04</b>
<b>UEE801</b>	0.00	8.64	59.26	25.93	6.17	<b>2.70</b>
<b>Student Class Performance Score</b>	<b>22.56</b>	<b>17.13</b>	<b>39.39</b>	<b>16.63</b>	<b>4.31</b>	<b>3.37</b>

## b) Indirect Measures:

The indirect measurement of performance criteria 'PO-03(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-03(B).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(B)'.

UEE502	Conceptualize the idea of high voltage and safety measures involved.
UEE801	Conceptualize the basic drive system and analyse it for different types of loads.

**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	
UEE502	35.37	21.83	20.49	9.51	12.80	<b>3.57</b>
UEE801	31.66	28.28	29.83	29.83	5.19	<b>3.76</b>
Course Survey score	<b>33.52</b>	<b>25.06</b>	<b>25.16</b>	<b>19.67</b>	<b>9.00</b>	<b>3.67</b>

## 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 given in Tables PO-03(B).5, PO-03(B).6 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	22.56	17.13	39.39	16.63	4.31	<b>3.37</b>	5
Course Survey	33.52	25.06	25.16	19.67	9.00	<b>3.67</b>	4
Other Surveys	30.18	42.02	25.22	1.93	0.64	<b>3.99</b>	3
Overall Score	<b>28.12</b>	<b>26.00</b>	<b>31.10</b>	<b>13.97</b>	<b>4.96</b>	<b>3.63</b>	-

## 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 *UEE402: Transmission and Distribution of Power* and *UEE601: Flexible AC Transmission systems* are used to assess performance criteria PO-03(C) as a direct measure. The analysis for each of these courses is provided below:

#### UEE402: Transmission and Distribution of Power

The performance of course *UEE402: Transmission and Distribution of Power* is used to measure the attainment of outcome 'PO-03(C)' through the End Semester Examination (Question No. 2, May 2015, weightage 05 marks).

#### Question:

Q.2	(a) Draw the structure of ring and radial distribution systems. What are the advantages of ring distribution system over radial distribution system? (b) How to choose voltage and frequency of transmission?	(05)
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The performance of the students in the above questions is summarized in Table PO-03(C).1 using rubrics defined in Table PO-03.1 (a).

**Table PO-03(C).1: Students' performance in question targeting 'PO-03(C)': Course UEE402**

S. No	Roll No.	Name of Student	Marks (05)	Score (1-5)
1	101304001	Aarushi Bajaj	3	4
2	101304002	Abhey Arora	2	3
3	101304003	Abhishek Taksali	1	2
4	101304004	Adhikaansh Tayal	0	1
5	101304005	Aditi Narang	3	4
6	101304006	Aditya	3	4
7	101304007	Akshat	2	3
8	101304008	Akshay Kapoor	3	4
9	101304009	Akshay Kumar	2	3

S. No	Roll No.	Name of Student	Marks (05)	Score (1-5)
10	101304010	Akshay Kumar Chaudhary	1	2
11	101304011	Akshay Sharma	1	2
12	101304012	AmandeepKaur	1	2
13	101304013	Amandeep Singh	2	3
14	101304014	Amaninder Singh Randhawa	2	3
15	101304015	AngadKapoor	3	4
16	101304016	AnkitaGarg	3	4
17	101304018	AnmolJawa	4	5
18	101304019	Anmolpreet Singh	2	3
19	101304020	AnyutiTiwary	3	4
20	101304021	Arpit Sharma	1	2
21	101304022	ArshKundal	1	2
22	101304023	ArshbirKaur	3	4
23	101304024	Arshdeep Singh Bagga	3	4
24	101304025	Ashish	2	3
25	101304026	AshishRajpal	2	3
26	101304028	Berry Lubana	2	3
27	101304029	BhanuDuggal	4	5
28	101304030	BhanuMarwaha	1	2
29	101304031	ChiragGaba	2	3
30	101304032	DipinGarg	1	2
31	101304033	DishantVanvari	3	4
32	101304034	DivyeshPratap Singh	1	2
33	101304035	Elham Anwar	2	3
34	101304036	Gurseerat Singh Meen	1	2
35	101304037	Gursewak Singh	1	2
36	101304040	HarianshSchgal	2	3
37	101304041	Hartejdeep Singh	0	1
38	101304042	HimanshuGoyal	3	4
39	101304044	Jasjit Singh	1	2
40	101304045	Jassimran Singh Julka	1	2
41	101304046	Jessica Dhaliwal	3	4
42	101304047	Kanwarpal Singh	1	2
43	101304048	Karan Kumar	1	2
44	101304049	Karanjot Singh Kochar	3	4
45	101304050	KashishAggarwal	4	5
46	101304052	Love Gaba	1	2
47	101304054	Manik Mittal	3	4
48	101304056	MayankSingla	2	3
49	101304057	MridulBhutani	2	3

S. No	Roll No.	Name of Student	Marks (05)	Score (1-5)
50	101304058	NamanGarg	5	5
51	101304059	Navdeep Singh	4	5
52	101304060	Navdeep Singh	2	3
53	101304062	NishantGarg	3	4
54	101304094	SatripleenKaur	4	5
55	101484001	Amandeep Singh	1	2
56	101484002	Amrinder Singh	2	3
57	101484003	Ashmeen Singh	1	2
58	101484005	ChandanGarg	2	3
59	101484007	Deepak Singla	2	3
60	101484008	Diljeet Singh	2	3

The performance of students through the course UEE402 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 UEE402 for criteria 'PO-03(C)'**

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE402	10.00	25.00	31.67	30.00	3.33	3.08

### 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 (May 2015, 06 marks).

#### Question:

Q.7	(a) Give the construction, operation and switching characteristics of power semiconductor device MOS-Controlled Thyristor (MCT)? (b) Describe the modeling of UPFC for power flow and transient stability studies?	(06)
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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 TablePO-03.1 (a).

**Table PO-03(C).3: Students' performance in question targeting 'PO-03(C)': Course UEE601**

S. No	Roll No.	Name of Student	Total Marks (06)	Score (1-5)
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1	101104082	Vishvesh	2	2
2	101204001	Aashna	3	3
3	101204002	Abhinav Sharma	3	3
4	101204003	Abhishek Jain	3	3
5	101204004	Aditya Jain	2	2
6	101204005	Akash Deep	4	4
7	101204006	AkashRatna	4	4
8	101204009	Akshu Gupta	3	3
9	101204010	AmanGoyal	3	3
10	101204012	AmitBansal	4	4
11	101204013	Anshul Kumar	2	2
12	101204014	AnukritiDwivedi	4	4
13	101204015	ArushiNagpal	4	4
14	101204016	AyushVaid	2	2
15	101204018	ChahatSingla	4	4
16	101204019	DeekshaGoyal	4	4
17	101204020	Dhruv Sharma	3	3
18	101204021	GauravArora	2	2
19	101204022	GursharanKaur	5	5
20	101204023	Gursimran Singh	3	3
21	101204024	Harjot Singh	4	4
22	101204025	Harsh Kothari	4	4
23	101204026	HemanshuGarg	5	5
24	101204027	HimanshuTakkar	4	4
25	101204028	Iqbal Singh Garcha	4	4
26	101204030	Ishtjot Singh	2	2
27	101204031	JasdeepGarg	2	2
28	101204033	JasleenKaur	4	4
29	101204035	KapilKinger	3	3
30	101204037	Karanbir Singh Kahlon	1	1
31	101204038	Karanveer Singh Bhangoo	2	2
32	101204039	KartikArora	3	3
33	101204040	KashishSethi	1	1
34	101204041	Kaustubh Singh	3	3
35	101204042	KrishnankAtrey	4	4
36	101204043	Lovely Goyal	3	3
37	101204045	Manik Mittal	3	3
38	101204046	Marshall	3	3
39	101204048	MohitKukkar	2	2
40	101204049	MohitManhas	2	2
41	101204051	NalinKaushik	3	3

42	101204053	NishantArora	4	4
43	101204054	P Siddharth	2	2
44	101204057	Rahul Kamboj	4	4
45	101204059	RajatSahore	3	3
46	101204060	Rajatdeep Singh	4	4
47	101204061	RamanpreetKaur	3	3
48	101204063	SahilArora	3	3
49	101204064	Sahil Mittal	3	3
50	101204065	SanchitGoel	4	4
51	101204066	Sewak Ram	2	2
52	101204067	Sheenu	4	4
53	101204069	Shubham Bhatia	4	4
54	101204070	ShubhamGoel	4	4
55	101204071	ShubhamKansal	2	2
56	101204074	Sukhdarshanpal Singh	1	1
57	101204075	Sultan Singh	2	2
58	101204076	TejasviAnand	3	3
59	101254001	Sahilpreet Singh	2	2
60	101254002	Naman Kumar	2	2
61	101254003	Sachin Pathak	3	3
62	101254004	SrijanAditya	1	1
63	101254005	NavjotKaur	3	3
64	101254006	Milan Jain	4	4
65	101254008	Gaurav	4	4
66	101254009	VarunKhanna	3	3
67	101254010	Swati Srivastava	3	3
68	101254012	ShubhamSingla	3	3
69	101254013	SorabhDevgun	3	3
70	101254014	ParasGhai	3	3
71	101254015	Kuldeep Singh Deora	3	3
72	101254016	Sachin Gupta	5	5
73	101254017	Nakul Kumar	3	3
74	101384001	AnkurSingla	4	4
75	101384002	Gagandeep Singh	5	5
76	101384004	HimanshuBansal	4	4
77	101384005	Navdeep Singh	3	3
78	101384006	Parampreet Singh	5	5
79	101384007	SauravGoyal	5	5
80	101384008	Surjeet Singh	3	3

The performance of students through the course UEE601 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 UEE601 for criteria PO-03(C)**

Course	% of Students in each Score					Average Score
	5	4	3	2	1	
<b>UEE601</b>	7.50	27.50	42.50	18.75	3.75	<b>3.16</b>

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	
<b>UEE402</b>	10.00	25.00	31.67	30.00	3.33	<b>3.08</b>
<b>UEE601</b>	7.50	27.50	42.50	18.75	3.75	<b>3.16</b>
<b>Student Class Performance Score</b>	<b>8.75</b>	<b>26.25</b>	<b>37.09</b>	<b>24.38</b>	<b>3.54</b>	<b>3.12</b>

## 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)'.

<b>UEE402</b>	Validate and identify the machine parameters.
<b>UEE601</b>	Analyse system behaviour with hybrid shunt-series compensators

**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	
<b>UEE402</b>	13.56	19.94	22.98	24.06	19.46	<b>2.84</b>
<b>UEE601</b>	29.51	22.09	16.99	10.22	21.20	<b>3.28</b>
<b>Course Survey Score</b>	<b>21.54</b>	<b>21.02</b>	<b>19.99</b>	<b>17.14</b>	<b>20.33</b>	<b>3.06</b>

## 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		
<b>Student Class Performance</b>	8.75	26.25	37.09	24.38	3.54	<b>3.12</b>	5
<b>Course Survey Score</b>	21.54	21.02	19.99	17.14	20.33	<b>3.06</b>	4
<b>Other Survey Score</b>	30.18	42.02	25.22	1.93	0.64	<b>3.99</b>	3
<b>Overall Score</b>	<b>18.37</b>	<b>28.45</b>	<b>28.42</b>	<b>16.35</b>	<b>8.41</b>	<b>3.32</b>	-

## 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 *UEI503: Digital Signal Processing and Applications* and *UEE804: Operation and Control of Power System* are used to assess performance criteria PO-03(D) 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: Control Systems* is used to measure the attainment of outcome 'PO-03(D)' through the Mid Semester Examination (Question No. 4, May 2015, 8 marks).

#### **Question:**

Q.4	DFT of a sequence $x(n)$ is given by $X(k) = \{10, 0, -2, 0\}$ . (i) Determine $x(n)$ , (ii) Plot $x_1(n)$ if $X_1(k)$ is $X(k)e^{-j*(2\pi k)/2}$ and (iii) Find circular autocorrelation of $x(n)$ using DFT and IDFT only	(8)
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The performance of the students in the above question is summarized in Table PO-03(D).1 using rubrics defined in Table PO-03.1(a).

**Table PO-03(D).1: Students' performance in question targeting 'PO-03(D)': Course UEI503**

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
1	101204001	Aashna	7	5
2	101204002	Abhinav Sharma	8	5
3	101204003	Abhishek Jain	8	5
4	101204004	Aditya Jain	6	5
5	101204005	Akash Deep	8	5
6	101204006	Akash Ratna	8	5
7	101204009	Akshu Gupta	8	5
8	101204010	Aman Goyal	8	5
10	101204011	Amarpreet	2	2
11	101204012	Amit Bansal	8	5
12	101204013	Anshul Kumar	4	3

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
13	101204014	AnukritiDwivedi	8	5
14	101204015	ArushiNagpal	8	5
15	101204016	AyushVaid	7	5
16	101204018	ChahatSingla	8	5
17	101204019	DeekshaGoyal	8	5
18	101204020	Dhruv Sharma	8	5
19	101204021	GauravArora	6	5
20	101204022	GursharanKaur	8	5
21	101204023	Gursimran Singh	8	5
22	101204024	Harjot Singh	8	5
23	101204025	Harsh Kothari	8	5
24	101204026	HemanshuGarg	8	5
25	101204027	HimanshuTakkar	8	5
26	101204028	Iqbal Singh Garcha	8	5
27	101204030	Ishtjot Singh	8	5
28	101204031	JasdeepGarg	8	5
29	101204033	JasleenKaur	8	5
30	101204035	KapilKinger	3	2
31	101204037	Karanbir Singh Kahlon	6	5
32	101204038	Karanveer Singh Bhangoo	6	5
33	101204039	KartikArora	8	5
34	101204040	KashishSethi	7	5
35	101204041	Kaustubh Singh	8	5
36	101204042	KrishnankAtrey	8	5
37	101204043	Lovely Goyal	8	5
38	101204045	Manik Mittal	8	5
39	101204046	Marshall	8	5
40	101204048	MohitKukkar	6	5
41	101204049	MohitManhas	8	5
42	101204051	NalinKaushik	8	5
43	101204053	NishantArora	8	5
44	101204054	P Siddharth	8	5
45	101204057	Rahul Kamboj	8	5
46	101204059	RajatSahore	8	5
47	101204060	Rajatdeep Singh	8	5
48	101204061	RamanpreetKaur	8	5
49	101204063	SahilArora	8	5
50	101204064	Sahil Mittal	7	5
51	101204065	SanchitGoel	7	5
52	101204066	Sewak Ram	7	5

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
53	101204067	Sheenu	8	5
54	101204069	Shubham Bhatia	7	5
55	101204070	ShubhamGoel	8	5
56	101204071	ShubhamKansal	8	5
57	101204074	Sukhdarshanpal Singh	4	3
58	101204075	Sultan Singh	8	5
59	101204076	TejasviAnand	8	5
60	101254001	Sahilpreet Singh	5	4
61	101254002	Naman Kumar	3	2
62	101254003	Sachin Pathak	8	5
63	101254004	SrijanAditya	5	4
64	101254005	NavjotKaur	5	4
65	101254006	Milan Jain	8	5
66	101254008	Mohit	8	5
67	101254009	Gaurav	8	5
68	101254010	VarunKhanna	7	5
69	101254012	Swati Srivastava	8	5
70	101254013	ShubhamSingla	6	5
71	101254014	SorabhDevgun	6	5
72	101254015	ParasGhai	5	4
73	101254016	Kuldeep Singh Deora	8	5
74	101254017	Sachin Gupta	8	5
75	101284008	Nakul Kumar	6	5
76	101284011	AnkurSingla	7	5
77	101384001	Gagandeep Singh	8	5
78	101384002	HimanshuBansal	8	5
79	101384004	Navdeep Singh	7	5
80	101384005	Parampreet Singh	7	5
81	101384006	SauravGoyal	8	5
82	101384007	Surjeet Singh	8	5

The performance of students through the course UEI503 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 UEI503 for criteria ‘PO-03(D)’**

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

UEI503	88.89	4.94	2.47	3.70	0.00	4.79
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### 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(D)’ through the Mid Semester Examination (Question No. 2, May 2014, 8 marks).

Q.2	<p>(a) A hydro thermal system consists of one thermal and one hydro unit. The units have the following characteristics:</p> $Q_h = 1500 + 2.5P_{Gh} + 0.2P_{Gh}^2 m^3/hr$ $F_C = 1000 + 10P_{Gt} + 0.002P_{Gt}^2 Rs/hr$ <p>Prepare a hydrothermal schedule per hour basis for the same plant one day, where the load has the following schedule:  12 mid night-12 Noon: 350 MW; 12 Noon-12 mid night: 700 MW  The volume of water available = 420000 m<sup>3</sup> (8)</p> <p>(b) Obtain the economic operation schedule for three thermal units delivering a total load of 1200 MW by neglecting network losses but considering generation limits. The data for units are as under:</p> <p>Unit 1 <math>F_C(P_1) = 500 + 7.5P_1 + 0.001P_1^2 \frac{Rs}{hr}</math> <math>1500MW \leq P_1 \leq 600 MW</math></p> <p>Unit 2 <math>F_C(P_2) = 350 + 7.8P_2 + 0.002P_2^2 \frac{Rs}{hr}</math> <math>125MW \leq P_2 \leq 500 MW</math></p> <p>Unit 3 <math>F_C(P_3) = 210 + 7.9P_3 + 0.005P_3^2 \frac{Rs}{hr}</math> <math>150MW \leq P_3 \leq 600 MW</math> (3)</p>	(8)
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The performance of the students in the above assessment process is summarized in Table PO-03(D).3 using rubrics defined in Table PO-03.1 (a).

**Table PO-03(D).3: Students’ performance in question targeting ‘PO-03(D)’: Course UEE804**

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
1	101004053	PulkitFarsaiya	0	1
2	101104001	AakritiSingla	3	2
3	101104002	AbhayGoel	2	2
4	101104003	Abhinav Kumar Sardana	1	1
5	101104005	AchinChetal	2	2
6	101104006	AkashVerma	2	2
7	101104007	AmanBhatnagar	5	4
8	101104008	Amar Deep Singh	3	2

9	101104009	AnkitBansal	3	2
10	101104010	AnkurSinghal	5	4
11	101104011	Anshuman Singh	2	2
12	101104012	ArunabhChoudhury	1	1
13	101104013	Ashish Gupta	4	3
14	101104016	ChetanBaria	2	2
15	101104017	DakshBansal	3	2
16	101104021	DhruvSrivastav	3	2
17	101104022	Gagandeep Singh	3	2
18	101104023	HarkaranTiwana	2	2
19	101104024	Harnoor Singh Ahluwalia	3	2
20	101104026	HarshitNath	4	3
21	101104027	Harwinder Singh	4	3
22	101104028	HimanshuGoel	5	4
23	101104029	IshaJhamb	3	2
24	101104030	Jagpreet Singh	2	2
25	101104031	KanikaLodha	1	1
26	101104032	Kanwaljot Singh	2	2
27	101104033	KaranpreetKaur	4	3
28	101104034	KeshavSingla	3	2
29	101104035	Ketan Joshi	4	3
30	101104036	KritiBansal	4	3
31	101104037	KunalRawat	2	2
32	101104038	ManikBudhiraja	3	2
33	101104040	Mudit Kumar	3	2
34	101104042	NandNandanArora	1	1
35	101104043	Narinderpal Singh Kaleka	4	3
36	101104044	Navjot Singh	3	2
37	101104045	Navjot Singh	3	2
38	101104046	NavneetBansal	2	2
39	101104047	Nikhil Agarwal	3	2
40	101104048	Nitin Kumar	4	3
41	101104049	NitishSingla	4	3
42	101104050	Perry Mittal	2	2
43	101104051	Piyush Gupta	4	3
44	101104052	Piyush Jain	3	2
45	101104054	PrabhleenKaur	3	2
46	101104055	Prashant	3	2
47	101104056	Prateek Jain	3	2
48	101104057	PriyaSaroha	1	1
49	101104058	Rajan Gaur	3	2

50	101104059	Rajat Gupta	3	2
51	101104060	Ratik Mittal	3	2
52	101104062	RishikaKukreja	4	3
53	101104063	RubbalMaggo	2	2
54	101104066	Shaurya Chopra	2	2
55	101104067	Shish Pal	2	2
56	101104068	ShubhamAhuja	3	2
57	101104069	ShubhamGarg	1	1
58	101104070	Sunny Kumar Saini	2	2
59	101104071	Sunny Maheshwary	2	2
60	101104072	Suraj Pal Singh	3	2
61	101104074	Tanya Sofat	3	2
62	101104075	TusharGarg	3	2
63	101104076	UditaKapoor	1	1
64	101104077	Varun	4	3
65	101104078	VikhyatKansal	3	2
66	101104079	Vineet Sharma	4	3
67	101104080	Vishal Gupta	4	3
68	101104081	Vishesh Gupta	2	2
69	101104082	Vishvesh	1	1
70	101104083	Vivek Gupta	4	3
71	101104084	HarmanjasrajGrewal	4	3
72	101104085	Akhilesh Sharma	4	3
73	101154001	Anna Kathpal	4	3
74	101154002	PapihaSalhotra	3	2
75	101154003	PrateekArora	1	1
76	101154004	Sandeep Singh	4	3
77	101284001	Ashish	3	2
78	101284002	Deepak Puri	0	1
79	101284004	IshanNarang	1	1
80	101284005	Jatinder Singh Kapur	1	1
81	101284006	Navneet Kumar	5	4
82	101284007	PrikshitSingla	5	4
83	101284008	Sachin Sharma	1	1
84	101284010	VikasBansal	3	2
85	101284011	Gurdeep Singh	1	1

The performance of students through the course UEE804 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	
<b>UEE804</b>	0.00	5.88	22.35	54.12	17.65	<b>2.16</b>

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	
<b>UEI503</b>	88.89	4.94	2.47	3.70	0.00	<b>4.79</b>
<b>UEE804</b>	0.00	5.88	22.35	54.12	17.65	<b>2.16</b>
<b>Student Class Performance Score</b>	<b>44.45</b>	<b>5.41</b>	<b>12.41</b>	<b>28.91</b>	<b>8.83</b>	<b>3.48</b>

## 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)'.

UEI503	Design and implementation digital filters
UEE804	Decide the scheduling of thermal units and hydro-thermal units for overall economy.

**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	
UEI503	31.66	28.28	29.83	29.83	5.19	<b>3.76</b>
UEE804	64.03	24.56	6.03	2.00	3.38	<b>4.44</b>
<b>Course Survey Score</b>	<b>47.85</b>	<b>26.42</b>	<b>17.93</b>	<b>15.92</b>	<b>4.29</b>	<b>4.10</b>

## 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	44.45	5.41	12.41	28.91	8.83	<b>3.48</b>	5
Course Survey	47.85	26.42	17.93	15.92	4.29	<b>4.10</b>	4
Other Surveys	30.18	42.02	25.22	1.93	0.64	<b>3.99</b>	3
<b>Overall Score</b>	<b>42.02</b>	<b>21.57</b>	<b>17.45</b>	<b>17.84</b>	<b>5.27</b>	<b>3.81</b>	-

**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)	25.39	22.81	28.37	14.13	9.30	<b>3.41</b>	5
PO-03(B)	28.12	26.00	31.10	13.97	4.96	<b>3.63</b>	5
PO-03(C)	18.37	28.45	28.42	16.35	8.41	<b>3.32</b>	5
PO-03(D)	42.02	21.57	17.45	17.84	5.27	<b>3.81</b>	5
<b>Overall score</b>	<b>28.47</b>	<b>24.71</b>	<b>26.34</b>	<b>15.57</b>	<b>6.98</b>	<b>3.54</b>	

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

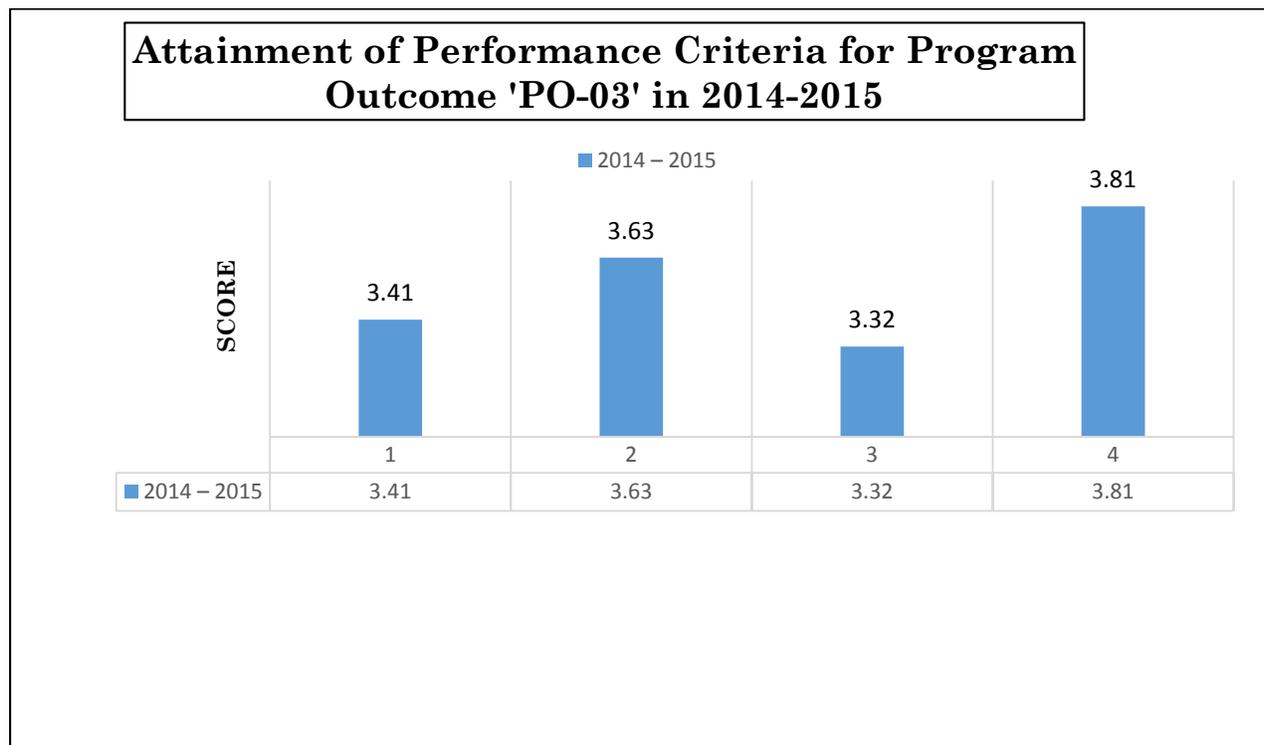


Fig.PO-03.2: Attainment of Performance Criteria for Program Outcome “PO-03 in 2014-2015

The data presented above pertains to the courses offered during academic year 2014-15.

# Assessment of Attainment of Program Outcome

## PO-04

*An ability to function in multidisciplinary teams*  
(2014-2015)

*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*

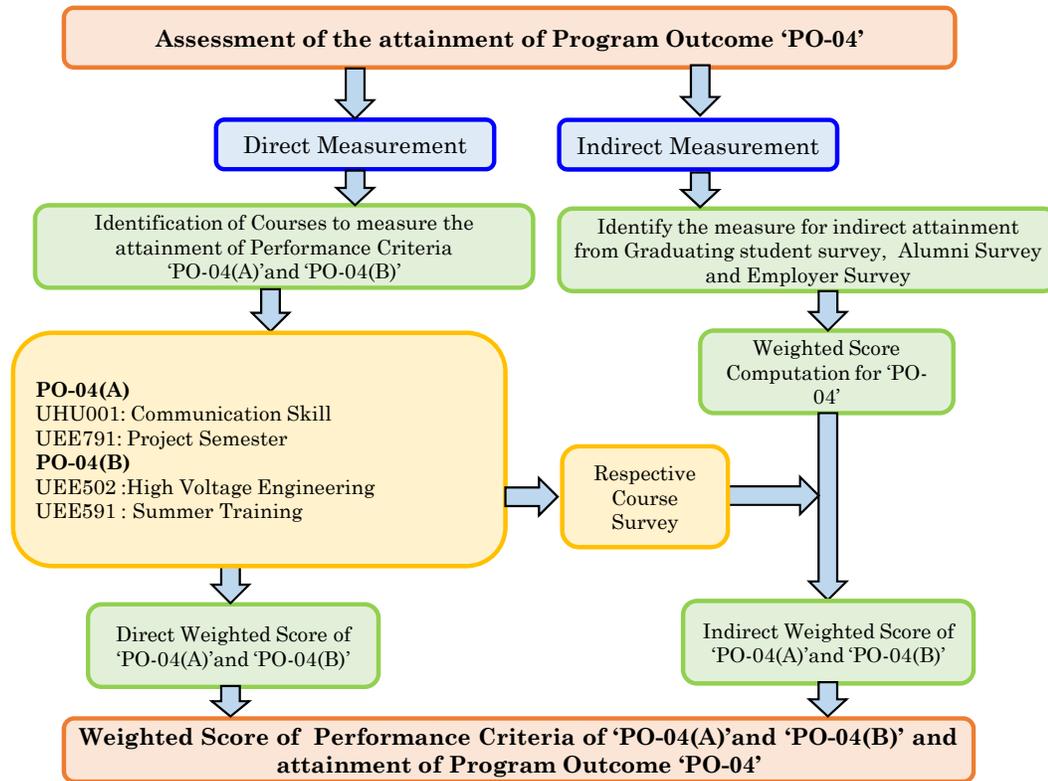
The program assessment committee identified the following courses for the assessment of program outcome ‘PO-04’:

- UEE101: Electrical Engineering
- **UHU001: Communication Skills**
- UHU031: Organizational Behaviour
- **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 2014-15.

Performance Criteria	Course -1	Course-2
PO-04(A)	UHU001: Communication Skills	UEE791: Project Semester
PO-04(B)	UEE502: High Voltage Engineering	UEE591 : Summer Training

The step by step methodology used to measure the attainment of program outcome ‘PO-04’ is shown in Fig. PO-04.1 for academic year (AY) 2014-15. 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 2014-15**

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: *UHU001 : Communication Skills* and *UEE791 : Project Semester* are used to assess performance criteria PO-04(A) as a direct measure. The analysis for each of these courses is provided below:

**UHU001 : Communication Skills**

The performance of course *UHU001 : Communication Skills* is used to measure the attainment of 'PO-04(A)' through the evaluation of Panel Discussion with others in team (10 marks) taught in Jul-Dec 2014. 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 UHU001**

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
1	101404001	Abhay Mahipal	6.8	4
2	101404002	Abhijeet Singh Sankhla	7	4
3	101404003	Abhimanyu Tyagi	6.45	4
4	101404004	Abhinav Arora	6.55	4
5	101404005	Abhishek Dhiman	0	1
6	101404006	Abhishek Sharma	6.85	4
7	101404007	Ajay Singh	6.65	4
8	101404008	Akhil Malik	6.75	4
9	101404009	Alka Thakur	7.55	4
10	101404010	Angad Singh	7.6	4
11	101404011	Ankit Bislawat	6.15	4
12	101404012	Ankush Goyal	6.35	4
13	101404013	Anmol Arjun Bharaj	6.5	4
14	101404014	Anmol Goyat	6.75	4
15	101404015	Anmol Rattan Kaur	6.95	4
16	101404016	Anshika Singh	7.15	4
17	101404017	Anubhav Kumar	6.95	4
18	101404018	Apeksha Goel	7	4
19	101404019	Arnish Jain	7.15	4
20	101404020	Arshiya	6.4	4
21	101404021	Arshjot Kaur	6.95	4
22	101404022	Ashish Jindal	0	1
23	101404023	Ayush Jain	7.05	4
24	101404024	Bhawani Singh	5.75	3
25	101404025	Chirag Jain	6.6	4
26	101404026	Davileen Garg	7.4	4
27	101404027	Dilpreet Kaur	7.35	4
28	101404028	Divesh Kamdar	6.7	4

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
29	101404029	Divyam Aggarwal	7.25	4
30	101404030	Divyansh Jain	7.8	4
31	101404031	Divyanshu Siddh	6.85	4
32	101404032	Garima	6.3	4
33	101404033	Garv Chahar	5.7	3
34	101404035	Gaurav Rathore	6.8	4
35	101404036	Gurpreet Singh	6.1	4
36	101404037	Gursagar Singh	7.5	4
37	101404038	Gurupinder Pal Si	6.85	4
38	101404039	Harmanpreet Sin	6.35	4
39	101404041	Harshit Kaushik	6.7	4
40	101404042	Harshvir Singh	6.7	4
41	101404043	Harsimarjot Kaur	6.4	4
42	101404044	Harsimran Singh	6.2	4
43	101404045	Hartej Singh Bai	7.5	4
44	101404046	Heema Gupta	6.75	4
45	101404047	Hitesh Kumar	6.65	4
46	101404048	Ishita Mahindru	5.85	3
47	101404049	Jagmeet Singh Ba	0	1
48	101404050	Jagnoor Kaur	6.95	4
49	101404051	Jashanpreet Sin	6.8	4
50	101404052	Jatin Bbansal	6.9	4
51	101404053	Jatin Raheja	6.5	4
52	101404054	Kanishak Sharma	7	4
53	101404055	Karan Sanjeev Bajaj	6.6	4
54	101404056	Kirtish Madaan	5.7	3
55	101404057	Mahitosh Sharma	6.9	4
56	101404058	Manan Mittal	0	1
57	101404059	Mandeep Singh Panesar	6.75	4
58	101404060	Manisha Gupta	6.65	4
59	101404061	Manit Gupta	6.75	4
60	101404062	Manjosh Singh Dhillon	6.75	4
61	101404063	Manpreet Singh Brar	7.2	4
62	101404064	Manvir Kaur	6.4	4

The performance of students through the course UHU001 for criteria PO-04(A) is summarized in Table PO-04(A).2:

**Table PO-04(A).2: Average score of student performance in the course UHU001 for criteria PO-04(A)**

Course	% of students in each score					Average Score
	5	4	3	2	1	
<b>UHU001</b>	0.00	87.10	6.45	0.00	6.45	3.74

## UEE791 : Project Semester

The performance of course *UEE791 : Project Semester* 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 (20 marks) taught in Jan-June 2015. The performance of the students in the above question is summarized 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 (20)	Score (1-5)
1	101104001	Aakriti Singla	19.8	5
2	101104002	Abhay Goel	19.4	5
3	101104003	Abhinav Kumar Sardana	15.2	4
4	101104006	Akash Verma	19.6	5
5	101104007	Aman Bhatnagar	19.8	5
6	101104008	Amar Deep Singh	17.8	5
7	101104009	Ankit Bansal	19.4	5
8	101104010	Ankur Singhal	16.6	5
9	101104011	Anshuman Singh	19.6	5
10	101104012	Arunabh Choudhury	18.8	5
11	101104013	Ashish Gupta	18.8	5
12	101104016	Chetan Baria	19.8	5
13	101104021	Dhruv Srivastav	19.2	5
14	101104022	Gagandeep Singh	18.8	5
15	101104023	Harkaran Tiwana	14.2	4
16	101104024	Harnoor Singh Ahluwalia	19	5
17	101104026	Harshit Nath	19.4	5
18	101104027	Harwinder Singh	19.2	5
19	101104028	Himanshu Goel	20	5
20	101104029	Isha Jhamb	18.8	5
21	101104030	Jagpreet Singh	19.4	5
22	101104031	Kanika Lodha	16.2	5
23	101104032	Kanwaljot Singh	19.2	5
24	101104033	Karanpreet Kaur	19.2	5
25	101104034	Keshav Singla	17.2	5
26	101104035	Ketan Joshi	19.4	5
27	101104036	Kriti Bansal	19.2	5
28	101104037	Kunal Rawat	19.4	5
29	101104040	Mudit Kumar	19.8	5
30	101104042	Nand Nandan Arora	18.4	5
31	101104043	Narinderpal Singh Kaleka	18.6	5
32	101104045	Navjot Singh	19.6	5
33	101104046	Navneet Bansal	19.2	5
34	101104047	Nikhil Agarwal	15.2	4

S. No	Roll No.	Name of Student	Marks (20)	Score (1-5)
35	101104048	Nitin Kumar	19.4	5
36	101104049	Nitish Singla	19.6	5
37	101104050	Perry Mittal	19.2	5
38	101104051	Piyush Gupta	19	5
39	101104052	Piyush Jain	18.2	5
40	101104054	Prabhleen Kaur	17.8	5
41	101104055	Prashant	19.2	5
42	101104056	Prateek Jain	20	5
43	101104058	Rajan Gaur	19.8	5
44	101104059	Rajat Gupta	19.8	5
45	101104060	Ratik Mittal	19	5
46	101104062	Rishika Kukreja	19.8	5
47	101104063	Rubbal Maggo	19.2	5
48	101104066	Shaurya Chopra	16.8	5
49	101104068	Shubham Ahuja	17.8	5
50	101104069	Shubham Garg	12	4
51	101104071	Sunny Maheshwary	18.8	5
52	101104072	Suraj Pal Singh	19.6	5
53	101104074	Tanya Sofat	18.4	5
54	101104075	Tushar Garg	14.6	4
55	101104076	Udita Kapoor	18	5
56	101104077	Varun	19.4	5
57	101104078	Vikhyat Kansal	19.4	5
58	101104079	Vineet Sharma	18.6	5
59	101104080	Vishal Gupta	18.2	5
60	101104081	Vishesh Gupta	18.6	5
61	101104083	Vivek Gupta	18.2	5
62	101104084	Harmanjasraj Grewal	18.6	5
63	101104085	Akhilesh Sharma	20	5
64	101154001	Anna Kathpal	19.2	5
65	101154002	Papiha Salhotra	18.6	5
66	101154003	Prateek Arora	14.2	4
67	101154004	Sandeep Singh	14.4	4
68	101284002	Deepak Puri	19	5
69	101284006	Navneet Kumar	19.4	5
70	101284007	Prikshit Singla	19.2	5
71	101284010	Vikas Bansal	20	5

The performance of students through the course UEE791 for criteria PO-04(A) is summarized 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	90.14	9.86	0	0	0	4.90

The data from Table PO-04(A).2 and PO-04(A).4 is used to evaluate weighted average of direct measure through course portfolio for criteria PO-04(A), 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	
UHU001	0.00	87.10	6.45	0.00	6.45	3.74
UEE791	90.14	9.86	0	0	0	4.90
<b>Student Class Performance Score</b>	45.07	48.48	3.23	0	3.23	4.32

### 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)'.

UHU001	Communicate verbally in a group as well as individually
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	
UHU001	26.15	36.15	32.31	1.54	3.85	3.79
UEE791	28.17	29.58	32.39	4.23	5.63	3.70
<b>Course Survey Score</b>	27.16	32.87	32.35	2.89	4.74	3.75

**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 Other Surveys.**

Course	% of students in each score					Average Score
	5	4	3	2	1	
Graduating Student Survey	16.05	37.04	38.27	4.94	3.70	3.53

Employer Survey	66.67	33.33	0.0	0.0	0.0	<b>4.67</b>
Alumni Survey	32.85	37.2	22.71	4.83	2.42	<b>3.93</b>
<b>Other Survey Score</b>	38.52	35.86	20.33	3.26	2.04	<b>4.04</b>

**c) Overall weighted average score of performance criterion ‘PO-04(A)’**

The overall weighted average score of performance criterion ‘PO-04(A)’ is 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		
<b>Student Class Performance</b>	45.07	48.48	3.225	0	3.225	<b>4.32</b>	5
<b>Course Surveys</b>	27.16	32.87	32.35	2.89	4.74	<b>3.75</b>	4
<b>Other Surveys</b>	38.52	35.86	20.33	3.26	2.04	<b>4.04</b>	3
<b>Overall Score</b>	37.46	40.12	17.21	1.78	3.43	<b>4.06</b>	

**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 *UEE502: High Voltage Engineering* and *UEE591: Summer Training* were used to assess performance criteria PO-04(B) 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-04(B)’ through the evaluation of Sessional Component (25 marks) taught in July-Dec 2014.

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: UEE502**

S. No.	Roll No.	Name	Marks (25)	Score(1-5)
1	100904083	Brahm Roop Singh	11	3
2	101204001	Aashna	11	3
3	101204002	Abhinav Sharma	14	3
4	101204003	Abhishek Jain	14.5	3
5	101204004	Aditya Jain	12	3
6	101204005	Akash Deep	19	4
7	101204006	Akash Ratna	17	4
8	101204009	Akshu Gupta	13.5	3
9	101204010	Aman Goyal	12	3
10	101204011	Amarpreet	10	3
11	101204012	Amit Bansal	12.5	3

S. No.	Roll No.	Name	Marks (25)	Score(1-5)
12	101204013	Anshul Kumar	13.5	3
13	101204014	Anukriti Dwivedi	14	3
14	101204015	Arushi Nagpal	22.5	5
15	101204016	Ayush Vaid	13	3
16	101204018	Chahat Singla	18	4
17	101204019	Deeksha Goyal	17	4
18	101204020	Dhruv Sharma	13	3
19	101204021	Gaurav Arora	15.5	4
20	101204022	Gursharan Kaur	18.5	4
21	101204023	Gursimran Singh	17.5	4
22	101204024	Harjot Singh	16.5	4
23	101204025	Harsh Kothari	17.5	4
24	101204026	Hemanshu Garg	16	4
25	101204027	Himanshu Takkur	14.5	3
26	101204028	Iqbal Singh Garcha	16	4
27	101204030	Ishtjot Singh	11.5	3
28	101204031	Jasdeep Garg	14	3
29	101204033	Jasleen Kaur	16.5	4
30	101204035	Kapil Kinger	12.5	3
31	101204037	Karanbir Singh Kahlon	11	3
32	101204038	Karanveer Singh Bhangoo	13	3
33	101204039	Kartik Arora	12	3
34	101204040	Kashish Sethi	12	3
35	101204041	Kaustubh Singh	13	3
36	101204042	Krishnank Atrey	14.5	3
37	101204043	Lovely Goyal	17	4
38	101204045	Manik Mittal	14.5	3
39	101204046	Marshall	13	3
40	101204048	Mohit Kukkar	11.5	3
41	101204049	Mohit Manhas	13.5	3
42	101204051	Nalin Kaushik	15.5	4
43	101204053	Nishant Arora	15	4
44	101204054	P Siddharth	14.5	3
45	101204057	Rahul Kamboj	17	4
46	101204059	Rajat Sahore	13.5	3
47	101204060	Rajatdeep Singh	17	4
48	101204061	Ramanpreet Kaur	17	4
49	101204063	Sahil Arora	16.5	4
50	101204064	Sahil Mittal	11	3
51	101204065	Sanchit Goel	17.5	4
52	101204066	Sewak Ram	12.5	3
53	101204067	Sheenu	15.5	4
54	101204069	Shubham Bhatia	14.5	3
55	101204070	Shubham Goel	19.5	4
56	101204071	Shubham Kansal	14.5	3
57	101204074	Sukhdarshanpal Singh	16	4
58	101204075	Sultan Singh	13	3
59	101204076	Tejasvi Anand	14.5	3
60	101254001	Sahilpreet Singh	13	3
61	101254002	Naman Kumar	12.5	3
62	101254003	Sachin Pathak	17	4
63	101254004	Srijan Aditya	12.5	3
64	101254005	Navjot Kaur	14	3
65	101254006	Milan Jain	16	4
66	101254008	Gaurav	17	4

S. No.	Roll No.	Name	Marks (25)	Score(1-5)
67	101254009	Varun Khanna	14.5	3
68	101254010	Swati Srivastava	12.5	3
69	101254012	Shubham Singla	13	3
70	101254013	Sorabh Devgun	14	3
71	101254014	Paras Ghai	12	3
72	101254015	Kuldeep Singh Deora	13	3
73	101254016	Sachin Gupta	17	4
74	101254017	Nakul Kumar	16	4
75	101384001	Ankur Singla	16	4
76	101384002	Gagandeep Singh	17.5	4
77	101384004	Himanshu Bansal	13.5	3
78	101384005	Navdeep Singh	13	3
79	101384006	Parampreet Singh	21	5
80	101384007	Saurav Goyal	19	4
81	101384008	Surjeet Singh	14	3

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

**Table PO-04(B).2: Average score of student performance in the course UEE691 for criteria PO-04(B)**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE502	2.47	38.27	59.26	0.00	0.00	3.43

### 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 novelty of ideas in viva-voce examination (100 marks) taught in July-Dec 2014.

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: UEE591**

S. No.	Roll No.	Name	Marks (100)	Score(1-5)
1	101104001	Aakriti Singla	84	5
2	101104002	Abhay Goel	86	5
3	101104003	Abhinav Kumar Sardana	64	4
4	101104005	Achin Chetal	74	4
5	101104006	Akash Verma	76	4
6	101104007	Aman Bhatnagar	86	5
7	101104008	Amar Deep Singh	76	4
8	101104009	Ankit Bansal	82	5
9	101104010	Ankur Singhal	74	4
10	101104011	Anshuman Singh	82	5
11	101104012	Arunabh Choudhury	84	5
12	101104013	Ashish Gupta	86	5
13	101104016	Chetan Baria	80	5
14	101104017	Daksh Bansal	80	5

S. No.	Roll No.	Name	Marks (100)	Score(1-5)
15	101104021	Dhruv Srivastav	88	5
16	101104022	Gagandeep Singh	86	5
17	101104023	Harkaran Tiwana	74	4
18	101104024	Harnoor Singh Ahluwalia	80	5
19	101104026	Harshit Nath	80	5
20	101104027	Harwinder Singh	64	4
21	101104028	Himanshu Goel	76	4
22	101104029	Isha Jhamb	80.7	5
23	101104030	Jagpreet Singh	77.3	4
24	101104031	Kanika Lodha	54.7	3
25	101104032	Kanwaljot Singh	71.3	4
26	101104033	Karanpreet Kaur	82	5
27	101104034	Keshav Singla	72.7	4
28	101104035	Ketan Joshi	68.7	4
29	101104036	Kriti Bansal	82	5
30	101104037	Kunal Rawat	70	4
31	101104038	Manik Budhiraja	78	4
32	101104040	Mudit Kumar	83.3	5
33	101104042	Nand Nandan Arora	76	4
34	101104043	Narinderpal Singh Kaleka	80	5
35	101104044	Navjot Singh	79.3	4
36	101104045	Navjot Singh	74	4
37	101104046	Navneet Bansal	75.3	4
38	101104047	Nikhil Agarwal	83.3	5
39	101104048	Nitin Kumar	74	4
40	101104049	Nitish Singla	77.3	4
41	101104050	Perry Mittal	82.7	5
42	101104051	Piyush Gupta	82.7	5
43	101104052	Piyush Jain	81.3	5
44	101104054	Prabhleen Kaur	80.7	5
45	101104055	Prashant	70	4
46	101104056	Prateek Jain	83.5	5
47	101104057	Priya Saroha	50.8	3
48	101104058	Rajan Gaur	96	5
49	101104059	Rajat Gupta	67.8	4
50	101104060	Ratik Mittal	80.5	5
51	101104062	Rishika Kukreja	70.2	4
52	101104063	Rubbal Maggo	53.2	3
53	101104066	Shaurya Chopra	54.5	3
54	101104067	Shish Pal	65.3	4
55	101104068	Shubham Ahuja	94	5
56	101104069	Shubham Garg	82.3	5
57	101104070	Sunny Kumar Saini	69.6	4
58	101104071	Sunny Maheshwary	62.9	4
59	101104072	Suraj Pal Singh	61.7	4
60	101104074	Tanya Sofat	87.7	5
61	101104075	Tushar Garg	55.7	3
62	101104076	Udita Kapoor	89.5	5
63	101104077	Varun	96	5
64	101104078	Vikhyat Kansal	90.1	5

S. No.	Roll No.	Name	Marks (100)	Score(1-5)
65	101104079	Vineet Sharma	53.8	3
66	101104080	Vishal Gupta	84.1	5
67	101104081	Vishesh Gupta	96	5
68	101104082	Vishvesh	64.1	4
69	101104083	Vivek Gupta	87.7	5
70	101104084	Harmanjasraj Grewal	70	4
71	101104085	Akhilesh Sharma	78	4
72	101154001	Anna Kathpal	78.7	4
73	101154002	Papiha Salhotra	83.3	5
74	101154003	Prateek Arora	76	4
75	101154004	Sandeep Singh	80	5
76	101284001	Ashish	68	4
77	101284002	Deepak Puri	74	4
78	101284004	Ishan Narang	86	5
79	101284005	Jatinder Singh Kapur	80	5
80	101284006	Navneet Kumar	96	5
81	101284007	Prikshit Singla	78	4
82	101284008	Sachin Sharma	70.2	4
83	101284010	Vikas Bansal	67.8	4
84	101284011	Gurdeep Singh	76	4

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

**Table PO-04(B).4: Average score of student performance in the course UEE691 for criteria PO-04(B)**

Course	% of students in each score					Average Score
	5	4	3	2	1	
<b>UEE591</b>	47.62	45.24	7.14	0.00	0.00	4.40

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	
<b>UEE502</b>	2.47	38.27	59.26	0.00	0.00	<b>3.43</b>
<b>UEE591</b>	47.62	45.24	7.14	0.00	0.00	<b>4.40</b>
<b>Student Class Performance Score</b>	25.04	41.75	33.20	0.00	0.00	<b>3.92</b>

#### **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 PO-04(B).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(B)'.

<b>UEE502</b>	Analyse and calculate the circuit parameters involved in generation of high voltages
<b>UEE591</b>	Use resources to adopt latest technologies

**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	
<b>UEE502</b>	35.37	21.83	20.43	9.51	3.53	<b>3.57</b>
<b>UEE591</b>	40.00	26.25	30.00	1.25	2.50	<b>4.00</b>
<b>Course Survey Score</b>	37.69	24.04	25.22	5.38	3.02	<b>3.79</b>

**(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?

**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 Table 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		
<b>Student Class Performance</b>	25.04	41.75	33.20	0.00	0.00	<b>3.92</b>	5
<b>Course Surveys</b>	37.69	24.04	25.22	5.38	3.02	<b>3.79</b>	4
<b>Other Surveys</b>	38.52	35.86	20.33	3.26	2.04	<b>4.05</b>	3
<b>Overall Score</b>	32.63	34.37	27.32	2.61	1.52	<b>3.91</b>	

## 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-04.2 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)	37.46	40.12	17.21	1.78	3.43	<b>4.06</b>	5
PO-04(B)	32.63	34.37	27.32	2.61	1.52	<b>3.91</b>	5
<b>Overall Score</b>	35.05	37.25	22.27	2.20	2.48	<b>3.99</b>	

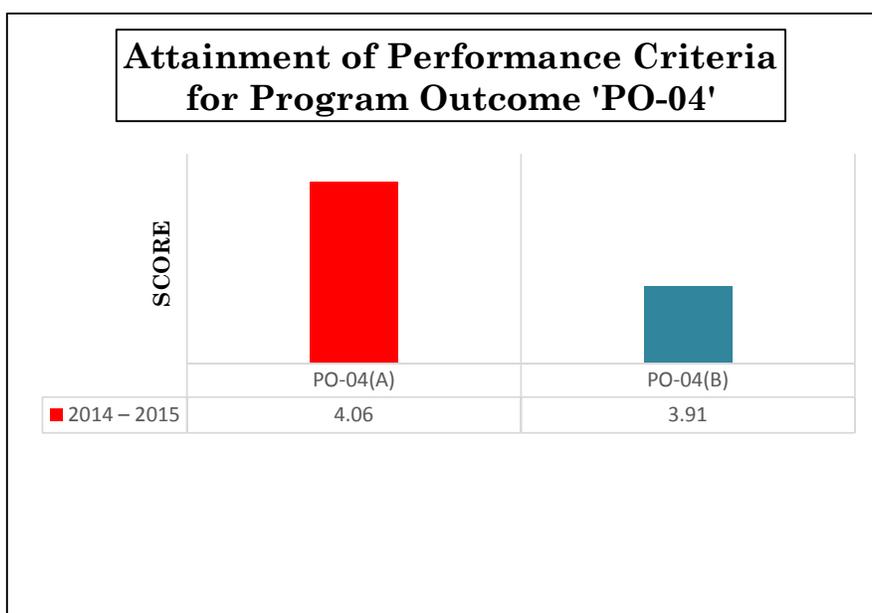


Fig PO-04.2: Performance criteria-wise assessment score of outcome 'PO-04' in the year 2014-15

# Assessment of Attainment of Program Outcome

## PO-05

*An ability to identify, formulates, and solve engineering problems*

**(2014-15)**

*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*

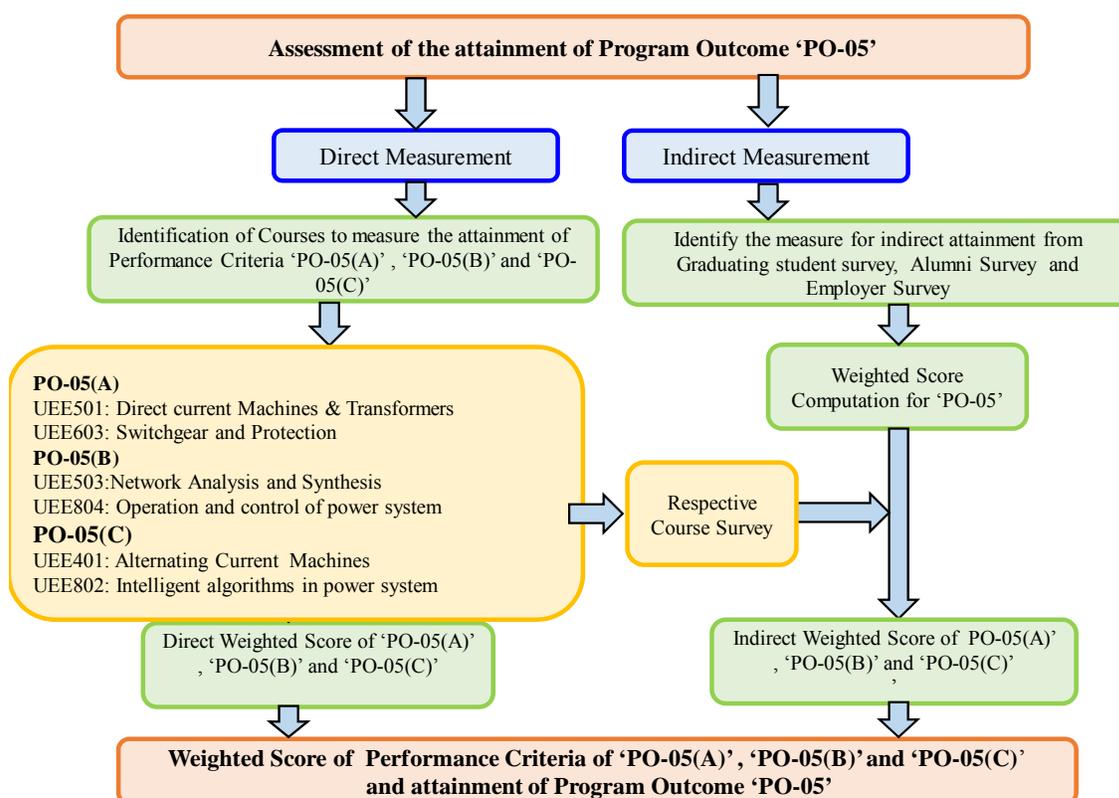
The program assessment committee identified the following courses for the assessment of program outcome 'PO-05': The courses used for the assessment during last two academic years are marked bold.

- **UEE301: Direct Current Machines and Transformers**
- **UEE401: Alternating current machines**
- UEE405: Network Theory & Design
- UEE501: Generalized Theory of Electrical Machines
- **UEE503: Network Analysis and Synthesis**
- UEI503: Digital Signal Processing 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
- UEE503: Network Analysis and Synthesis
- 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 2014-15.

Performance Criteria	Course -1	Course-2
PO-05(A)	UEE301: DC Machine and Transformer	UEE603: Switchgear and Protection
PO-05(B)	UEE503: Network Analysis and Synthesis	UEE804: Operation and control of power system
PO-05(C)	UEE401: Alternating Current Machines	UEE802: Intelligent algorithms in power system

The step by step methodology used to measure the attainment of program outcome 'PO-05' is shown in Fig. PO-05.1 for academic year (AY) 2014-15. 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 Program outcome 'PO-05' for the year 2014-15**

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 *UEE 301: DC Machine and Transformer* and *UEE603: Switchgear and Protection* are used to assess performance criteria PO-05(A) as a direct measure. The analysis for each of these courses is provided below:

**UEE 301: Direct Current Machines and Transformers**

The performance of course *UEE 301: Direct Current Machines and Transformers* is used to measure the attainment of outcome 'PO-05(A)' through the End Semester Examination ((Question No. 6(a & b), July-Dec 2014, 16 marks).

**Question:**

Q.1	<p>(a) A Scott-connected transformer set supplies two single-phase furnaces A and B each at 120 V from a 3-phase 6600 V system. If the furnace connected to teaser transformer takes 300 kW at unity power factor and the other one connected to main transformer takes 495 kW at 0.8 power factor lagging, determine the line currents taken from the 3-phase mains. Neglect losses.</p> <p>(b) Describe the different type of losses of DC machines. Draw the power flow sequence of a DC generator</p>	(16)
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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 UEE301**

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

S. No	Roll No.	Name of Student	Marks (16)	Score (1-5)
36	101404046	Heema Gupta	10	4
37	101404047	Hitesh Kumar	8	3
38	101404048	Ishita Mahindru	8	3
39	101404049	Jagmeet Singh Bawa	7	3
40	101404050	Jagnoor Kaur	9	3
41	101404051	Jashanpreet Singh	10	4
42	101404052	Jatin Bansal	10	4
43	101404053	Jatin Raheja	9	3
44	101404054	Kanishak Sharma	10	4
45	101404055	Karan Sanjeev Bajaj	10	4
46	101404056	Kirtish Madaan	10	4
47	101404057	Mahitosh Sharma	13	5
48	101404058	Manan Mittal	10	4
49	101404059	Mandeep Singh Panesar	10	4
50	101404060	Manisha Gupta	8	3
51	101404061	Manit Gupta	11	4
52	101404121	Siddharth Singh	6	2
53	101404129	Tarun Kumar	9	3
54	101404130	Tushar Goel	11	4
55	101404132	Utkarsh Atri	11	4
56	101404133	Vandana Gora	10	4
57	101404135	Vasu Mittal	12	5
58	101404136	Yashika Chopra	12	5
59	101404137	Yatin Gudwani	9	3
60	101404138	Yogesh Garg	9	3
61	101454001	Yatendra Agrawal	12	5
62	101454002	Yash Motwani	9	3
63	101584001	Amanjit Singh	11	4
64	101584002	Chetan Garg	14	5
65	101584008	Lakshay Garg	11	4
66	101584010	Rohit Gupta	8	3
67	101584012	Sharandeep Singh	12	5

The performance of students through the course UEE301 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 UEE301 for criteria 'PO-05(A)'**

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE301	23.88	40.30	29.85	4.48	1.49	3.81

**UEE: 603 Switchgear and Protection**

The performance of course *UEE: 603 Switchgear and Protection* is used to measure the attainment of outcome 'PO-05(A)' through the End Semester Examination (Question No. 3 (a), Jan-May 2014, 8 marks).

**Question:**

Q.3 (a)	Elaborate the characteristics of different types of distance relays on R-X diagram. Compare the merits and demerits. Discuss their field of applications	(8)
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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 UEE603**

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
1	101404001	Abhay Mahipal	6	5
2	101404002	Abhijeet Singh Sankhla	5	4
3	101404004	Abhinav Arora	3	2
4	101404006	Abhishek Sharma	6	5
5	101404007	Ajay Singh	4	3
6	101404009	Alka Thakur	5	4
7	101404012	Ankush Goyal	7	5
8	101404013	Anmol Arjun Bharaj	5	4
9	101404014	Anmol Goyat	6	5
10	101404015	Anmol Rattan Kaur	6	5
11	101404017	Anubhav Kumar	4	3
12	101404018	Apeksha Goel	6	5
13	101404019	Arnish Jain	6	5
14	101404020	Arshiya	7	5
15	101404021	Arshjot Kaur	6	5

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
16	101404023	Ayush Jain	6	5
17	101404024	Bhawani Singh	7	5
18	101404025	Chirag Jain	6	5
19	101404026	Davileen Garg	6	5
20	101404027	Dilpreet Kaur	6	5
21	101404028	Divesh Kamdar	7	5
22	101404029	Divyam Aggarwal	6	5
23	101404031	Divyanshu Sidhartha	5	4
24	101404032	Garima	6	5
25	101404033	Garv Chahar	3	2
26	101404035	Gaurav Rathore	4	3
27	101404036	Gurpreet Singh	4	3
28	101404037	Gursagar Singh	6	5
29	101404038	Gurupinder Pal Singh	5	4
30	101404039	Harmanpreet Singh	3	2
31	101404041	Harshit Kaushik	6	5
32	101404042	Harshvir Singh	6	5
33	101404043	Harsimarjot Kaur	7	5
34	101404044	Harsimran Singh	6	5
35	101404046	Hartej Singh Bains	5	4
36	101404047	Heema Gupta	4	3
37	101404048	Hitesh Kumar	4	3
38	101404049	Ishita Mahindru	5	4
39	101404050	Jagmeet Singh Bawa	6	5
40	101404051	Jagnoor Kaur	6	5
41	101404052	Jashanpreet Singh	6	5
42	101404053	Jatin Bansal	5	4
43	101404054	Jatin Raheja	7	5
44	101404055	Kanishak Sharma	6	5
45	101404056	Karan Sanjeev Bajaj	6	5
46	101404057	Kirtish Madaan	7	5
47	101404058	Mahitosh Sharma	7	5
48	101404059	Manan Mittal	6	5
49	101404060	Mandeep Singh Panesar	5	4
50	101404061	Manisha Gupta	6	5
51	101404121	Manit Gupta	3	2
52	101404129	Siddharth Singh	4	3

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
53	101404130	Tarun Kumar	7	5
54	101404132	Tushar Goel	5	4
55	101404133	Utkarsh Atri	6	5
56	101404135	Vandana Gora	6	5
57	101404136	Vasu Mittal	7	5
58	101404137	Yashika Chopra	5	4
59	101404138	Yatin Gudwani	5	4
60	101454001	Yogesh Garg	6	5
61	101454002	Yatendra Agrawal	4	3
62	101584001	Yash Motwani	6	5
63	101584002	Amanjit Singh	7	5
64	101584008	Chetan Garg	7	5
65	101584010	Lakshay Garg	4	3
66	101584012	Rohit Gupta	7	5

The performance of students through the course UEE603 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 UEE603 for criteria PO-05(A)**

Course	% of Students in each Score					Average Score
	5	4	3	2	1	
UEE603	62.12	18.18	13.64	6.06	0.00	4.36

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	
UEE301	23.88	40.30	29.85	4.48	1.49	3.81
UEE603	62.12	18.18	13.64	6.06	0.00	4.36
Student class performance score	43.00	29.24	21.74	5.27	0.75	4.08

**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)’.

UEE301	Test the transformer and calculate the its efficiency and performance in distribution system
UEE603	Select the protection elements such as fuse, circuit breakers and relay etc. for a given configuration

**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	
UEE301	55.33	27.82	15.92	0.77	0.15	<b>4.37</b>
UEE603	27.46	29.41	25.10	9.55	8.49	<b>3.58</b>
Course surveys score	<b>41.39</b>	<b>28.61</b>	<b>20.51</b>	<b>5.16</b>	<b>4.32</b>	<b>3.97</b>

**(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	<b>3.77</b>
Employer survey	60	40	0	0	0	<b>4.60</b>
Alumni survey	30.43	36.23	24.64	5.80	2.90	<b>3.85</b>
Other surveys score	<b>36.73</b>	<b>40.1</b>	<b>18.38</b>	<b>3.62</b>	<b>1.15</b>	<b>4.07</b>

**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	43.00	29.24	21.74	5.27	0.75	4.08	5
Course surveys score	41.39	28.61	20.51	5.16	4.32	3.97	4
Other surveys score	36.73	40.1	18.38	3.62	1.15	4.07	3
Overall weighted score	<b>40.89</b>	<b>31.74</b>	<b>20.49</b>	<b>4.82</b>	<b>2.04</b>	<b>4.04</b>	-

**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 *UEE 503: Network Analysis and Synthesis* and *UEE804: Operation and control of power system* are used to assess performance criteria PO-05(B) as a direct measure. The analysis for each of these courses is provided below:

**UEE 503: Network Analysis and Synthesis**

The performance of course *UEE 503: Network Analysis and Synthesis* is used to measure the attainment of outcome ‘PO-05(B)’ through End Semester Examination (Question No. 1 (a &b), July-Dec 2014, 9 marks).

**Question:**

Q.1	(a) Design a composite HPF having characteristic impedance of 600 Ohms and cut-off frequency 1kHz. Use constant $k$ T-section, one m-derived T-section with $m' = 0.2$ and two m-derived terminating half-sections with $m = 0.6$ . b) Design a bridged-T symmetrical attenuator for a characteristic impedance of 500 Ohms and an attenuation of 15dB.	(9)
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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 UEE503**

S. No	Roll No.	Name of Student	Marks (9)	Score (1-5)
1	101154003	Prateek Arora	2	2
2	101204001	Aashna	4	3
3	101204002	Abhinav Sharma	5	3
4	101204003	Abhishek Jain	9	5
5	101204004	Aditya Jain	0	1
6	101204005	Akash Deep	6	4

S. No	Roll No.	Name of Student	Marks (9)	Score (1-5)
7	101204006	Akash Ratna	8	5
8	101204009	Akshu Gupta	7	5
9	101204010	Aman Goyal	5	3
10	101204011	Amarpreet	0	1
11	101204012	Amit Bansal	5	3
12	101204013	Anshul Kumar	5	3
13	101204014	Anukriti Dwivedi	6	4
14	101204015	Arushi Nagpal	5	3
15	101204016	AyushVaid	5	3
16	101204018	Chahat Singla	9	5
17	101204019	Deeksha Goyal	7	5
18	101204020	Dhruv Sharma	3	2
19	101204021	Gaurav Arora	4	3
20	101204022	Gursharan Kaur	9	5
21	101204023	Gursimran Singh	11	5
22	101204024	Harjot Singh	10	5
23	101204025	Harsh Kothari	11	5
24	101204026	Hemanshu Garg	11	5
25	101204027	Himanshu Takkar	9	5
26	101204028	Iqbal Singh Garcha	5	3
27	101204030	Ishtjot Singh	0	1
28	101204031	Jasdeep Garg	8	5
29	101204033	Jasleen Kaur	8	5
30	101204035	Kapil Kinger	4	3
31	101204037	Karanbir Singh Kahlon	4	3
32	101204038	Karanveer Singh Bhangoo	3	2
33	101204039	Kartik Arora	0	1
34	101204040	Kashish Sethi	6	4
35	101204041	Kaustubh Singh	6	4
36	101204042	Krishnan kAtrey	4	3
37	101204043	Lovely Goyal	0	1
38	101204045	Manik Mittal	3	2
39	101204046	Marshall	5	3
40	101204048	Mohit Kukkar	0	1
41	101204049	Mohit Manhas	5	3
42	101204051	Nalin Kaushik	6	4
43	101204053	Nishant Arora	5	3

S. No	Roll No.	Name of Student	Marks (9)	Score (1-5)
44	101204054	P Siddharth	4	3
45	101204057	Rahul Kamboj	4	3
46	101204059	Rajat Sahore	5	3
47	101204060	Rajatdeep Singh	6	4
48	101204061	Ramanpreet Kaur	6	4
49	101204063	Sahil Arora	8	5
50	101204064	Sahil Mittal	2	2
51	101204065	Sanchit Goel	3	2
52	101204066	Sewak Ram	2	2
53	101204067	Sheenu	4	3
54	101204069	Shubham Bhatia	1	1
55	101204070	Shubham Goel	7	5
56	101204071	Shubham Kansal	5	3
57	101204074	Sukhdarshanpal Singh	4	3
58	101204075	Sultan Singh	5	3
59	101204076	Tejasvi Anand	6	4
60	101205033	Manish Tripathi	1	1
61	101254001	Sahilpreet Singh	4	3
62	101254002	Naman Kumar	0	1
63	101254003	Sachin Pathak	7	5
64	101254004	Srijan Aditya	3	2
65	101254005	Navjot Kaur	3	2
66	101254006	Milan Jain	9	5
67	101254008	Gaurav	4	3
68	101254009	Varun Khanna	6	4
69	101254010	Swati Srivastava	6	4
70	101254012	Shubham Singla	5	3
71	101254013	Sorabh Devgun	7	5
72	101254014	Paras Ghai	3	2
73	101254015	Kuldeep Singh Deora	0	1
74	101254016	Sachin Gupta	7	5
75	101254017	Nakul Kumar	7	5
76	101384001	Ankur Singla	6	4
77	101384002	Gagandeep Singh	10	5
78	101384004	Himanshu Bansal	7	5
79	101384005	Navdeep Singh	6	4
80	101384006	Parampreet Singh	12	5

S. No	Roll No.	Name of Student	Marks (9)	Score (1-5)
81	101384007	Saurav Goyal	8	5
82	101384008	Surjeet Singh	5	3

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 UEE503 for criteria PO-05(B)**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE503	29.27	14.63	31.71	12.20	12.20	3.37

#### 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-05(B)' through the End Semester Examination (Question No. 1, Jan- July 2014, 10 marks).

#### Question:

Q.1	Develop the mathematical model for speed governor system and obtain the block diagram for the same	(10)
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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 UEE804**

Sr.No.	Roll No.	Name	Marks(10)	Score(1-5)
1	101004053	Pulkit Farsaiya	4	3
2	101104001	Aakriti Singla	3	2
3	101104002	AbhayGoel	2	2
4	101104003	Abhinav Kumar Sardana	3	2
5	101104005	Achin Chetal	2	2
6	101104006	Akash Verma	6	4
7	101104007	Aman Bhatnagar	4	3
8	101104008	Amar Deep Singh	4	3
9	101104009	Ankit Bansal	6	4
10	101104010	Ankur Singhal	2	2
11	101104011	Anshuman Singh	2	2
12	101104012	Arunabh Choudhury	5	3

Sr.No.	Roll No.	Name	Marks(10)	Score(1-5)
13	101104013	Ashish Gupta	3	2
14	101104016	Chetan Baria	4	3
15	101104017	Daksh Bansal	3	2
16	101104021	Dhruv Srivastav	4	3
17	101104022	Gagandeep Singh	3	2
18	101104023	Harkaran Tiwana	3	2
19	101104024	Harnoor Singh Ahluwalia	5	3
20	101104026	Harshit Nath	6	4
21	101104027	Harwinder Singh	6	4
22	101104028	Himanshu Goel	4	3
23	101104029	Isha Jhamb	2	2
24	101104030	Jagpreet Singh	1	1
25	101104031	Kanika Lodha	2	2
26	101104032	Kanwaljot Singh	5	3
27	101104033	Karanpreet Kaur	4	3
28	101104034	Keshav Singla	5	3
29	101104035	Ketan Joshi	6	4
30	101104036	Kriti Bansal	3	2
31	101104037	Kunal Rawat	4	3
32	101104038	Manik Budhiraja	4	3
33	101104040	Mudit Kumar	2	2
34	101104042	Nand Nandan Arora	5	3
35	101104043	Narinderpal Singh Kaleka	4	3
36	101104044	Navjot Singh	4	3
37	101104045	Navjot Singh	3	2
38	101104046	Navneet Bansal	4	3
39	101104047	Nikhil Agarwal	5	3
40	101104048	Nitin Kumar	5	3
41	101104049	Nitish Singla	2	2
42	101104050	Perry Mittal	5	3
43	101104051	Piyush Gupta	4	3
44	101104052	Piyush Jain	3	2
45	101104054	Prabhleen Kaur	4	3
46	101104055	Prashant	4	3
47	101104056	Prateek Jain	1	1
48	101104057	Priya Saroha	4	3
49	101104058	Rajan Gaur	4	3

Sr.No.	Roll No.	Name	Marks(10)	Score(1-5)
50	101104059	Rajat Gupta	4	3
51	101104060	Ratik Mittal	5	3
52	101104062	Rishika Kukreja	2	2
53	101104063	Rubbal Maggo	3	2
54	101104066	Shaurya Chopra	3	2
55	101104067	Shish Pal	3	2
56	101104068	Shubham Ahuja	2	2
57	101104069	Shubham Garg	2	2
58	101104070	Sunny Kumar Saini	3	2
59	101104071	Sunny Maheshwary	4	3
60	101104072	Suraj Pal Singh	4	3
61	101104074	Tanya Sofat	3	2
62	101104075	Tushar Garg	1	1
63	101104076	Udita Kapoor	5	3
64	101104077	Varun	4	3
65	101104078	Vikhyat Kansal	5	3
66	101104079	Vineet Sharma	6	4
67	101104080	Vishal Gupta	3	2
68	101104081	Vishesh Gupta	2	2
69	101104082	Vishvesh	5	3
70	101104083	Vivek Gupta	5	3
71	101104084	Harmanjasraj Grewal	5	3
72	101104085	Akhilesh Sharma	6	4
73	101154001	Anna Kathpal	4	3
74	101154002	Papiha Salhotra	1	1
75	101154003	Prateek Arora	5	3
76	101154004	Sandeep Singh	4	3
77	101284001	Ashish	0	1
78	101284002	Deepak Puri	2	2
79	101284004	Ishan Narang	2	2
80	101284005	Jatinder Singh Kapur	6	4
81	101284006	Navneet Kumar	6	4
82	101284007	Prikshit Singla	1	1
83	101284008	Sachin Sharma	4	3
84	101284010	Vikas Bansal	1	1
85	101284011	Gurdeep Singh	0	1

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 UEE505 for criteria PO-05(B)**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE605	0.00	10.59	45.88	34.12	9.41	2.58

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	
UEE503	29.27	14.63	31.71	12.20	12.20	3.37
UEE804	0.00	10.59	45.88	34.12	9.41	2.58
<b>Student class performance score</b>	<b>14.63</b>	<b>12.61</b>	<b>38.79</b>	<b>23.16</b>	<b>10.80</b>	<b>2.97</b>

**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.

UEE503	Design the passive filters and or attenuator(s) for various applications
UEE804	Develop small scale model of alternator, excitation and governing systems

**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	
UEE503	49.81	14.45	20.67	5.61	9.45	3.90
UEE804	15.91	25.64	32.18	14.17	12.62	3.18
<b>Course surveys score</b>	<b>32.86</b>	<b>20.05</b>	<b>26.43</b>	<b>9.89</b>	<b>11.04</b>	<b>3.54</b>

- (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(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		
Weighted average student class performance	14.63	12.61	38.79	23.16	10.80	<b>2.97</b>	5
Weighted average score course surveys	32.86	20.05	26.43	9.89	11.04	<b>3.54</b>	4
Weighted average score other surveys	36.73	40.1	18.38	3.62	1.15	<b>4.07</b>	3
<b>Overall weighted score</b>	<b>26.23</b>	<b>21.96</b>	<b>29.56</b>	<b>13.85</b>	<b>8.46</b>	<b>3.43</b>	

**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 *UEE802 and Intelligent algorithms in power system* 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. 3&5, Jan-May 2014, 8 marks)

**Question:**

Q3.	A 230V, 50Hz, 4-pole, single phase induction motor, gave the following test results No- load test: 230V, 84W, 2.8A Blocked rotor test: 111V, 460W, 6.2A The stator winding resistance is 4.6Ω and during the blocked rotor test, auxiliary winding is open. Determine the equivalent circuit parameters.	8
Q.5	A 3.3KV, 50 Hz, star connected synchronous motor has synchronous impedance of $(.8+j55)$ Ω. It is synchronized to 3.3 KV main from which it is drawing 750 KW at an excitation e.m.f of 4.27KV (line). Determine the armature current, power factor, and power angle. Also find the mechanical power developed. If stray loss is 30KW, find the efficiency.	

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: Students’ performance in question targeting ‘PO-05(C)’; Course UEE401**

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
1	101304001	Aarushi Bajaj	3	2
2	101304002	Abhey Arora	4	3

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
3	101304003	Abhishek Taksali	4	3
4	101304004	Adhikaansh Tayal	1	1
5	101304005	Aditi Narang	6	5
6	101304006	Aditya	5	4
7	101304007	Akshat	5	4
8	101304008	Akshay Kapoor	5	4
9	101304009	Akshay Kumar	3	2
10	101304010	Akshay Kumar Chaudhary	1	1
11	101304011	Akshay Sharma	3	2
12	101304012	Amandeep Kaur	2	2
13	101304013	Amandeep Singh	4	3
14	101304014	Amaninder Singh Randhawa	3	2
15	101304015	Angad Kapoor	4	3
16	101304016	Ankita Garg	6	5
17	101304017	Anmol Jawa	4	3
18	101304018	Anmolpreet Singh	6	5
19	101304019	Anyuti Tiwary	4	3
20	101304020	Arpit Sharma	4	3
21	101304021	Arsh Kundal	4	3
22	101304022	Arshbir Kaur	4	3
23	101304023	Arshdeep Singh	6	5
24	101304024	Ashish	4	3
25	101304025	Ashish Rajpal	4	3
26	101304026	Berry	4	3
27	101304028	Bhanu	4	3
28	101304029	Bhanu	5	4
29	101304030	Chirag Gaba	3	2
30	101304031	Dipin	4	3
31	101304032	Dishant	4	3
32	101304033	Divyesh Pratap	3	2
33	101304034	Elham	5	4
34	101304035	Gurseerat	5	4
35	101304036	Gursewak Singh	2	2
36	101304037	Harvensh	3	2
37	101304040	Hartejdeep Singh	2	2
38	101304041	Himanshu Goyal	2	2
39	101304042	Jasjit Singh	5	4

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
40	101304044	Jassimran Singh	0	1
41	101304045	Jessica	4	3
42	101304046	Kanwarpal Singh	5	4
43	101304047	Karan Kumar	3	2
44	101304048	Karamjot Singh	2	2
45	101304049	Kashish Agarwal	3	2
46	101304050	Kritika	4	3
47	101304052	Love Gaba	3	2
48	101304054	Manik Mittal	4	3
49	101304055	Maninderjit Singh	3	2
50	101304056	Mayank Singla	3	2
51	101304057	Mridul	3	2
52	101304058	Naman Garg	7	5
53	101304059	Navdeep Singh	3	2
54	101304060	Navdeep Singh	5	4
55	101304062	Nazuk Agarwal	5	4
56	101304094	Nishant Garg	4	3
57	101484001	Nishtha Raheja	5	4
58	101484002	Paras Bawa	6	5
59	101484003	Parth Ahuja	2	2
60	101484004	Parushi	3	2
61	101484005	Pency Goyal	5	4
62	101484007	Piyush Jindal	6	5
63	101484008	Piyush Tripathi	5	4

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	
<b>UEE401</b>	11.11	20.63	30.16	33.33	4.76	<b>3.00</b>

#### **UEE802: Intelligent algorithms in power system**

The performance of course UEE802: An intelligent algorithm in power system is used to measure the attainment of outcome 'PO-05(C)' Mid Semester Examination (Question No. 5, July-Dec 2014, 5 marks).

**Question:**

Q.5	<p>Consider a function maximization application of GA. Suppose the 5 chromosomes at a given generation have fitness value listed below.</p> <p style="text-align: center;"> <math>f(x_1) = 55</math>  <math>f(x_2) = 24</math>  <math>f(x_3) = 8</math>  <math>f(x_4) = 19</math>  <math>f(x_5) = 42</math> </p> <p>Construct the “rowlett wheel” for selection of parents for crossover.</p>	<b>5</b>
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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 UEE802**

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101004053	Pulkit Farsaiya	1	2
2	101004076	Harshobit Singh	0	1
3	101104001	Aakriti Singla	4	5
4	101104002	Abhay Goel	4	5
5	101104003	Abhinav Kumar Sardana	3	4
6	101104005	Achin Chetal	3	4
7	101104006	Akash Verma	2	3
8	101104007	Aman Bhatnagar	4	5
9	101104008	Amar Deep Singh	4	5
10	101104009	Ankit Bansal	3	4
11	101104010	Ankur Singhal	3	4
12	101104011	Anshuman Singh	3	4
13	101104012	Arunabh Choudhury	4	5
14	101104013	Ashish Gupta	4	5
15	101104016	Chetan Baria	3	4
16	101104017	Daksh Bansal	4	5
17	101104021	Dhruv Srivastav	5	5
18	101104022	Gagandeep Singh	3	4
19	101104023	Harkaran Tiwana	4	5
20	101104024	Harnoor Singh Ahluwalia	2	3
21	101104026	Harshit Nath	4	5
22	101104027	Harwinder Singh	4	5
23	101104028	Himanshu Goel	4	5
24	101104029	Isha Jhamb	3	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
25	101104030	Jagpreet Singh	3	4
26	101104031	Kanika Lodha	2	3
27	101104032	Kanwaljot Singh	4	5
28	101104033	Karanpreet Kaur	3	4
29	101104034	Keshav Singla	4	5
30	101104035	Ketan Joshi	3	4
31	101104036	Kriti Bansal	4	5
32	101104037	Kunal Rawat	3	4
33	101104038	Manik Budhiraja	4	5
34	101104040	Mudit Kumar	4	5
35	101104042	Nand Nandan Arora	3	4
36	101104043	Narinderpal Singh Kaleka	4	5
37	101104044	Navjot Singh	3	4
38	101104045	Navjot Singh	4	5
39	101104046	Navneet Bansal	3	4
40	101104047	Nikhil Agarwal	4	5
41	101104048	Nitin Kumar	4	5
42	101104049	Nitish Singla	3	4
43	101104050	Perry Mittal	2	3
44	101104051	Piyush Gupta	4	5
45	101104052	Piyush Jain	4	5
46	101104054	Prabhleen Kaur	2	3
47	101104055	Prashant	4	5
48	101104056	Prateek Jain	3	4
49	101104057	Priya Saroha	1	2
50	101104058	Rajan Gaur	3	4
51	101104059	Rajat Gupta	3	4
52	101104060	Ratik Mittal	3	4
53	101104062	Rishika Kukreja	5	5
54	101104063	Rubbal Maggo	3	4
55	101104066	Shaurya Chopra	3	4
56	101104067	Shish Pal	2	3
57	101104068	Shubham Ahuja	4	5
58	101104069	Shubham Garg	3	4
59	101104070	Sunny Kumar Saini	2	3
60	101104071	Sunny Maheshwary	3	4
61	101104072	Suraj Pal Singh	4	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
62	101104074	Tanya Sofat	4	5
63	101104075	Tushar Garg	5	5
64	101104076	Udita Kapoor	4	5
65	101104077	Varun	3	4
66	101104078	Vikhyat Kansal	4	5
67	101104079	Vineet Sharma	5	5
68	101104080	Vishal Gupta	4	5
69	101104081	Vishesh Gupta	4	5
70	101104082	Vishvesh	2	3
71	101104083	Vivek Gupta	4	5
72	101104084	Harmanjasraj Grewal	4	5
73	101104085	Akhilesh Sharma	3	4
74	101154001	Anna Kathpal	4	5
75	101154002	Papiha Salhotra	4	5
76	101154003	Prateek Arora	3	4
77	101154004	Sandeep Singh	4	5
78	101284001	Ashish	4	5
79	101284002	Deepak Puri	2	3
80	101284004	Ishan Narang	3	4
81	101284005	Jatinder Singh Kapur	3	4
82	101284006	Navneet Kumar	5	5
83	101284007	Prikshit Singla	3	4
84	101284008	Sachin Sharma	3	4
85	101284010	Vikas Bansal	4	5
86	101284011	Gurdeep Singh	3	4

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	
<b>UEE802</b>	48.84	37.21	10.47	2.33	1.16	4.30

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	11.11	20.63	30.16	33.33	4.76	3.00
UEE802	48.84	37.21	10.47	2.33	1.16	4.30
<b>Student class performance score</b>	<b>29.97</b>	<b>28.92</b>	<b>20.31</b>	<b>17.83</b>	<b>2.96</b>	<b>3.65</b>

**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	Validate and identify the machine parameters
UEE802	Obtain the optimum solution of well formulated optimisation problem using evolutionary approach

**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	35.94	36.74	21.64	1.46	4.22	<b>3.99</b>
UEE802	35.40	29.40	28.63	5.61	0.97	<b>3.93</b>
<b>Course surveys score</b>	<b>35.67</b>	<b>33.07</b>	<b>25.14</b>	<b>3.54</b>	<b>2.60</b>	<b>3.96</b>

- (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

**(ii) Assessment Tool: Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys)**

**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 score	29.97	28.92	20.31	17.83	2.96	3.65	5
Course surveys score	35.67	33.07	25.14	3.54	2.60	3.96	4
Other surveys score	36.73	40.1	18.38	3.62	1.15	4.07	3
Overall weighted score	34.12	34.03	21.27	8.33	2.23	3.89	

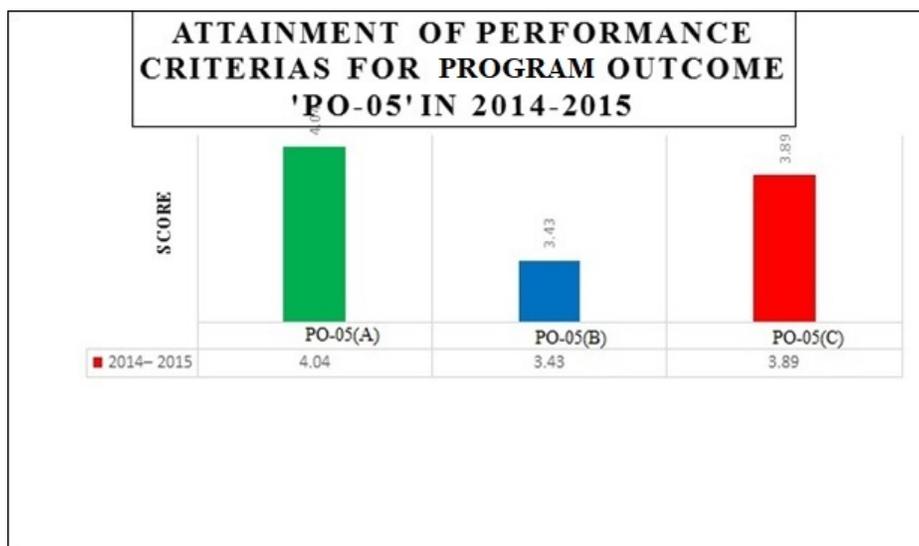
**Overall assessment of program outcome PO-05 using scores of PO-05(A), PO-05(B) and PO-05(C)**

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)	40.89	31.74	20.49	4.82	2.04	4.04	5
PO-05(B)	26.23	21.96	29.56	13.85	8.46	3.43	5
PO-05(C)	34.12	34.03	21.27	8.33	2.23	3.89	5
Overall score	33.74	29.24	23.77	9.0	4.24	3.78	



**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*  
(2014-15)

*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-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*

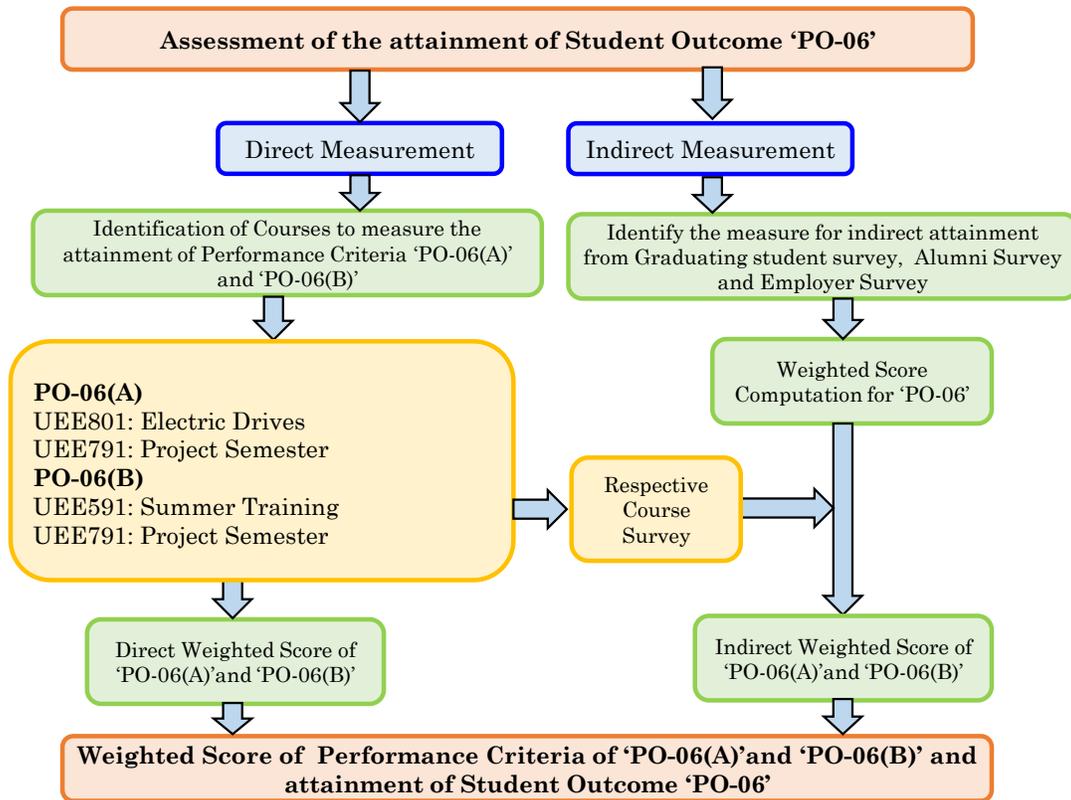
The program assessment committee identified the following courses for the assessment of program outcome ‘PO-06’:

- UEN001: Environmental Studies
- UHU001: Communication Skills
- UHU032: Human Values, Ethics and IPR
- UTA002: Manufacturing Processes
- UEE522: Energy Auditing and Management
- **UEE591: Summer Training**
- **UEE791: Project Semester**
- **UEE801: Electric Drives**

Program 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 2014-15.

<b>Performance Criteria</b>	<b>Course -1</b>	<b>Course-2</b>
PO-06(A)	UEE801: Electric Drives	UEE791: Project Semester
PO-06(B)	UEE591: Summer Training	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 the academic year (AY) 2014-15.



**Fig. PO-06.1: Process for measurement of attainment of outcome 'PO-06' for the year 2014-15**

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 subjects 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 *UEE801: Electric Drives* 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:

#### **UEE801: Electric Drives**

The performance of course *UEE801: Electric Drives* is used to measure the attainment of outcome PO-06(A) by considering **industry orientation of students in a professional manner to achieve their goals** through viva voce component in laboratory assessment in July-Dec 2014, (5 Marks).

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 UEE801**

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101104001	Aakriti Singla	3	4
2	101104002	Abhay Goel	3	4
3	101104003	Abhinav Kumar Sardana	3	4
4	101104005	Achin Chetal	2	3
5	101104006	Akash Verma	2	3
6	101104007	Aman Bhatnagar	4	5
7	101104008	Amardeep Singh	3	4
8	101104009	Ankit Bansal	3	4
9	101104010	Ankur Singhal	3	4
10	101104011	Anshuman Singh	3	4
11	101104012	Arunabh Choudhury	4	5
12	101104013	Ashish Gupta	3	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
13	101104016	Chetan Baria	3	4
14	101104017	Daksh Bansal	3	4
15	101104021	Dhruv Srivastav	4	5
16	101104022	Gagandeep Singh	3	4
17	101104023	Harkaran Tiwana	2.5	3
18	101104024	Harnoor Singh Ahluwalia	3	4
19	101104026	Harshit Nath	4	5
20	101104027	Harwinder Singh	3	4
21	101104028	Himanshu Goel	2.5	3
22	101104029	Isha Jhamb	2	3
23	101104030	Jagpreet Singh	4	5
24	101104031	Kanika Lodha	2	3
25	101104032	Kanwaljot Singh	3	4
26	101104033	Karanpreet Kaur	3	4
27	101104034	Keshav Singla	4	5
28	101104035	Ketan Joshi	2	3
29	101104036	Kriti Bansal	4	5
30	101104037	Kunal Rawat	2	3
31	101104038	Manik Budhiraja	2	3
32	101104040	Mudit Kumar	2	3
33	101104042	Nand Nandan Arora	3.5	4
34	101104043	Narinderpal Singh Kaleka	4	5
35	101104044	Navjot Singh	2	3
36	101104045	Navjot Singh	2	3
37	101104046	Navneet Bansal	3	4
38	101104047	Nikhil Agarwal	4	5
39	101104048	Nitin Kumar	2	3
40	101104049	Nitish Singla	2	3
41	101104050	Perry Mittal	4	5
42	101104051	Piyush Gupta	3	4
43	101104052	Piyush Jain	2	3
44	101104054	Prabhleen Kaur	3	4
45	101104055	Prashant	3	4
46	101104056	Prateek Jain	3.5	4
47	101104057	Priya Saroha	4.5	5
48	101104058	Rajan Gaur	4.5	5
49	101104059	Rajat Gupta	3.5	4
50	101104060	Ratik Mittal	4	5
51	101104062	Rishika Kukreja	4	5
52	101104063	Rubbal Maggo	3.5	4
53	101104066	Shaurya Chopra	3	4
54	101104067	Shish Pal	3.5	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
55	101104068	Shubham Ahuja	3.5	4
56	101104069	Shubham Garg	3	4
57	101104070	Sunny Kumar Saini	3	4
58	101104071	Sunny Maheshwary	3.5	4
59	101104072	Suraj Pal Singh	3.5	4
60	101104074	Tanya Sofat	4	5
61	101104075	Tushar Garg	4	5
62	101104076	Udita Kapoor	4	5
63	101104077	Varun	4	5
64	101104078	Vikhyat Kansal	3.5	4
65	101104079	Vineet Sharma	4	5
66	101104080	Vishal Gupta	4	5
67	101104081	Vishesh Gupta	4	5
68	101104082	Vishvesh	3	4
69	101104083	Vivek Gupta	4	5
70	101104084	Harmanjasraj Grewal	3	4
71	101104085	Akhilesh Sharma	4	5
72	101154001	Anna Kathpal	4	5
73	101154002	Papiha Salhotra	2	3
74	101154003	Prateek Arora	2	3
75	101154004	Sandeep Singh	3	4
76	101284002	Deepak Puri	3	4
77	101284004	Ishan Narang	2	3
78	101284005	Jatinder Singh Kapur	3	4
79	101284006	Navneet Kumar	4	5
80	101284007	Prikshit Singla	3.5	4
81	101284008	Sachin Sharma	3	4
82	101284010	Vikas Bansal	4	5
83	101284011	Gurdeep Singh	2	3

The performance of students through the course UEE801 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 UEE801 for criteria PO-06(A)**

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE801	31.33	45.78	22.89	0.00	0.00	4.08

## UEE791: Project Semester

The performance of course *UEE791: Project Semester* is used to measure the attainment of outcome PO-06(A) by considering the EST viva component of project semester for Jan-June 2015, (50 Marks). 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 to achieve their goals.**

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 (50)	Score (1-5)
1	101104001	Aakriti Singla	36	4
2	101104002	Abhay Goel	39	4
3	101104003	Abhinav Kumar Sardana	25	3
4	101104006	Akash Verma	35	4
5	101104007	Aman Bhatnagar	30	4
6	101104008	Amar Deep Singh	39	4
7	101104009	Ankit Bansal	31	4
8	101104010	Ankur Singhal	36	4
9	101104011	Anshuman Singh	45	5
10	101104012	Arunabh Choudhury	36	4
11	101104013	Ashish Gupta	34	4
12	101104016	Chetan Baria	39	4
13	101104021	Dhruv Srivastav	37	4
14	101104022	Gagandeep Singh	39	4
15	101104023	Harkaran Tiwana	35	4
16	101104024	Harnoor Singh Ahluwalia	31	4
17	101104026	Harshit Nath	35	4
18	101104027	Harwinder Singh	33	4
19	101104028	Himanshu Goel	40	5
20	101104029	Isha Jhamb	34	4
21	101104030	Jagpreet Singh	28	3
22	101104031	Kanika Lodha	37	4
23	101104032	Kanwaljot Singh	34	4
24	101104033	Karanpreet Kaur	38	4
25	101104034	Keshav Singla	31	4
26	101104035	Ketan Joshi	38	4
27	101104036	Kriti Bansal	36	4
28	101104037	Kunal Rawat	24	3
29	101104040	Mudit Kumar	32	4
30	101104042	Nand Nandan Arora	40	5
31	101104043	Narinderpal Singh Kaleka	38	4

S. No	Roll No.	Name of Student	Marks (50)	Score (1-5)
32	101104045	Navjot Singh	31	4
33	101104046	Navneet Bansal	40	5
34	101104047	Nikhil Agarwal	27	3
35	101104048	Nitin Kumar	31	4
36	101104049	Nitish Singla	34	4
37	101104050	Perry Mittal	37	4
38	101104051	Piyush Gupta	39	4
39	101104052	Piyush Jain	37	4
40	101104054	Prabhleen Kaur	38	4
41	101104055	Prashant	37	4
42	101104056	Prateek Jain	39	4
43	101104058	Rajan Gaur	38	4
44	101104059	Rajat Gupta	31	4
45	101104060	Ratik Mittal	42	5
46	101104062	Rishika Kukreja	37	4
47	101104063	Rubbal Maggo	30	4
48	101104066	Shaurya Chopra	39	4
49	101104068	Shubham Ahuja	36	4
50	101104069	Shubham Garg	35	4
51	101104071	Sunny Maheshwary	39	4
52	101104072	Suraj Pal Singh	32	4
53	101104074	Tanya Sofat	39	4
54	101104075	Tushar Garg	34	4
55	101104076	Udita Kapoor	35	4
56	101104077	Varun	39	4
57	101104078	Vikhyat Kansal	25	3
58	101104079	Vineet Sharma	32	4
59	101104080	Vishal Gupta	36	4
60	101104081	Vishesh Gupta	35	4
61	101104083	Vivek Gupta	33	4
62	101104084	Harmanjasraj Grewal	28	3
63	101104085	Akhilesh Sharma	31	4
64	101154001	Anna Kathpal	30	4
65	101154002	Papiha Salhotra	37	4
66	101154003	Prateek Arora	20	3
67	101154004	Sandeep Singh	30	4
68	101284002	Deepak Puri	32	4
69	101284006	Navneet Kumar	24	3
70	101284007	Prikshit Singla	36	4
71	101284010	Vikas Bansal	34	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	7.04	81.69	11.27	0.00	0.00	3.96

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	
UEE801	31.33	45.78	22.89	0.00	0.00	4.08
UEE791	7.04	81.69	11.27	0.00	0.00	3.96
<b>Weighted Average Score</b>	<b>19.19</b>	<b>63.74</b>	<b>17.08</b>	<b>0.00</b>	<b>0.00</b>	<b>4.02</b>

**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).

UEE801	<ul style="list-style-type: none"> <li>▪ Conceptualise the use of PLC for drive control</li> <li>▪ Understand the use of NEMA/IEC standards for selection of control and protection circuitry in motor drive system</li> </ul>
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	
UEE801	31.66	28.28	29.83	29.83	5.19	3.76
UEE791	22.54	22.54	43.66	7.04	4.23	3.52
Weighted average score	27.10	25.41	36.75	18.44	4.71	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-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	16.05	41.98	33.33	2.47	6.17	3.59
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	35.98	36.86	22.19	2.43	2.54	4.01

**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	19.19	63.74	17.08	0.00	0.00	4.02	5
Course surveys	27.10	25.41	36.75	18.44	4.71	3.64	4
Other surveys	35.98	36.86	22.19	2.43	2.54	4.01	3
Overall weighted score	26.02	44.24	24.91	6.75	2.21	3.89	-

## 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 *UEE591: Summer Training* 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:

#### **UEE591: Summer Training**

The performance of course *UEE591: Summer Training* is used to measure the attainment of outcome 'PO-06(B)' considering the following expected outcomes assessed through the evaluation of summer training during undergone by the students in June-July 2014, (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 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 UEE591**

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
1	101204001	Aashna	5	4
2	101204002	Abhinav Sharma	6	4
3	101204003	Abhishek Jain	7	4
4	101204004	Aditya Jain	5	3
5	101204005	Akash Deep	7	5

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
6	101204006	Akash Ratna	8	5
7	101204009	Akshu Gupta	6	4
8	101204010	Aman Goyal	7	4
9	101204011	Amarpreet	4	3
10	101204012	Amit Bansal	7	5
11	101204013	Anshul Kumar	7	4
12	101204014	Anukriti Dwivedi	7	5
13	101204015	Arushi Nagpal	7	4
14	101204016	Ayush Vaid	5	4
15	101204018	Chahat Singla	7	5
16	101204019	Deeksha Goyal	7	4
17	101204020	Dhruv Sharma	7	4
18	101204021	Gaurav Arora	6	4
19	101204022	Gursharan Kaur	7	4
20	101204023	Gursimran Singh	7	5
21	101204024	Harjot Singh	7	5
22	101204025	Harsh Kothari	7	4
23	101204026	Hemanshu Garg	7	5
24	101204027	Himanshu Takkar	7	4
25	101204028	Iqbal Singh Garcha	6	4
26	101204030	Ishtjot Singh	7	4
27	101204031	Jasdeep Garg	5	4
28	101204033	Jasleen Kaur	7	4
29	101204035	Kapil Kinger	6	4
30	101204037	Karanbir Singh Kahlon	6	4
31	101204038	Karanveer Singh Bhangoo	7	4
32	101204039	Kartik Arora	7	5
33	101204040	Kashish Sethi	6	4
34	101204041	Kaustubh Singh	7	4
35	101204042	Krishnank Atrey	8	5
36	101204043	Lovely Goyal	7	4
37	101204045	Manik Mittal	7	4
38	101204046	Marshall	6	4
39	101204048	Mohit Kukkar	7	4
40	101204049	Mohit Manhas	6	4
41	101204051	Nalin Kaushik	7	4
42	101204053	Nishant Arora	7	4
43	101204054	P Siddharth	5	4
44	101204057	Rahul Kamboj	6	4
45	101204059	Rajat Sahore	6	4
46	101204060	Rajatdeep Singh	7	4
47	101204061	Ramanpreet Kaur	7	4

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
48	101204063	Sahil Arora	8	5
49	101204064	Sahil Mittal	7	4
50	101204065	Sanchit Goel	7	4
51	101204066	Sewak Ram	7	4
52	101204067	Sheenu	6	4
53	101204069	Shubham Bhatia	7	4
54	101204070	Shubham Goel	7	4
55	101204071	Shubham Kansal	7	4
56	101204074	Sukhdarshanpal Singh	5	3
57	101204075	Sultan Singh	6	4
58	101204076	Tejasvi Anand	6	4
59	101254001	Sahilpreet Singh	6	4
60	101254002	Naman Kumar	6	4
61	101254003	Sachin Pathak	7	4
62	101254004	Srijan Aditya	7	4
63	101254005	Navjot Kaur	6	4
64	101254006	Milan Jain	8	5
65	101254008	Gaurav	8	5
66	101254009	Varun Khanna	5	3
67	101254010	Swati Srivastava	6	4
68	101254012	Shubham Singla	7	4
69	101254013	Sorabh Devgun	6	4
70	101254014	Paras Ghai	4	3
71	101254015	Kuldeep Singh Deora	6	4
72	101254016	Sachin Gupta	7	5
73	101254017	Nakul Kumar	5	3
74	101384001	Ankur Singla	6	4
75	101384002	Gagandeep Singh	8	5
76	101384004	Himanshu Bansal	7	5
77	101384005	Navdeep Singh	6	4
78	101384006	Parampreet Singh	7	5
79	101384007	Saurav Goyal	7	4
80	101384008	Surjeet Singh	8	5

The performance of students through the course UEE591 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 UEE591 for criteria 'PO-06(B)'**

Course	% of Students in each score					Average Score
	5	4	3	2	1	
UEE591	22.50	70.00	7.50	0.00	0.00	4.15

## UEE791: Project Semester

The performance of course *UEE791: Project Semester* is used to measure the attainment of outcome 'PO-06(B)' considering the evaluation of Industry Mentor marks in Project Semester during Jan-June 2015, (20 Marks). The expected outcomes from the industry mentor evaluation are:

- a. **Optimized design considering engineering, social, environmental, ethical, economic, financial, institutional and commercial constraints.**
- b. **Application of engineering principles and knowledge and concepts/ codes/ standards.**

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 (20)	Score (1-5)
1	101104001	Aakriti Singla	19.8	5
2	101104002	Abhay Goel	19.4	5
3	101104003	Abhinav Kumar Sardana	15.2	4
4	101104006	Akash Verma	19.6	5
5	101104007	Aman Bhatnagar	19.8	5
6	101104008	Amar Deep Singh	17.8	5
7	101104009	Ankit Bansal	19.4	5
8	101104010	Ankur Singhal	16.6	5
9	101104011	Anshuman Singh	19.6	5
10	101104012	Arunabh Choudhury	18.8	5
11	101104013	Ashish Gupta	18.8	5
12	101104016	Chetan Baria	19.8	5
13	101104021	Dhruv Srivastav	19.2	5
14	101104022	Gagandeep Singh	18.8	5
15	101104023	Harkaran Tiwana	14.2	4
16	101104024	Harnoor Singh Ahluwalia	19	5
17	101104026	Harshit Nath	19.4	5
18	101104027	Harwinder Singh	19.2	5
19	101104028	Himanshu Goel	20	5
20	101104029	Isha Jhamb	18.8	5
21	101104030	Jagpreet Singh	19.4	5
22	101104031	Kanika Lodha	16.2	5
23	101104032	Kanwaljot Singh	19.2	5
24	101104033	Karanpreet Kaur	19.2	5
25	101104034	Keshav Singla	17.2	5
26	101104035	Ketan Joshi	19.4	5
27	101104036	Kriti Bansal	19.2	5
28	101104037	Kunal Rawat	19.4	5

S. No	Roll No.	Name of Student	Marks (20)	Score (1-5)
29	101104040	Mudit Kumar	19.8	5
30	101104042	Nand Nandan Arora	18.4	5
31	101104043	Narinderpal Singh Kaleka	18.6	5
32	101104045	Navjot Singh	19.6	5
33	101104046	Navneet Bansal	19.2	5
34	101104047	Nikhil Agarwal	15.2	4
35	101104048	Nitin Kumar	19.4	5
36	101104049	Nitish Singla	19.6	5
37	101104050	Perry Mittal	19.2	5
38	101104051	Piyush Gupta	19	5
39	101104052	Piyush Jain	18.2	5
40	101104054	Prabhleen Kaur	17.8	5
41	101104055	Prashant	19.2	5
42	101104056	Prateek Jain	20	5
43	101104058	Rajan Gaur	19.8	5
44	101104059	Rajat Gupta	19.8	5
45	101104060	Ratik Mittal	19	5
46	101104062	Rishika Kukreja	19.8	5
47	101104063	Rubbal Maggo	19.2	5
48	101104066	Shaurya Chopra	16.8	5
49	101104068	Shubham Ahuja	17.8	5
50	101104069	Shubham Garg	12	4
51	101104071	Sunny Maheshwary	18.8	5
52	101104072	Suraj Pal Singh	19.6	5
53	101104074	Tanya Sofat	18.4	5
54	101104075	Tushar Garg	14.6	4
55	101104076	Udita Kapoor	18	5
56	101104077	Varun	19.4	5
57	101104078	Vikhyat Kansal	19.4	5
58	101104079	Vineet Sharma	18.6	5
59	101104080	Vishal Gupta	18.2	5
60	101104081	Vishesh Gupta	18.6	5
61	101104083	Vivek Gupta	18.2	5
62	101104084	Harmanjasraj Grewal	18.6	5
63	101104085	Akhilesh Sharma	20	5
64	101154001	Anna Kathpal	19.2	5
65	101154002	Papiha Salhotra	18.6	5
66	101154003	Prateek Arora	14.2	4
67	101154004	Sandeep Singh	14.4	4
68	101284002	Deepak Puri	19	5
69	101284006	Navneet Kumar	19.4	5
70	101284007	Prikshit Singla	19.2	5

S. No	Roll No.	Name of Student	Marks (20)	Score (1-5)
71	101284010	Vikas Bansal	20	5

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	
<b>UEE791</b>	90.14	9.86	0.00	0.00	0.00	<b>4.90</b>

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	
<b>UEE591</b>	22.50	70.00	7.50	0.00	0.00	<b>4.15</b>
<b>UEE791</b>	90.14	9.86	0.00	0.00	0.00	<b>4.90</b>
<b>Weighted Average Score</b>	<b>56.32</b>	<b>39.93</b>	<b>3.75</b>	<b>0.00</b>	<b>0.00</b>	<b>4.53</b>

**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)’.

UEE591	Experience the social, economic and administrative aspects of an organization
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	
UEE591	30.00	40.00	27.50	0.00	2.50	<b>3.95</b>
UEE791	32.39	29.58	33.80	1.41	2.82	<b>3.87</b>
<b>Weighted average score</b>	<b>31.20</b>	<b>34.79</b>	<b>30.65</b>	<b>0.71</b>	<b>2.66</b>	<b>3.91</b>

**(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 summarised 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		
<b>Student class performance</b>	<b>56.32</b>	<b>39.93</b>	<b>3.75</b>	<b>0.00</b>	<b>0.00</b>	<b>4.53</b>	<b>5</b>
<b>Course surveys</b>	<b>31.20</b>	<b>34.79</b>	<b>30.65</b>	<b>0.71</b>	<b>2.66</b>	<b>3.91</b>	<b>4</b>
<b>Other surveys</b>	<b>35.81</b>	<b>36.20</b>	<b>21.45</b>	<b>4.57</b>	<b>1.96</b>	<b>3.99</b>	<b>3</b>
<b>Overall weighted score</b>	<b>42.82</b>	<b>37.28</b>	<b>17.14</b>	<b>1.38</b>	<b>1.38</b>	<b>4.15</b>	<b>-</b>

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

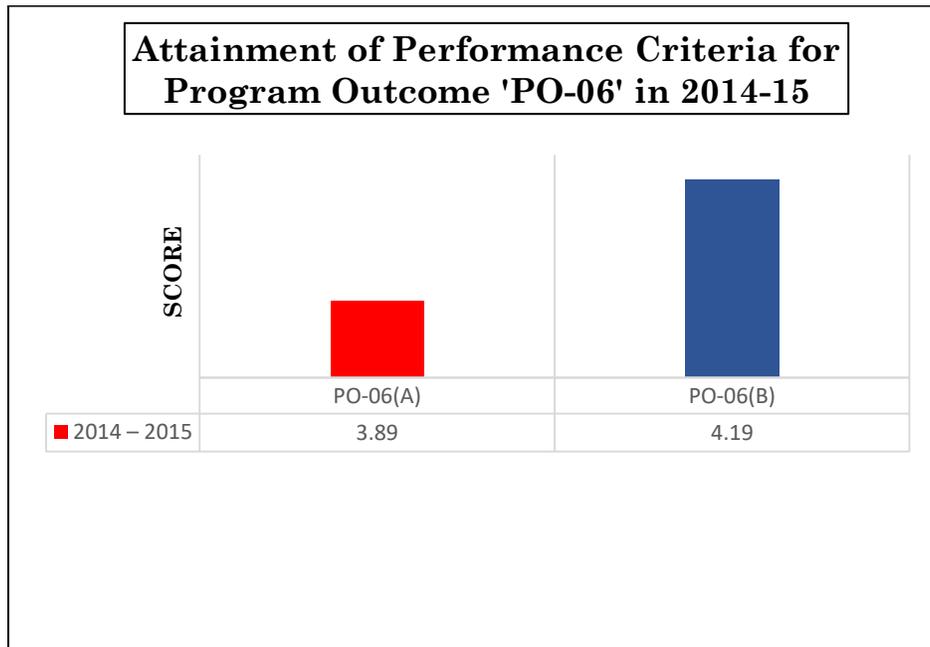
In the previous sections, each of the individual performance criteria PO-06(A) and PO-06(B) has been assessed. The performance for attainment of outcome PO-06 has been completed using the attainment values for PO-06(A) and PO-06(B) are given below:

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)	26.02	44.24	24.91	6.75	2.21	3.89	5
PO-06(B)	42.82	37.28	17.14	1.38	1.38	4.15	5
<b>Overall score</b>	<b>34.42</b>	<b>40.76</b>	<b>21.03</b>	<b>4.07</b>	<b>1.80</b>	<b>4.04</b>	-

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 2014-15. 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*

(2014-15)

*for the*  
*Bachelor of Engineering*  
*in*  
*Electrical Engineering*



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

**Electrical & Instrumentation Engineering Department**  
**Thapar University, Patiala (Punjab) -INDIA**

## **Attainment of Program Outcome ‘PO-07’**

The attainment of program outcome **PO-07: *An ability to communicate effectively*** 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***

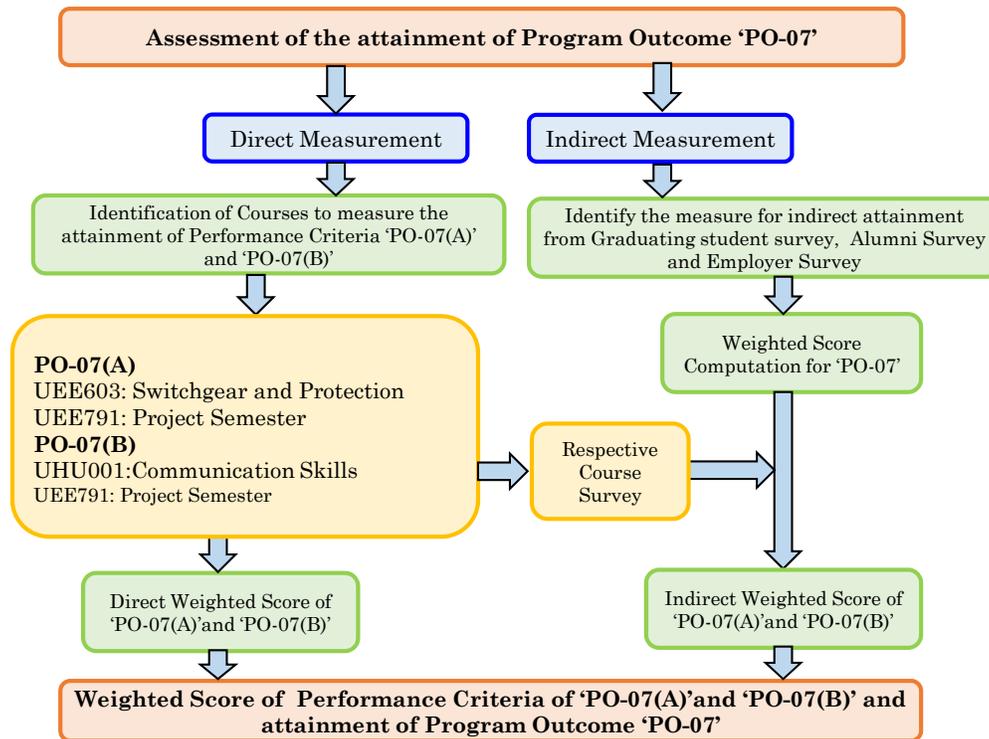
The program assessment committee identified the following courses for the assessment of program outcome ‘PO-07’:

- UTA010: Engineering Design II
- UEE504: Power Electronics
- UEE591: Summer Training
- UEE601: FAACTS
- 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 2014-15.

Performance Criteria	Course -1	Course-2
PO-07(A)	UEE603:Switchgear and Protection	UEE791: Project Semester
PO-07(B)	UEE791: Project Semester	UHU001: Communication Skills

The step by step methodology used to measure the attainment of program outcome ‘PO-07’ is shown in Fig. PO-07(A) for academic year (AY) 2014-15.



**Fig. PO-07(A): Process for measurement of attainment of outcome 'PO-07' for the year 2014-15**

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-07.1.

**Table PO-07.1: 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-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: Project Semester* 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 2015. 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 using rubrics defined in Table PO-07.1.

**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	101204001	Aashna	4	5
2	101204002	Abhinav Sharma	4	5
3	101204003	Abhishek Jain	3.5	4
4	101204004	Aditya Jain	4	5
5	101204005	Akash Deep	3.5	4
6	101204006	Akash Ratna	3.5	4
7	101204009	Akshu Gupta	2.5	3
8	101204010	Aman Goyal	3.5	4
9	101204012	Amit Bansal	4.5	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
10	101204013	Anshul Kumar	4	5
11	101204014	Anukriti Dwivedi	4.5	5
12	101204015	Arushi Nagpal	4	5
13	101204016	Ayush Vaid	4.5	5
14	101204018	Chahat Singla	4.5	5
15	101204019	Deeksha Goyal	3.5	4
16	101204020	Dhruv Sharma	3.5	4
17	101204021	Gaurav Arora	3.5	4
18	101204022	Gursharan Kaur	4	5
19	101204023	Gursimran Singh	4	5
20	101204024	Harjot Singh	3.5	4
21	101204025	Harsh Kothari	4	5
22	101204026	Hemanshu Garg	3.5	4
23	101204027	Himanshu Takkar	4	5
24	101204028	Iqbal Singh Garcha	4	5
25	101204030	Ishtjot Singh	4	5
26	101204031	Jasdeep Garg	3.5	4
27	101204033	Jasleen Kaur	3	4
28	101204035	Kapil Kinger	2.5	3
29	101204037	Karanbir Singh Kahlon	3	4
30	101204038	Karanveer Singh Bhangoo	4	5
31	101204039	Kartik Arora	3.5	4
32	101204040	Kashish Sethi	3.5	4
33	101204041	Kaustubh Singh	3	4
34	101204042	Krishnank Atrey	4	5
35	101204043	Lovely Goyal	4	5
36	101204045	Manik Mittal	4	5
37	101204046	Marshall	4	5
38	101204048	Mohit Kukkar	4	5
39	101204049	Mohit Manhas	3	4
40	101204051	Nalin Kaushik	3	4
41	101204053	Nishant Arora	3	4
42	101204054	P Siddharth	3	4
43	101204057	Rahul Kamboj	3	4
44	101204059	Rajat Sahore	3	4
45	101204060	Rajatdeep Singh	4.5	5
46	101204061	Ramanpreet Kaur	4.5	5
47	101204063	Sahil Arora	3.5	4
48	101204064	Sahil Mittal	4.5	5
49	101204065	Sanchit Goel	3.5	4
50	101204066	Sewak Ram	4	5
51	101204067	Sheenu	4	5
52	101204069	Shubham Bhatia	3	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
53	101204070	Shubham Goel	4	5
54	101204071	Shubham Kansal	3.5	4
55	101204074	Sukhdarshanpal Singh	4.5	5
56	101204075	Sultan Singh	3.5	4
57	101204076	Tejasvi Anand	2.5	3
58	101254001	Sahilpreet Singh	3	4
59	101254002	Naman Kumar	2.5	3
60	101254003	Sachin Pathak	3	4
61	101254004	Srijan Aditya	2.5	3
62	101254005	Navjot Kaur	3	4
63	101254006	Milan Jain	3	4
64	101254008	Gaurav	4	5
65	101254009	Varun Khanna	4	5
66	101254010	Swati Srivastava	3	4
67	101254012	Shubham Singla	3	4
68	101254013	Sorabh Devgun	3.5	4
69	101254014	Paras Ghai	3.5	4
70	101254015	Kuldeep Singh Deora	3	4
71	101254016	Sachin Gupta	4.5	5
72	101254017	Nakul Kumar	3.5	4
73	101384001	Ankur Singla	4	5
74	101384002	Gagandeep Singh	4.5	5
75	101384004	Himanshu Bansal	3.5	4
76	101384005	Navdeep Singh	3.5	4
77	101384006	Parampreet Singh	4	5
78	101384007	Saurav Goyal	3	4
79	101384008	Surjeet 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	44.30	49.37	6.33	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 rubrics defined in Table PO-07.1.

**Table PO-07(A).3: Students' performance in question targeting 'PO-07(A)'; Course UEE791**

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1	101104001	Aakriti Singla	5	5
2	101104002	Abhay Goel	4	5
3	101104003	Abhinav Kumar Sardana	3	4
4	101104006	Akash Verma	3	4
5	101104007	Aman Bhatnagar	3.5	4
6	101104008	Amar Deep Singh	3	4
7	101104009	Ankit Bansal	4	5
8	101104010	Ankur Singhal	3	4
9	101104011	Anshuman Singh	4	5
10	101104012	Arunabh Choudhury	3	4
11	101104013	Ashish Gupta	3.5	4
12	101104016	Chetan Baria	3.5	4
13	101104021	Dhruv Srivastav	4.5	5
14	101104022	Gagandeep Singh	3	4
15	101104023	Harkaran Tiwana	3	4
16	101104024	Harnoor Singh Ahluwalia	3	4
17	101104026	Harshit Nath	4	5
18	101104027	Harwinder Singh	3	4
19	101104028	Himanshu Goel	3.5	4
20	101104029	Isha Jhamb	2.5	3
21	101104030	Jagpreet Singh	4	5
22	101104031	Kanika Lodha	2	3
23	101104032	Kanwaljot Singh	3	4
24	101104033	Karanpreet Kaur	4	5
25	101104034	Keshav Singla	2	3
26	101104035	Ketan Joshi	2	3
27	101104036	Kriti Bansal	5	5
28	101104037	Kunal Rawat	4	5
29	101104040	Mudit Kumar	4	5
30	101104042	Nand Nandan Arora	5	5
31	101104043	Narinderpal Singh Kaleka	5	5
32	101104045	Navjot Singh	5	5
33	101104046	Navneet Bansal	5	5

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
34	101104047	Nikhil Agarwal	5	5
35	101104048	Nitin Kumar	4	5
36	101104049	Nitish Singla	4	5
37	101104050	Perry Mittal	4	5
38	101104051	Piyush Gupta	4	5
39	101104052	Piyush Jain	5	5
40	101104054	Prabhleen Kaur	5	5
41	101104055	Prashant	3.5	4
42	101104056	Prateek Jain	4	5
43	101104058	Rajan Gaur	4	5
44	101104059	Rajat Gupta	4	5
45	101104060	Ratik Mittal	3.5	4
46	101104062	Rishika Kukreja	5	5
47	101104063	Rubbal Maggo	5	5
48	101104066	Shaurya Chopra	3.5	4
49	101104068	Shubham Ahuja	3.5	4
50	101104069	Shubham Garg	3	4
51	101104071	Sunny Maheshwary	3.5	4
52	101104072	Suraj Pal Singh	5	5
53	101104074	Tanya Sofat	5	5
54	101104075	Tushar Garg	5	5
55	101104076	Udita Kapoor	4.5	5
56	101104077	Varun	4	5
57	101104078	Vikhyat Kansal	3.5	4
58	101104079	Vineet Sharma	5	5
59	101104080	Vishal Gupta	4.5	5
60	101104081	Vishesh Gupta	3.5	4
61	101104083	Vivek Gupta	3	4
62	101104084	Harmanjasraj Grewal	5	5
63	101104085	Akhilesh Sharma	4.5	5
64	101154001	Anna Kathpal	4.5	5
65	101154002	Papiha Salhotra	3	4
66	101154003	Prateek Arora	3	4
67	101154004	Sandeep Singh	3.5	4
68	101284002	Deepak Puri	3	4
69	101284006	Navneet Kumar	3.5	4
70	101284007	Prikshit Singla	2	3
71	101284010	Vikas Bansal	3.5	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)**

Course	% of students in each score					Average Score
	5	4	3	2	1	
<b>UEE791</b>	52.11	40.85	7.04	0.00	0.00	4.45

The data from Table PO-07(A).2 and Table PO-07(A).4 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	
<b>UEE603</b>	44.30	49.37	6.33	0.00	0.00	4.38
<b>UEE791</b>	52.11	40.85	7.04	0.00	0.00	4.45
<b>Students class performance Score</b>	48.21	45.11	6.69	0.00	0.00	4.42

### 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.

#### Assessment Tools: Student Course Surveys

**Table 4 PO-07(A).6: Weighted average score of performance criterion ‘PO-07(A)’ based on student course surveys**

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE603	12.7	58.2	29.1	0.0	0.0	3.84
UEE791	22.54	22.54	43.66	7.04	4.23	3.52
Course survey score	17.62	40.37	36.38	3.52	2.115	3.68

**Table PO-07(A).7: 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	27.16	51.85	18.52	0.00	2.47	4.01
Employer survey	39.61	38.16	16.43	4.35	1.45	4.10
Alumni survey	53.33	46.67	0.00	0.00	0.00	4.53
Other survey score	40.03	45.56	11.65	1.45	1.31	4.21

### c) Overall weighted average score of performance criterion ‘PO-07(A)’

The overall weighted average score of performance criterion ‘PO-07(A)’ is summarised in Table PO-07(A).8 from the data given in Tables PO-07(A).5, PO-07(A).6 and 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		
Weighted average student class performance	48.21	45.11	6.69	0.00	0.00	4.42	5
Weighted average score course surveys	17.62	40.37	36.38	3.52	2.115	3.68	4
Weighted average score surveys	40.03	45.56	11.65	1.45	1.31	4.21	3
Overall score	<b>35.29</b>	<b>43.68</b>	<b>18.24</b>	<b>1.66</b>	<b>1.14</b>	<b>4.10</b>	

### 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 *UEE791: Project Semester* and *UHU001: Communication Skills* are used to assess performance criteria PO-07(B) 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	101104001	Aakriti Singla	5	5
2	101104002	Abhay Goel	3.5	4
3	101104003	Abhinav Kumar Sardana	4	5
4	101104006	Akash Verma	3.5	4
5	101104007	Aman Bhatnagar	3	4
6	101104008	Amar Deep Singh	4	5
7	101104009	Ankit Bansal	4	5
8	101104010	Ankur Singhal	3	4
9	101104011	Anshuman Singh	3	4
10	101104012	Arunabh Choudhury	3.5	4
11	101104013	Ashish Gupta	4	5
12	101104016	Chetan Baria	4	5
13	101104021	Dhruv Srivastav	4	5
14	101104022	Gagandeep Singh	3.5	4
15	101104023	Harkaran Tiwana	3.5	4
16	101104024	Harnoor Singh Ahluwalia	3	4
17	101104026	Harshit Nath	4	5
18	101104027	Harwinder Singh	3.5	4
19	101104028	Himanshu Goel	3	4
20	101104029	Isha Jhamb	3.5	4
21	101104030	Jagpreet Singh	4	5
22	101104031	Kanika Lodha	2.5	3
23	101104032	Kanwaljot Singh	3.5	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
24	101104033	Karanpreet Kaur	3.5	4
25	101104034	Keshav Singla	3.5	4
26	101104035	Ketan Joshi	2.5	3
27	101104036	Kriti Bansal	4.5	5
28	101104037	Kunal Rawat	5	5
29	101104040	Mudit Kumar	4.5	5
30	101104042	Nand Nandan Arora	3.5	4
31	101104043	Narinderpal Singh Kaleka	4	5
32	101104045	Navjot Singh	4.5	5
33	101104046	Navneet Bansal	4.5	5
34	101104047	Nikhil Agarwal	4.5	5
35	101104048	Nitin Kumar	4	5
36	101104049	Nitish Singla	4.5	5
37	101104050	Perry Mittal	4.5	5
38	101104051	Piyush Gupta	4.5	5
39	101104052	Piyush Jain	4.5	5
40	101104054	Prabhleen Kaur	4.5	5
41	101104055	Prashant	4	5
42	101104056	Prateek Jain	4	5
43	101104058	Rajan Gaur	4.5	5
44	101104059	Rajat Gupta	4.5	5
45	101104060	Ratik Mittal	4	5
46	101104062	Rishika Kukreja	5	5
47	101104063	Rubbal Maggo	5	5
48	101104066	Shaurya Chopra	4	5
49	101104068	Shubham Ahuja	4	5
50	101104069	Shubham Garg	3.5	4
51	101104071	Sunny Maheshwary	4	5
52	101104072	Suraj Pal Singh	4.5	5
53	101104074	Tanya Sofat	4.5	5
54	101104075	Tushar Garg	5	5
55	101104076	Udita Kapoor	4.5	5
56	101104077	Varun	4.5	5
57	101104078	Vikhyat Kansal	4	5
58	101104079	Vineet Sharma	4.5	5
59	101104080	Vishal Gupta	4	5
60	101104081	Vishesh Gupta	4	5
61	101104083	Vivek Gupta	4	5
62	101104084	Harmanjasraj Grewal	4.5	5
63	101104085	Akhilesh Sharma	5	5
64	101154001	Anna Kathpal	5	5
65	101154002	Papiha Salhotra	4	5
66	101154003	Prateek Arora	3.5	4

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
67	101154004	Sandeep Singh	4	5
68	101284002	Deepak Puri	3.5	4
69	101284006	Navneet Kumar	4	5
70	101284007	Prikshit Singla	3	4
71	101284010	Vikas Bansal	3.5	4

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	67.61	29.58	2.82	0.00	0.00	4.65

**(ii) UHU001 Communication Skills**

The performance criteria is used to measure the attainment of outcome 'PO-07(B)' by considering evaluation of the subject *UHU001 Communication Skills*. Total marks reflect the communication skills between peers.

The performance of the students in the above question is then summarized as given below in Table PO-07(B).3 using Table PO-07.1.

**Table PO-07(B).3: Students' performance in question targeting 'PO-07(B)'; Course UHU001**

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
1	101404001	Abhay Mahipal	7.9	4
2	101404002	Abhijeet Singh Sankhla	3.75	2
3	101404003	Abhimanyu Tyagi	7.5	4
4	101404004	Abhinav Arora	7.4	4
5	101404005	Abhishek Dhiman	6.45	4
6	101404006	Abhishek Sharma	7.4	4
7	101404007	Ajay Singh	6.25	4
8	101404008	Akhil Malik	7.1	4
9	101404009	Alka Thakur	8.75	5
10	101404010	Angad Singh	8.8	5
11	101404011	Ankit Bislawat	4.75	3
12	101404012	Ankush Goyal	8	5
13	101404013	Anmol Arjun Bharaj	6	4
14	101404014	Anmol Goyat	5.5	3
15	101404015	Anmol Rattan Kaur	7.75	4

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
16	101404016	Anshika Singh	7.5	4
17	101404017	Anubhav Kumar	7.5	4
18	101404018	Apeksha Goel	7	4
19	101404019	Arnish Jain	8.5	5
20	101404020	Arshiya	6	4
21	101404021	Arshjot Kaur	7.25	4
22	101404022	Ashish Jindal	0	1
23	101404023	Ayush Jain	7.68	4
24	101404024	Bhawani Singh	6	4
25	101404025	Chirag Jain	7.1	4
26	101404026	Davleen Garg	9	5
27	101404027	Dilpreet Kaur	7.49	4
28	101404028	Divesh Kamdar	4.62	3
29	101404029	Divyam Aggarwal	7.62	4
30	101404030	Divyansh Jain	7.8	4
31	101404031	Divyanshu Siddh	7.56	4
32	101404032	Garima	7	4
33	101404033	Garv Chahar	7	4
34	101404035	Gaurav Rathore	7.5	4
35	101404036	Gurpreet Singh	6.6	4
36	101404037	Gursagar Singh	8.15	5
37	101404038	Gurupinder Pal Si	6.75	4
38	101404039	Harmanpreet Sin	4.85	3
39	101404041	Harshit Kaushik	7.45	4
40	101404042	Harshvir Singh	5.75	3
41	101404043	Harsimarjot Kaur	6.65	4
42	101404044	Harsimran Singh	6.25	4
43	101404045	Hartej Singh Bai	7.85	4
44	101404046	Heema Gupta	6.8	4
45	101404047	Hitesh Kumar	6.85	4
46	101404048	Ishita Mahindru	5.4	3
47	101404049	Jagmeet Singh Ba	3.5	2
48	101404050	Jagnoor Kaur	6.8	4
49	101404051	Jashanpreet Sin	5.49	3
50	101404052	Jatin Bansal	6.11	4
51	101404053	Jatin Raheja	5.3	3
52	101404054	Kanishak Sharma	7.86	4
53	101404055	Karan Sanjeev Bajaj	8.62	5
54	101404056	Kirtish Madaan	6	4
55	101404057	Mahitosh Sharma	7.8	4
56	101404058	Manan Mittal	6.24	4
57	101404059	Mandeep Singh Panesar	6.81	4
58	101404060	Manisha Gupta	5.62	3

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
59	101404061	Manit Gupta	6.43	4
60	101404062	Manjosh Singh Dhillon	6.12	4
61	101404063	Manpreet Singh Brar	6.81	4
62	101404064	Manvir Kaur	6.62	4

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 UHU001 for criteria PO-07(B)**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UHU001	11.29	69.35	14.52	3.23	1.61	3.85

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	
UHU001	11.29	69.35	14.52	3.23	1.61	3.85
UEE791	67.61	29.58	2.82	0.00	0.00	4.65
Student class performance score	39.45	49.47	8.67	1.61	0.81	4.25

**b) Indirect measures for Performance criteria PO-07(B) (Surveys)**

The indirect measurement of performance criteria ‘PO-07(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-07(B).6 and Table PO-07(B).7.

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

**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	
<b>UHU001</b>	26.15	36.15	32.31	1.54	3.85	<b>3.79</b>
<b>UEE791</b>	22.54	22.54	43.66	7.04	4.23	3.52
<b>Course survey score</b>	24.35	29.35	37.99	4.29	4.04	3.66

**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	
<b>Graduating student survey</b>	27.16	51.85	18.52	0.00	2.47	4.01
<b>Employer survey</b>	39.61	38.16	16.43	4.35	1.45	4.10
<b>Alumni survey</b>	53.33	46.67	0.00	0.00	0.00	4.53
<b>Other survey score</b>	40.03	45.56	11.65	1.45	1.31	4.21

**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	Assessment Tool Weight
	5	4	3	2	1		
Weighted average student class performance	39.45	49.47	8.67	1.61	0.81	4.25	5
Weighted average score on course surveys	24.35	29.35	37.99	4.29	4.04	3.66	4
Weighted average score surveys	40.03	45.56	11.65	1.45	1.31	4.21	3
<b>Overall weighted score</b>	<b>34.61</b>	<b>41.46</b>	<b>19.44</b>	<b>2.45</b>	<b>2.05</b>	<b>4.04</b>	

## 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-07.1** 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-07.1: 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)	35.29	43.68	18.24	1.66	1.14	4.10	5
PO-07(B)	34.61	41.46	19.44	2.45	2.05	4.04	5
<b>Overall score</b>	<b>34.95</b>	<b>42.57</b>	<b>18.84</b>	<b>2.055</b>	<b>1.595</b>	<b>4.07</b>	

The performance criteria wise assessment score distribution of outcome 'PO-07' is shown in Figure PO-07.2.

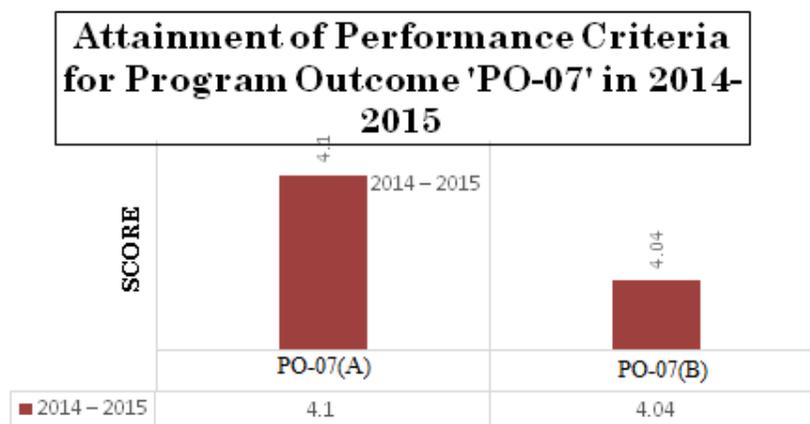


Figure PO-07.2: Performance criteria-wise assessment score distribution of outcome 'PO-07'

# 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*

**(2014-15)**

*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':

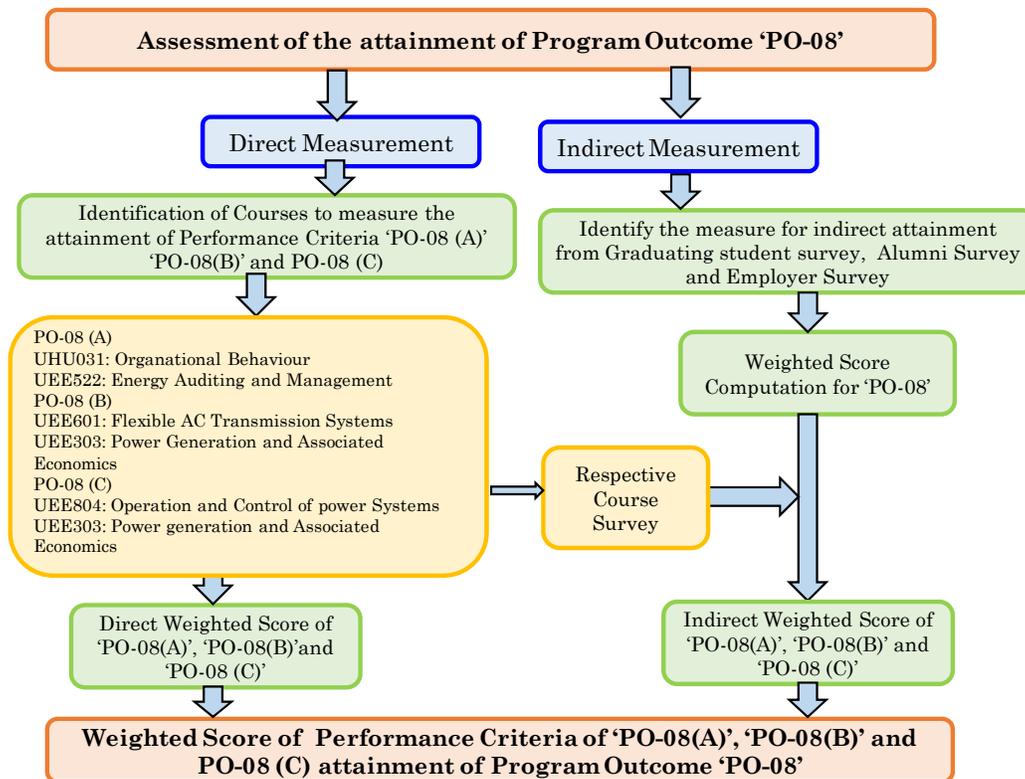
- UHU081: Engineering Economics
- UEN002: Energy and Environment
- **UHU031: Organizational Behavior**
- **UEE522: Energy Auditing and Management**
- **UEE303: Power Generation and Associated Economics**
- **UEE804: Operation and Control of Power Systems**
- **UEE601: Flexible AC Transmission Systems**
- 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 2014-15.

Performance Criteria	Course -1	Course-2
PO-08 (A)	UHU031:Organizational Behaviour	UEE522:Energy Auditing and Management
PO-08 (B)	UEE601:Flexible AC Transmission Systems	UEE303:Power Generation and Associated Economics
PO-08 (C)	UEE804: Operation and Control of Power	UEE303: Power Generation and

Systems	Associated Economics
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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) 2014-15. 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 2014-15**

The following Rubric has been 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 in most cases unless specifically mentioned.

**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 *UHU031: Organizational Behaviour* 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:

#### **UHU031: Organizational Behaviour**

The performance of the course UHU031: Organizational Behaviour is used to measure the attainment of outcome 'PO-08 (A)' through the End Semester Examination (Question No. 3 (a), (b), July-Dec. 2014, 07 marks).

#### **Question:**

Q.3	(a) "Equity theory of motivation holds that motivation is a function of fairness in social exchanges." Describe the factors affecting equity in the inputs and outputs and how people restore inequity in the organizations.  (b) "Classical and operant conditioning are two important concepts central to behavioural psychology. While both result in learning, the processes are quite different." Explain with the help of examples why operant conditioning is considered better than Classical conditioning.	(3+4)
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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 UHU031**

S. No.	Roll No	Name	Marks (07)	Rating (1-5)
1	101213052	Tanvi Mittal	4	3
2	101253007	Manik Baliyan	4	3
3	101304001	Aarushi Bajaj	4	3
4	101304002	Abhey Arora	2.5	2

S. No.	Roll No	Name	Marks (07)	Rating (1-5)
5	101304003	Abhishek Taksali	2	2
6	101304004	Adhikaansh Tayal	3	3
7	101304005	Aditi Narang	5	4
8	101304006	Aditya	5	4
9	101304007	Akshat	3.5	3
10	101304008	Akshay Kapoor	6	5
11	101304009	Akshay Kumar	5	4
12	101304010	Akshay Kumar Chaudhary	3	3
13	101304011	Akshay Sharma	3	3
14	101304012	Amandeep Kaur	2	2
15	101304013	Amandeep Singh	2	2
16	101304014	Amaninder Singh Randhawa	4	3
17	101304015	Angad Kapoor	2	2
18	101304016	Ankita Garg	5	4
19	101304017	Ankur Malik	3	3
20	101304018	Anmol Jawa	5.5	5
21	101304019	Anmolpreet Singh	3	3
22	101304020	Anyuti Tiwary	3	3
23	101304021	Arpit Sharma	2.5	2
24	101304022	Arsh Kundal	2.5	2
25	101304023	Arshbir Kaur	3	3
26	101304024	Arshdeep Singh Bagga	3	3
27	101304025	Ashish	1	1
28	101304026	Ashish Rajpal	1	1
29	101304028	Berry Lubana	3	3
30	101304029	Bhanu Duggal	4	3
31	101304030	Bhanu Marwaha	4	3
32	101304031	Chirag Gaba	6	5
33	101304032	Dipin Garg	4	3
34	101304033	Dishant Vanvari	6	5
35	101304034	Divyesh Pratap Singh	3	3
36	101304035	Elham Anwar	4	3
37	101304036	Gurseerat Singh Meen	4	3
38	101304037	Gursewak Singh	1	1
39	101304040	Hariansh Sehgal	6	5
40	101304041	Hartejdeep Singh	6	5
41	101304042	Himanshu Goyal	4	3
42	101304044	Jasjit Singh	3	3

S. No.	Roll No	Name	Marks (07)	Rating (1-5)
43	101304045	Jassimran Singh Julka	6	5
44	101304046	Jessica Dhaliwal	4	3
45	101304047	Kanwarpal Singh	2	2
46	101304048	Karan Kumar	0	1
47	101304049	Karanjot Singh Kochar	3	3
48	101304050	Kashish Aggarwal	5	4
49	101304052	Love Gaba	6	5
50	101304054	Manik Mittal	3	3
51	101304055	Maninderjit Singh	4	3
52	101304056	Mayank Singla	3	3
53	101304057	Mridul Bhutani	2	2
54	101304058	Naman Garg	4	3
55	101304059	Navdeep Singh	1	1
56	101304060	Navdeep Singh	4	3
57	101304062	Nishant Garg	4	3
58	101304094	Satripleen Kaur	3	3
59	101306001	Aaditya Lohia	4	3
60	101306002	Aarush Goel	2	2
61	101306003	Aastha Mahendru	5.5	5
62	101306004	Abhinav Garg	4	3
63	101306005	Abhishek Jain	4	3
64	101306007	Adarshdeep Kaur	3.5	3
65	101306008	Agrim Varshney	4	3
66	101306009	Aikansh Jain	6	5
67	101306010	Akash Aggarwal	4	3
68	101306011	Akashdeep Singh	2	2
69	101306012	Akshat Mittal	4	3
70	101306013	Akshat Srivastava	4	3
71	101306014	Akshay Dua	4	3
72	101306015	Akshay Joshi	3	3
73	101306017	Amar Nath Vaid	6	5
74	101306019	Amrita Aggarwal	5	4
75	101306020	Amritangshu Mukherjee	5.5	5
76	101306021	Aneesh Kumar	5	4
77	101306022	Ankit Madaan	4	3
78	101306023	Ankur Aghi	0	1
79	101306024	Ankush Vasishta	6	5
80	101306025	Anmoljot Kaur	4	3

S. No.	Roll No	Name	Marks (07)	Rating (1-5)
81	101306026	Anshul Prashar	4.5	4
82	101306027	Antariksh Verma	5	4
83	101306028	Anubhav Gupta	4	3
84	101306029	Anuj Jain	6	5
85	101306030	Anurag Mittal	4	3
86	101306031	Archit Choudhury	3	3
87	101306033	Arshdeep Singh	3.5	3
88	101306034	Arushi Mittal	4	3
89	101306035	Ashish Singla	6	5
90	101306036	Atul Kumar	3	3
91	101306037	Atulbir Singh	4	3
92	101306038	Ayush Aggarwal	5	4
93	101306040	Celeste Goel	5	4
94	101306041	Chahat	4	3
95	101306042	Chaitanya	0	1
96	101306043	Chandan Swan	4	3
97	101306044	Charika Bhatia	4	3
98	101306045	Charul Badoni	4.5	4
99	101306046	Chetan Sharma	2	2
100	101306047	Chinmay Jain	5	4
101	101306048	Chirag Agarwal	2	2
102	101306050	Chirag Khurana	2	2
103	101306051	Chirag Saluja	2.5	2
104	101306052	Divanshu Kapila	6	5
105	101306053	Divij Arora	1	1
106	101306054	Dixit Khosla	6	5
107	101306055	Gagan Kukreja	3	3
108	101306057	Garima Sharma	6	5
109	101306059	Gaurav Garg	5	4
110	101306060	Gifty Mehra	4	3
111	101306061	Gunjan Arora	2	2
112	101306062	Guntaasjeet Singh	5	4
113	101306063	Gurleen Kaur	3	3
114	101306070	Himani	3	3
115	101484001	Amandeep Singh	4	3
116	101484002	Amrinder Singh	6	5
117	101484003	Ashmeen Singh	3	3
118	101484004	Azad Singh	3	3

S. No.	Roll No	Name	Marks (07)	Rating (1-5)
119	101484005	Chandan Garg	0	1
120	101484007	Deepak Singla	5	4
121	101484008	Diljeet Singh	4	3
122	101486002	Akshay Jain	3	3
123	101486003	Amrinder Singh	3	3
124	101486005	Chandanpreet Kaur	4	3
125	101486007	Gurpriya	4	3
126	101486009	Kirti Sharma	5	4
127	101486015	Navdeep Singh	4	3
128	101486016	Nitin Moudgil	4	3
129	101486017	Nitish Mittal	5	4
130	101486022	Raminder Pal Singh	5	4

The performance of students through the course UHU031 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 UHU031 for criteria 'PO-08 (A)'**

Course	% of students in each score					Average Score
	5	4	3	2	1	
<b>UHU081</b>	14.62	14.62	51.54	12.31	6.92	3.18

## 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. 2 (a), July-December 2014, 08 marks).

### Question:

2 (a)	<u>Data given</u>	<u>Operating Data</u>	(8)
	Rated kW of motor=40kW Rated voltage=420V Rated amperes=50A Name plate efficiency=96%, Name plate speed=1440rpm, No: of poles=4, Frequency=50Hz. Calculate motor loading by slip method, input power method and line current method. Why voltage correction factor is needed?	Measured speed =1460 rpm input power=20kW input load current= 45A	

The performance of the students in the above question is then summarized as given below in Table PO-08 (A).3 using rubrics defined in Table PO-08.1.

**Table PO-08 (A).3: Students' performance in question targeting 'PO-08 (A)'; Course UEE522**

S. No.	Roll No	Name	Marks (8)	Score(1-5)
1	101055002	Ayush Jaiwal	0	1
2	101105004	Adamyia Poundrik	7	5
3	101105008	Akshay Ahluwalia	5	4
4	101105019	Ashish Manchanda	7.5	5
5	101105032	Guntas Singh Ahluwalia	3	2
6	101105037	Jaspreet Singh	4.5	3
7	101105042	Madan Mohan Mahajan	6	5
8	101105063	Rohan Mitra	6	5
9	101105064	Rohan Srivastava	7	5
10	101105077	Suraj Gupta	6	5
11	101105078	Swaroop Chougule	7	5
12	101185003	Gurpreet Singh	2.5	2
13	101204001	Aashna	3	2
14	101204002	Abhinav Sharma	5.5	4
15	101204003	Abhishek Jain	4	3
16	101204004	Aditya Jain	2.5	2
17	101204005	Akash Deep	6	5
18	101204006	Akash Ratna	4	3
19	101204009	Akshu Gupta	6.5	5
20	101204010	Aman Goyal	6	5
21	101204011	Amarpreet	4	3

S. No.	Roll No	Name	Marks (8)	Score(1-5)
22	101204012	Amit Bansal	4	3
23	101204013	Anshul Kumar	5	4
24	101204014	Anukriti Dwivedi	4	3
25	101204015	Arushi Nagpal	6	5
26	101204016	Ayush Vaid	4	3
27	101204018	Chahat Singla	6	5
28	101204019	Deeksha Goyal	4	3
29	101204020	Dhruv Sharma	6	5
30	101204021	Gaurav Arora	6	5
31	101204022	Gursharan Kaur	6	5
32	101204023	Gursimran Singh	5.5	4
33	101204024	Harjot Singh	7	5
34	101204025	Harsh Kothari	7	5
35	101204026	Hemanshu Garg	5	4
36	101204027	Himanshu Takkar	7	5
37	101204028	Iqbal Singh Garcha	6	5
38	101204030	Ishtjot Singh	6	5
39	101204031	Jasdeep Garg	6	5
40	101204033	Jasleen Kaur	5.5	4
41	101204035	Kapil Kinger	5	4
42	101204037	Karanbir Singh Kahlon	4	3
43	101204038	Karanveer Singh Bhangoo	6.5	5
44	101204039	Kartik Arora	5	4
45	101204040	Kashish Sethi	5.5	4
46	101204041	Kaustubh Singh	4	3
47	101204042	Krishnank Atrey	4	3
48	101204043	Lovely Goyal	7	5
49	101204045	Manik Mittal	3.5	3
50	101204046	Marshall	2	2
51	101204048	Mohit Kukkar	6.5	5
52	101204049	Mohit Manhas	5	4
53	101204051	Nalin Kaushik	8	5
54	101204053	Nishant Arora	5.5	4
55	101204054	P Siddharth	5.5	4
56	101204057	Rahul Kamboj	6	5
57	101204059	Rajat Sahore	7	5
58	101204060	Rajatdeep Singh	6	5
59	101204061	Ramanpreet Kaur	5.5	4

S. No.	Roll No	Name	Marks (8)	Score(1-5)
60	101204063	Sahil Arora	7	5
61	101204064	Sahil Mittal	6.5	5
62	101204065	Sanchit Goel	6	5
63	101204066	Sewak Ram	5	4
64	101204067	Sheenu	5	4
65	101204069	Shubham Bhatia	4	3
66	101204070	Shubham Goel	7	5
67	101204071	Shubham Kansal	5.5	4
68	101204074	Sukhdarshanpal Singh	4.5	3
69	101204075	Sultan Singh	6	5
70	101204076	Tejasvi Anand	5	4
71	101208037	G S Tushar	8	5
72	101208055	Jatin Singh	5	4
73	101208061	Karan Mehra	5	4
74	101208069	Manav Juneja	4.5	3
75	101208072	Mayank Joshi	5	4
76	101208075	Navraj Singh	4.5	3
77	101208078	Nishant Bansal	4.5	3
78	101208080	Nishant Kabra	2.5	2
79	101208082	Nitin Mahajan	7	5
80	101208083	Nitish Gupta	4.5	3
81	101208084	Omang	4	3
82	101208089	Puneet Arora	4.5	3
83	101208101	Sagar Saini	2.5	2
84	101208106	Sarthak Mattas	5	4
85	101208110	Shashank Jain	5	4
86	101208136	Vivek Goyal	8	5
87	101208142	Vasu Sharma	5	4
88	101254001	Sahilpreet Singh	6	5
89	101254002	Naman Kumar	3	2
90	101254003	Sachin Pathak	7	5
91	101254004	Srijan Aditya	6	5
92	101254005	Navjot Kaur	7	5
93	101254006	Milan Jain	6	5
94	101254007	Mohit	4	3
95	101254008	Gaurav	6	5
96	101254009	Varun Khanna	6.5	5
97	101254010	Swati Srivastava	5	4

S. No.	Roll No	Name	Marks (8)	Score(1-5)
98	101254012	Shubham Singla	3	2
99	101254013	Sorabh Devgun	5	4
100	101254014	Paras Ghai	3.5	3
101	101254015	Kuldeep Singh Deora	4.5	3
102	101254016	Sachin Gupta	6	5
103	101254017	Nakul Kumar	0	1
104	101384001	Ankur Singla	6.5	5
105	101384002	Gagandeep Singh	8	5
106	101384003	Gurdhyan Singh	0	1
107	101384004	Himanshu Bansal	5	4
108	101384005	Navdeep Singh	6.5	5
109	101384006	Parampreet Singh	7	5
110	101384007	Saurav Goyal	8	5
111	101384008	Surjeet Singh	4.5	3

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	
<b>UEE522</b>	44.14	23.42	21.62	8.11	2.70	3.98

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	
<b>UHU031</b>	14.62	14.62	51.54	12.31	6.92	3.18
<b>UEE522</b>	44.14	23.42	21.62	8.11	2.70	3.98
<b>Weighted Average Score</b>	<b>29.38</b>	<b>19.02</b>	<b>36.58</b>	<b>10.21</b>	<b>4.81</b>	<b>3.58</b>

**b) Indirect measures:**

The indirect measurement of performance criteria ‘PO-08 (A)’ PO-08 as 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)’.

UHU031	Elucidate challenges in organization behavior especially in the challenging world scenario
UEE522	Analyze about various energy related aspect of electrical system

**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	
UPH031	32.09	36.64	23.00	5.99	2.28	3.90
UEE522	46.77	21.85	21.25	4.40	5.73	4.00
<b>Weighted Average Score</b>	<b>39.43</b>	<b>29.24</b>	<b>22.12</b>	<b>5.19</b>	<b>4</b>	<b>3.95</b>

**(ii) Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (other surveys) are used to assess the attainment of program outcome ‘PO-08 ’ the rough 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	18.51	45.67	24.69	4.9	6.1	3.65
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
<b>Weighted average score surveys</b>	<b>30.42</b>	<b>41.6</b>	<b>21.04</b>	<b>4.05</b>	<b>2.84</b>	<b>3.92</b>

**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		
<b>Student class performance</b>	29.38	19.02	36.58	10.21	4.81	<b>3.58</b>	5
<b>Score surveys</b>	39.43	29.24	22.12	5.19	4	<b>3.95</b>	4
<b>Score on other surveys</b>	30.42	41.6	21.04	4.05	2.84	<b>3.92</b>	3
<b>Overall weighted score</b>	<b>32.99</b>	<b>28.07</b>	<b>27.87</b>	<b>6.99</b>	<b>4.04</b>	<b>3.78</b>	

## 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 *UEE601: Flexible AC Transmission Systems* and *UEE303: Power Generation and Associated Economics* were used to assess performance criteria PO-08 (B) as a direct measure. The analysis of this course is provided below:

### **UEE601: Flexible AC Transmission Systems**

The performance of the course *UEE522: Flexible AC Transmission Systems* used to measure the attainment of outcome 'PO-08 (B)' through the End Semester Examination (Question No. 8, July-December 2014, 05 marks).

**Question :**

Q.8	<p>The particulars of the transmission line with a TCR are as <math>V=220V</math>, <math>f=60</math> hz, <math>X=1.2</math> ohm, and <math>P_p=56</math> kw. The maximum current of TCR is <math>I_{L(max)}=100A</math>. Find (a) the phase angle, (b) the line current (c) the reactive power <math>Q_p</math> of the shunt compensator, (d) the current through the TCR, (e) the inductive reactance <math>X_L</math>, and the delay angle of the TCR if the <math>I_L</math> is 60% of the maximum current.</p>	(5)
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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: UEE601**

S. No.	Roll No	Name	Marks (05)	Score(1-5)
1	101104082	Vishvesh	2	3
2	101204001	Aashna	4	5
3	101204002	Abhinav Sharma	5	5
4	101204003	Abhishek Jain	4	5
5	101204004	Aditya Jain	3	4
6	101204005	Akash Deep	5	5
7	101204006	Akash Ratna	3	4
8	101204009	Akshu Gupta	3	4
9	101204010	Aman Goyal	4	5
10	101204011	Amarpreet	2.5	3
11	101204012	Amit Bansal	3.5	4
12	101204013	Anshul Kumar	4	5
13	101204014	Anukriti Dwivedi	3	4
14	101204015	Arushi Nagpal	4	5
15	101204016	Ayush Vaid	2	3
16	101204018	Chahat Singla	4	5
17	101204019	Deeksha Goyal	5	5
18	101204020	Dhruv Sharma	4	5

S. No.	Roll No	Name	Marks (05)	Score(1-5)
19	101204021	Gaurav Arora	3	4
20	101204022	Gursharan Kaur	3	4
21	101204023	Gursimran Singh	4	5
22	101204024	Harjot Singh	3.5	4
23	101204025	Harsh Kothari	4	5
24	101204026	Hemanshu Garg	4	5
25	101204027	Himanshu Takkar	3.5	4
26	101204028	Iqbal Singh Garcha	3.5	4
27	101204030	Ishtjot Singh	3	4
28	101204031	Jasdeep Garg	3	4
29	101204033	Jasleen Kaur	4	5
30	101204035	Kapil Kinger	3	4
31	101204037	Karanbir Singh Kahlon	4	5
32	101204038	Karanveer Singh Bhangoo	4	5
33	101204039	Kartik Arora	2	3
34	101204040	Kashish Sethi	3	4
35	101204041	Kaustubh Singh	2	3
36	101204042	Krishnank Atrey	2	3
37	101204043	Lovely Goyal	3	4
38	101204045	Manik Mittal	4	5
39	101204046	Marshall	2.5	3
40	101204048	Mohit Kukkar	2.5	3
41	101204049	Mohit Manhas	1.5	2
42	101204051	Nalin Kaushik	1.5	2
43	101204053	Nishant Arora	3	4
44	101204054	P Siddharth	2	3
45	101204057	Rahul Kamboj	3.5	4
46	101204059	Rajat Sahore	3.5	4
47	101204060	Rajatdeep Singh	4	5
48	101204061	Ramanpreet Kaur	4	5
49	101204063	Sahil Arora	3	4
50	101204064	Sahil Mittal	2.5	3
51	101204065	Sanchit Goel	3	4
52	101204066	Sewak Ram	1	2
53	101204067	Sheenu	2	3
54	101204069	Shubham Bhatia	1	2
55	101204070	Shubham Goel	4	5
56	101204071	Shubham Kansal	2	3
57	101204074	Sukhdarshanpal Singh	2.5	3
58	101204075	Sultan Singh	2	3
59	101204076	Tejasvi Anand	3	4
60	101254001	Sahilpreet Singh	3	4
61	101254002	Naman Kumar	3	4
62	101254003	Sachin Pathak	2	3
63	101254004	Srijan Aditya	2.5	3
64	101254005	Navjot Kaur	2	3
65	101254006	Milan Jain	3	4
66	101254008	Gaurav	3.5	4
67	101254009	Varun Khanna	3.5	4

S. No.	Roll No	Name	Marks (05)	Score(1-5)
68	101254010	Swati Srivastava	2	3
69	101254012	ShubhamSingla	3.5	4
70	101254013	SorabhDevgun	3.5	4
71	101254014	Paras Ghai	3	4
72	101254015	Kuldeep Singh Deora	3	4
73	101254016	Sachin Gupta	4	5
74	101254017	Nakul Kumar	2.5	3

The overall performance of the students in the course based on marks in *UEE601:Flexible AC Transmission Systems* 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 UEE601 for criteria PO-08 (B).**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE601	28.38	40.54	25.68	5.41	0.00	3.92

### UEE303: Power Generation and Associated Economics

The performance of the course UEE303: Power Generation and Associated Economics is used to measure the attainment of outcome ‘PO-08 (B)’ through the End Semester Examination (Question No. 3 (b), July-December 2014, 05 marks).

#### Question:

Q.3 (b)	<p>A 20 MW thermal power plant is estimated to cost RS 1000 millions. Other cost are as follows</p> <p>(i) Insurance and taxes Rs 20 Lacs/annum (ii) Fuel and lubricants Rs200 Lacs/annum (iii) Transport and storage Rs 30 Lac/annum (iv) Salaries and wages Rs 36 Lac/annum (v) Miscellaneous Rs 6 Lac/annum Reckoning interest and depreciation at 15% per annum of capital cost, determine the cost of energy generated per unit if power station works at an average load factor of 60%. What would it be, if the load factor is increased to 75% with a consequent increase in fuel cost by 10%. Other cost remains same.</p>	(5)
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The overall performance of the students in the above question is then summarized as given below in Table PO-08 (B).3.

**Table PO-08 (B).3: Student’s performance in question targeting ‘PO-08 (B)’; Course UEE303**

S. No.	Roll No	Name	Marks (05)	Score(1-5)
1	101304001	Aarushi Bajaj	3.5	4
2	101304002	Abhey Arora	4.5	5

S. No.	Roll No	Name	Marks (05)	Score(1-5)
3	101304003	Abhishek Taksali	4	5
4	101304004	Adhikaansh Tayal	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	Anyuti Tiwary	3	4
20	101304021	Arpit Sharma	4	5
21	101304022	ArshKundal	3.5	4
22	101304023	Arshbir Kaur	4.5	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	Bhanu Marwaha	4	5
29	101304031	Chirag Gaba	0	1
30	101304032	Dipin Garg	4	5
31	101304033	Dishant Vanvari	4	5
32	101304034	Divyesh Pratap 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	Himanshu Goyal	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	Kritika Singla	4	5
47	101304052	Love Gaba	4	5
48	101304054	Manik Mittal	3.5	4
49	101304055	Maninderjit Singh	4	5
50	101304056	Mayank Singla	4	5
51	101304057	Mridul Bhutani	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	Nishtha Raheja	3.5	4
58	101304064	Paras Bawa	4	5
59	101304065	Parth Ahuja	3.5	4

S. No.	Roll No	Name	Marks (05)	Score(1-5)
60	101304066	Parushi	2	3
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	Shagundeeep 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
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

S. No.	Roll No	Name	Marks (05)	Score(1-5)
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 the students in the above question is then summarized as given below in Table PO-08 (B).4

**Table PO-08 (B).4 Average score of student performance in the course UEE303 for criteria PO-08 (B).**

Course	% of students in each score					Average Score
	5	4	3	2	1	
<b>UEE303</b>	<b>60.16</b>	<b>19.53</b>	<b>11.72</b>	<b>5.47</b>	<b>3.13</b>	<b>4.28</b>

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	
<b>UEE601</b>	28.38	40.54	25.68	5.41	0.00	<b>3.92</b>
<b>UEE303</b>	60.16	19.53	11.72	5.47	3.13	<b>4.28</b>
<b>Weighted Average Score</b>	<b>44.27</b>	<b>30.04</b>	<b>18.70</b>	<b>5.44</b>	<b>1.56</b>	<b>4.10</b>

**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.

UEE601	Decide the scheme for power system stability and voltage control
UEE303	Select the methods and size of plant generating power for overall economy

**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	
UEE601	41.28	36.57	16.20	5.34	0.61	<b>4.13</b>
UEE303	29.51	22.09	16.99	10.22	21.20	<b>3.28</b>
<b>Weighted Average Score</b>	<b>35.39</b>	<b>29.33</b>	<b>16.59</b>	<b>7.78</b>	<b>10.90</b>	<b>3.79</b>

(ii) **Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'H' through indirect measurement is summarized in Table 4. 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		
<b>Student class performance</b>	44.27	30.04	18.70	5.44	1.56	<b>4.10</b>	5
<b>Score surveys</b>	35.39	29.33	16.59	7.78	10.90	<b>3.79</b>	4
<b>Score on other surveys</b>	30.42	41.6	21.04	4.05	2.84	<b>3.92</b>	3
<b>Overall weighted score</b>	<b>37.84</b>	<b>32.69</b>	<b>18.58</b>	<b>5.87</b>	<b>4.99</b>	<b>3.95</b>	

## 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 *UEE303: Power Generation and Associated Economics* 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:

### **UEE303: Power Generation and Associated Economics**

The performance of the course UEE303: Power Generation and Associated Economics used to measure the attainment of outcome 'PO-08 (C)' through the Mid Semester Examination (Question No. 2, September 2014, 06 marks).

**Question:**

Q2	A generating station has a maximum demand of 10,000Kw and daily load on the station is as below				(06)
	Time	Kw	Time	kW	
	11PM to 6 AM	2,000	1 PM to 5 PM	7,500	
	6 AM to 8 AM	3,500	5 PM to 7 PM	8,500	
	8 AM to 12 Noon	8,000	7 PM to 9 PM	10,000	
	12 Noon to 1 PM	3,000	9 PM to 11 PM	4,500	
Draw chronological load curve. Find average load. Choose the size and number of generating units. Find the load factor and plant capacity factor.					

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: UEE303**

S. No.	Roll No	Name	Marks (06)	Score (1-5)
1	101304001	Aarushi Bajaj	3.5	3
2	101304002	Abhey Arora	4.5	5
3	101304003	Abhishek Taksali	4	4
4	101304004	Adhikaanshtayal	3.5	3
5	101304005	Aditi Narang	4	4
6	101304006	Aditya	4	4
7	101304007	Akshat	4	4
8	101304008	Akshay Kapoor	4	4
9	101304009	Akshay Kumar	4	4
10	101304010	Akshay Kumar Chaudhary	4.5	5
11	101304011	Akshay Sharma	4	4
12	101304012	Amandeep Kaur	1.5	2

S. No.	Roll No	Name	Marks (06)	Score (1-5)
13	101304013	Amandeep Singh	4.5	5
14	101304014	Amaninder Singh Randhawa	3.5	3
15	101304015	Angad Kapoor	4	4
16	101304016	Ankita Garg	3.5	3
17	101304018	Anmol Jawa	3	3
18	101304019	Anmolpreet Singh	4.5	5
19	101304020	Anyutitiwary	3	3
20	101304021	Arpit Sharma	4	4
21	101304022	Arshkunal	3.5	3
22	101304023	Arshbir Kaur	4.5	5
23	101304024	Arshdeep Singh Bagga	4	4
24	101304025	Ashish	4	4
25	101304026	Ashish Rajpal	1.5	2
26	101304028	Berry Lubana	1.5	2
27	101304029	Bhanu Duggal	3.5	3
28	101304030	Bhanumarwaha	4	4
29	101304031	Chirag Gaba	0	1
30	101304032	Dipin Garg	4	4
31	101304033	Dishantvanvari	4	4
32	101304034	Divyeshpratap Singh	3.5	3
33	101304035	Elham Anwar	3.5	3
34	101304036	Gurseerat Singh Meen	4	4
35	101304037	Gursewak Singh	3.5	3
36	101304040	Hariansh Sehgal	4	4
37	101304041	Hartejdeep Singh	3.5	3
38	101304042	Himanshugoyal	4.5	5
39	101304044	Jasjit Singh	3	3
40	101304045	Jassimran Singh Julka	2	2
41	101304046	Jessica Dhaliwal	4	4
42	101304047	Kanwarpal Singh	3.5	3
43	101304048	Karan Kumar	1.5	2
44	101304049	Karanjot Singh Kochar	4	4
45	101304050	Kashish Aggarwal	4.5	5
46	101304051	Kritikasingla	4	4
47	101304052	Love Gaba	4	4
48	101304054	Manik Mittal	3.5	3
49	101304055	Maninderjit Singh	4	4
50	101304056	Mayanksingla	4	4

S. No.	Roll No	Name	Marks (06)	Score (1-5)
51	101304057	Mridulbhutani	4	4
52	101304058	Naman Garg	4	4
53	101304059	Navdeep Singh	0	1
54	101304060	Navdeep Singh	2	2
55	101304061	Nazuk Aggarwal	4	4
56	101304062	Nishant Garg	2	2
57	101304063	Nishtharaheja	3.5	3
58	101304064	Paras Bawa	4	4
59	101304065	Parth Ahuja	3.5	3
60	101304066	Parushi	2	2
61	101304067	Pencygoyal	2	2
62	101304068	Piyush Jindal	4	4
63	101304069	Piyushtripathi	2	2
64	101304070	Prachi Garg	2	2
65	101304071	Prashant Kataria	0	1
66	101304072	Preeti Garg	4	4
67	101304073	Priyank Arora	4	4
68	101304074	Priyanka	4	4
69	101304075	Priyanka Singh	4	4
70	101304076	Priyansh Mahajan	4	4
71	101304077	Rahul Meena	1.5	2
72	101304078	Rajan	4	4
73	101304079	Rajat Sharma	4	4
74	101304080	Ratulgoyal	4	4
75	101304081	Ravinder Singh	4	4
76	101304082	Rishabhjuneja	3.5	3
77	101304083	Robin Manktala	4	4
78	101304084	Rohan Ghai	3.5	3
79	101304085	Rohan Singla	4	4
80	101304086	Rohan Wadhawan	4	4
81	101304087	Rohitgoyal	4	4
82	101304088	Rubinabamba	3.5	3
83	101304089	Sagarpulani	3.5	3
84	101304090	Sahilkataria	4	4
85	101304091	Sakshi	4	4
86	101304092	Sandal Singh Sidhu	2	2
87	101304093	Sandeep Kaur	1.5	2
88	101304094	Satripleen Kaur	4	4

S. No.	Roll No	Name	Marks (06)	Score (1-5)
89	101304095	Saurabh Mohan	2	2
90	101304096	Shagundeep Singh	2	2
91	101304097	Shailly Gupta	4	4
92	101304098	Shaina	4	4
93	101304099	Shivika Gupta	3.5	3
94	101304100	Shresth Rai	3.5	3
95	101304101	Shubhamgoyal	4	4
96	101304102	Shubham Gupta	4	4
97	101304103	Shubham Sharma	4	4
98	101304104	Shubham Sharma	4	4
99	101304105	Shubhamsoin	4	4
100	101304106	Siddharthgoyal	4	4
101	101304107	Sidharth Garg	4	4
102	101304108	Simran Kaur	2.5	3
103	101304109	Simranjit Singh	0	1
104	101304111	Sumitdhingra	4	4
105	101304112	Sumit Kaushik	4	4
106	101304113	Tushardheer	4	4
107	101304114	Tushar Sharma	4	4
108	101304116	Utsav Chhabra	2	2
109	101304117	Vaibhav Gupta	4	4
110	101304118	Vaishali	4	4
111	101304119	Varun Bansal	4	4
112	101304120	Veni Jindal	4	4
113	101304121	Vishal Arora	4	4
114	101304122	Yugeshgoyal	4	4
115	101484001	Amandeep Singh	4	4
116	101484002	Amrinder Singh	4	4
117	101484003	Ashmeen Singh	3	3
118	101484004	Azad Singh	2	2
119	101484005	Chandan Garg	4	4
120	101484007	Deepak Singla	4	4
121	101484008	Diljeet Singh	4	4
122	101484009	Jyotikaushal	1.5	2
123	101484011	Pawan Kumar	3.5	3
124	101484012	Rajat Singla	4	4
125	101484013	Satveer Kaur	2	2
126	101484014	Saurabh Kumar Wadhawan	4	4

S. No.	Roll No	Name	Marks (06)	Score (1-5)
127	101484015	Shweta Sharma	2	2
128	101484016	Sukhjeet Singh	4	4

The overall performance of the students in the course based on marks in Power Generation and Associated Economics (UEE303) is summarized as given below in Table 4.PO-08 (C).2.

**Table PO-08 (C).2: Average score of student performance in the course UEE303 for criteria PO-08 (C).**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE303	5.47	54.69	20.31	16.41	3.13	3.43

## 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. 2, July-December 2014, 08 marks).

### Question :

Q2	<p>(a) A hydro thermal system consists of one thermal and one hydro unit. The units have the following characteristics:</p> $Q_h = 1500 + 2.5P_{Gh} + 0.2P_{Gh}^2 \text{ m}^3/\text{hr}$ $F_c = 1000 + 10P_{Gt} + 0.002P_{Gt}^2 \text{ Rs/hr}$ <p>Prepare a hydrothermal schedule per hour basis for the same plant one day, where the load has the following schedule: 12 midnight-12 Noon: 350MW; 12 Noon-12 midnight:700MW The volume of water available =420000 m<sup>3</sup>.</p> <p>b) Obtain the economic operation schedule for three thermal units delivering a total load of 1200MW by neglecting network losses but considering generation limits. The data for units are as under:</p> <p>Unit 1 <math>F_c(P_1) = 500 + 7.5P_1 + 0.0017P_1^2 \text{ Rs/hr}</math> <math>150\text{MW} \leq P_1 \leq 600\text{MW}</math>  Unit 2 <math>F_c(P_2) = 350 + 7.8P_2 + 0.002P_2^2 \text{ Rs/hr}</math> <math>125\text{MW} \leq P_2 \leq 500\text{MW}</math>  Unit 3 <math>F_c(P_3) = 210 + 7.9P_3 + 0.005P_3^2 \text{ Rs/hr}</math> <math>150\text{MW} \leq P_3 \leq 600\text{MW}</math></p>	(08)
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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 (08)	Score (1-5)
1	101004053	PulkitFarsaiya	2	2
2	101104001	AakritiSingla	3	2
3	101104002	AbhayGoel	3	2
4	101104003	Abhinav Kumar Sardana	3	2
5	101104005	AchinChetal	4	3
6	101104006	AkashVerma	3	2
7	101104007	AmanBhatnagar	4	3
8	101104008	Amar Deep Singh	5	4
9	101104009	AnkitBansal	5	4
10	101104010	AnkurSinghal	4	3
11	101104011	Anshuman Singh	4	3
12	101104012	ArunabhChoudhury	3	2
13	101104013	Ashish Gupta	4	3
14	101104016	ChetanBaria	3	2
15	101104017	DakshBansal	5	4
16	101104021	DhruvSrivastav	3.5	3
17	101104022	Gagandeep Singh	4.5	3
18	101104023	HarkaranTiwana	5	4
19	101104024	Harnoor Singh Ahluwalia	4	3

S. No.	Roll No	Name	Marks (08)	Score (1-5)
20	101104026	HarshitNath	5	4
21	101104027	Harwinder Singh	6	5
22	101104028	HimanshuGoel	7	5
23	101104029	IshaJhamb	6	5
24	101104030	Jagpreet Singh	3	2
25	101104031	KanikaLodha	2	2
26	101104032	Kanwaljot Singh	3	2
27	101104033	KaranpreetKaur	7	5
28	101104034	KeshavSingla	4	3
29	101104035	Ketan Joshi	5	4
30	101104036	KritiBansal	6	5
31	101104037	KunalRawat	4	3
32	101104038	ManikBudhiraja	5.5	4
33	101104040	Mudit Kumar	6	5
34	101104042	NandNandanArora	3	2
35	101104043	Narinderpal Singh Kaleka	6.5	5
36	101104044	Navjot Singh	5	4
37	101104045	Navjot Singh	4.5	3
38	101104046	NavneetBansal	6	5
39	101104047	Nikhil Agarwal	4	3
40	101104048	Nitin Kumar	5	4
41	101104049	NitishSingla	6	5
42	101104050	Perry Mittal	5.5	4
43	101104051	Piyush Gupta	7	5
44	101104052	Piyush Jain	6	5
45	101104054	PrabhleenKaur	5	4
46	101104055	Prashant	5.5	4
47	101104056	Prateek Jain	4.5	3
48	101104057	PriyaSarooha	4	3
49	101104058	Rajan Gaur	6	5
50	101104059	Rajat Gupta	6	5
51	101104060	Ratik Mittal	5.5	4
52	101104062	RishikaKukreja	6	5
53	101104063	RubbalMaggo	4	3
54	101104066	Shaurya Chopra	5	4
55	101104067	Shish Pal	4.5	3
56	101104068	ShubhamAhuja	6	5
57	101104069	ShubhamGarg	3.5	3

S. No.	Roll No	Name	Marks (08)	Score (1-5)
58	101104070	Sunny Kumar Saini	4	3
59	101104071	Sunny Maheshwary	5	4
60	101104072	Suraj Pal Singh	6.5	5
61	101104074	Tanya Sofat	7	5
62	101104075	TusharGarg	6	5
63	101104076	UditaKapoor	4	3
64	101104077	Varun	7	5
65	101104078	VikhyatKansal	6	5
66	101104079	Vineet Sharma	5.5	4
67	101104080	Vishal Gupta	5	4
68	101104081	Vishesh Gupta	5.5	4
69	101104082	Vishvesh	7	5
70	101104083	Vivek Gupta	7	5
71	101104084	HarmanjasrajGrewal	5.5	4
72	101104085	Akhilesh Sharma	6	5
73	101154001	Anna Kathpal	6.5	5
74	101154002	PapihaSalhotra	5.5	4
75	101154003	PrateekArora	6	5
76	101154004	Sandeep Singh	6	5
77	101284001	Ashish	3	2
78	101284002	Deepak Puri	0	1
79	101284004	IshanNarang	7	5
80	101284005	Jatinder Singh Kapur	6	5
81	101284006	Navneet Kumar	8	5
82	101284007	PrikshitSingla	7.7	5
83	101284008	Sachin Sharma	6	5
84	101284010	VikasBansal	5.5	4
85	101284011	Gurdeep Singh	5	4
86	101284011	Sakshi	3.5	3

The overall performance of the students in the course based on marks in UEE804: Operation and Control of Power Systems 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	36.05	25.58	23.26	13.95	1.16	3.81

The above data is used to evaluate weighted average student class performance (course portfolio) for criteria PO-08 (C) as given below in Table 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	
UEE303	5.47	54.69	20.31	16.41	3.13	3.43
UEE804	36.05	25.58	23.26	13.95	1.16	3.81
Weighted Average Score	20.76	40.13	21.78	15.18	2.14	3.62

### 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
UEE303	Select the methods and size of plant generating power for overall economy

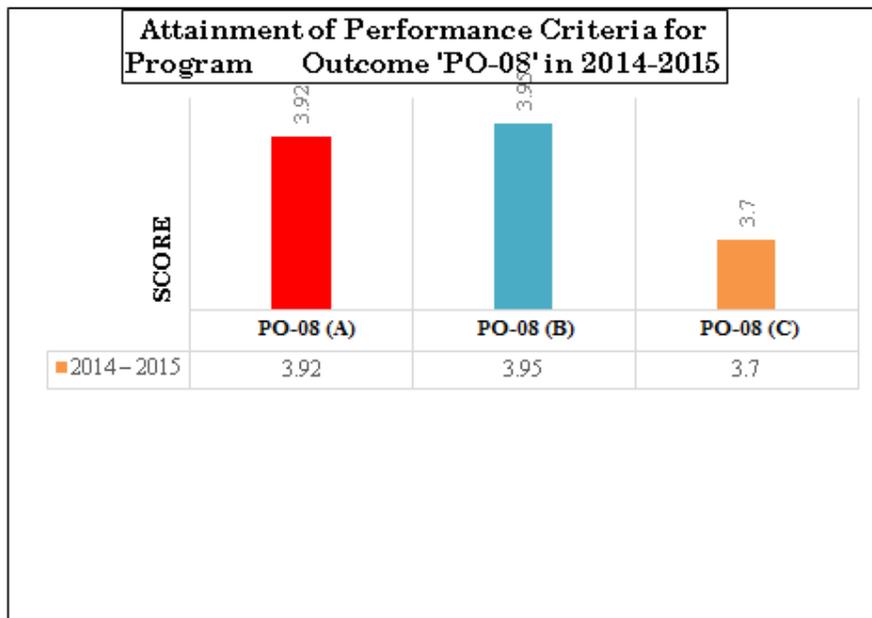
**Table PO-08 (C).6: Weighted average score of performance criterion 'PO-08 (C)' based on surveys.**

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE303	41.28	36.57	16.20	5.34	0.61	4.13
UEE804	15.91	25.64	32.18	14.17	12.62	3.18
Weighted Average Score	21.59	31.10	24.19	9.75	6.61	3.65

(ii) **Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys) are used to assess the attainment of program outcome 'H' 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	20.76	40.13	21.78	15.18	2.14	<b>3.62</b>	5
Score surveys	21.59	31.10	24.19	9.75	6.61	<b>3.65</b>	4
Score on other surveys	30.42	41.6	21.04	4.05	2.84	<b>3.92</b>	3
Overall weighted score	<b>23.45</b>	<b>37.48</b>	<b>22.39</b>	<b>10.58</b>	<b>3.80</b>	<b>3.70</b>	

**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 H 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)	30.42	41.6	21.04	4.08	2.84	<b>3.92</b>
PO-08 (B)	37.84	32.69	18.58	5.87	4.99	<b>3.95</b>
PO-08 (C)	23.45	37.48	22.39	10.58	3.80	<b>3.70</b>
Overall score	<b>30.57</b>	<b>37.25</b>	<b>20.67</b>	<b>6.83</b>	<b>3.87</b>	<b>3.85</b>



**Assessment of Attainment of Program outcome**

**PO-09**

*A recognition of the need for, and an ability to engage in life-long learning*

**(2014-15)**

*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-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 explained in the Self-Assessment Report (SAR) 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 and 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 I has been assessed by 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 2014-15.

Performance Criteria	Course -1	Course-2
PO-09(B)	UEE603: Switchgear and Protection	UEE802: Intelligent Algorithms in Power Systems
PO-09(B)	UEE601: Flexible AC Transmission Systems	UEE801: Electric Drives
PO-09(C)	UEE591: Summer Training	UEE791: Project Semester

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) 2014-15. The similar procedure is followed to measure the attainment of program outcome ‘PO-09’ for all three academic years under consideration.

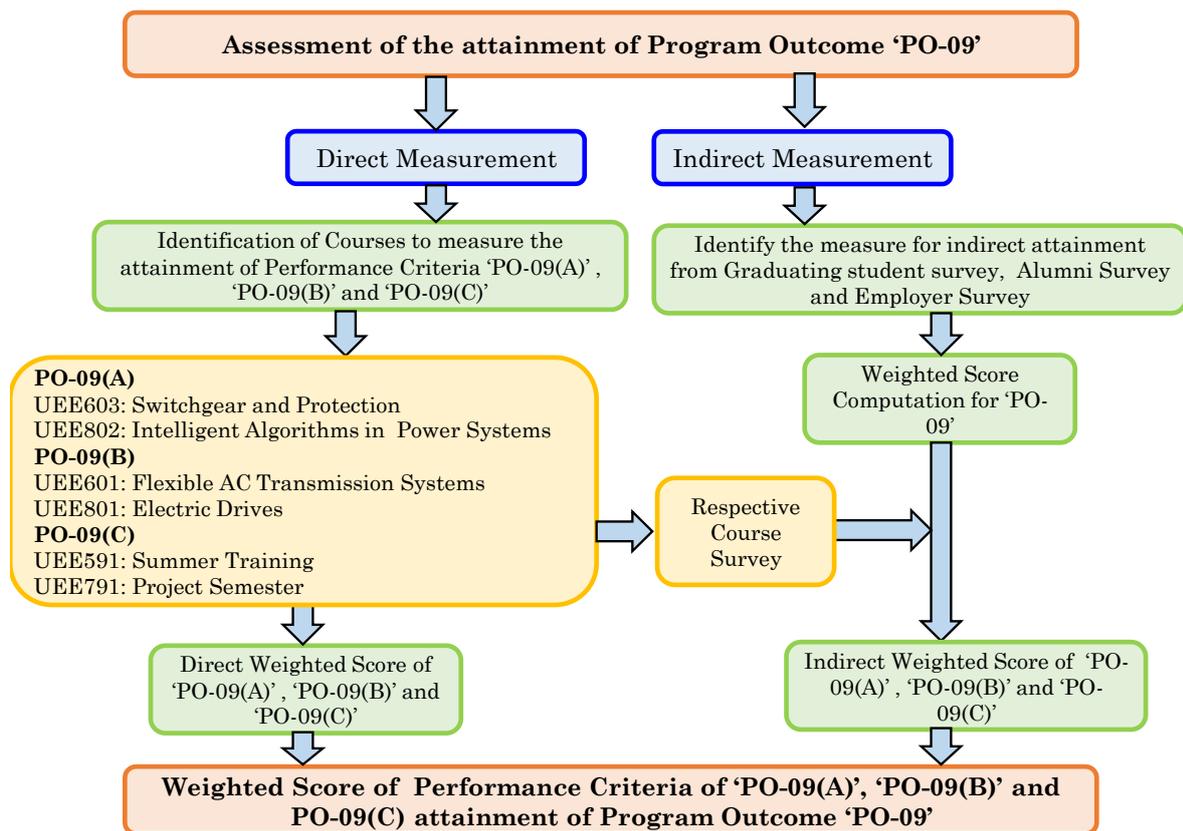


Fig. PO-09.1: Process for measurement of attainment of outcome ‘PO-09(A)’ for the year 2014-15

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 subjects mentioned.

## Assessment of Outcome 'PO-09' using Performance Criterion PO-09(B)

**PO-09(B):** *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 *UEE603: Switchgear and Protection* and *UEE802: Intelligent Algorithms in Power Systems* are used to assess performance criteria PO-09(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-09(A)' through the **seminar delivered** (Jan-June 2015, marks 5) by student in this course regarding applications of new technique.

The performance of the students in the above question is then summarized as given below in Table PO-09(B).1 using rubrics defined in Table PO-09.1(a).

**Table PO-09(B).1: Students' performance in targeting 'PO-09(A)': Course UEE603**

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	3	4
4	101204004	Aditya Jain	3	4
5	101204005	Akash Deep	4	5
6	101204006	Akash Ratna	3	4
7	101204009	Akshu Gupta	3	4
8	101204010	Aman Goyal	3	4
9	101204012	Amarpreet	4	5
10	101204013	Amit Bansal	2	3
11	101204014	Anshul Kumar	3	4
12	101204015	Anukriti Dwivedi	4	5
13	101204016	Arushi Nagpal	3	4
14	101204018	Ayush Vaid	4	5
15	101204019	Chahat Singla	3	4
16	101204020	Deeksha Goyal	3	4

17	101204021	Dhruv Sharma	2	3
18	101204022	Gaurav Arora	4	5
19	101204023	Gursharan Kaur	3	4
20	101204024	Gursimran Singh	3	4
21	101204025	Harjot Singh	3	4
22	101204026	Harsh Kothari	4	5
23	101204027	Hemanshu Garg	4	5
24	101204028	Himanshu Takkar	4	5
25	101204030	Iqbal Singh Garcha	3	4
26	101204031	Ishtjot Singh	4	5
27	101204033	Jasdeep Garg	3	4
28	101204035	Jasleen Kaur	3	4
29	101204037	Kapil Kinger	3	4
30	101204038	Karanbir Singh Kahlon	3	4
31	101204039	Karanveer Singh Bhangoo	4	5
32	101204040	Kartik Arora	2	3
33	101204041	Kashish Sethi	3	4
34	101204042	Kaustubh Singh	3	4
35	101204043	Krishnank Atrey	3	4
36	101204045	Lovely Goyal	3	4
37	101204046	Manik Mittal	3	4
38	101204048	Marshall	2	3
39	101204049	Mohit Kukkar	3	4
40	101204051	Mohit Manhas	3	4
41	101204053	Nalin Kaushik	3	4
42	101204054	Nishant Arora	3	4
43	101204057	P. Siddharth	4	5
44	101204059	Rahul Kamboj	3	4
45	101204060	Rajat Sahore	4	5
46	101204061	Rajatdeep Singh	3	4
47	101204063	Ramanpreet Kaur	4	5
48	101204064	Sahil Arora	3	4
49	101204065	Sahil Mittal	4	5
50	101204066	Sanchit Goel	3	4
51	101204067	Sewak Ram	3	4
52	101204069	Sheenu	3	4
53	101204070	Shubham Bhatia	4	5
54	101204071	Shubham Goel	3	4
55	101204074	Shubham Kansal	2	3
56	101204075	Sukhdarshanpal Singh	3	4
57	101204076	Sultan Singh	2	3

58	101254001	Tejasvi Anand	3	4
59	101254002	Sahilpreet Singh	3	4
60	101254003	Naman Kumar	4	5
61	101254004	Sachin Pathak	2	3
62	101254005	Srijan Aditya	3	4
63	101254006	Navjot Kaur	3	4
64	101254008	Milan Jain	3	4
65	101254009	Gaurav	3	4
66	101254010	Varun Khanna	3	4
67	101254012	Swati Srivastava	3	4
68	101254013	Shubham Singla	3	4
69	101254014	Sorabh Devgun	3	4
70	101254015	Paras Ghai	3	4
71	101254016	Kuldeep Singh Deora	4	5
72	101254017	Sachin Gupta	4	5
73	101384001	Nakul Kumar	4	5
74	101384002	Ankur Singla	3	4
75	101384004	Gagandeep Singh	4	5
76	101384005	Himanshu Bansal	4	5
77	101384006	Navdeep Singh	4	5
78	101384007	Parampreet Singh	4	5
79	101384008	Saurav Goyal	4	5

The performance of students through the course UEE603 for criteria 'PO-09(A)' is summarized in Table PO-09(B).2

**Table PO-09(B).2: Average score of student performance in the course UEE603 for criteria 'PO-09(A)'**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE603	30.38	60.76	8.86	0.00	0.00	4.22

## UEE802: Intelligent Algorithms in Power Systems

The performance of course *UEE802: Intelligent Algorithms* in Power Systems used to measure the attainment of outcome 'PO-09(A)' through **seminar delivered** by students about use of new techniques and tools (July-Dec., 2014, 5 marks).

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 targeting 'PO-09(A)': Course UEE802**

S. No.	Roll No	Name of Student	Marks (5)	Score(1-5)
1	101004053	Pulkit Farsaiya	2.8	3
2	101004076	Harshobit Singh	0.3	1
3	101104001	Aakriti Singla	3.4	4
4	101104002	Abhay Goel	3.6	4
5	101104003	Abhinav Kumar Sardana	3	4
6	101104005	Achin Chetal	3	4
7	101104006	Akash Verma	3.8	4
8	101104007	Aman Bhatnagar	4	5
9	101104008	Amar Deep Singh	2.8	3
10	101104009	Ankit Bansal	3.6	4
11	101104010	Ankur Singhal	3.4	4
12	101104011	Anshuman Singh	3.8	4
13	101104012	Arunabh Choudhury	3.6	4
14	101104013	Ashish Gupta	4	5
15	101104016	Chetan Baria	3	4
16	101104017	Daksh Bansal	3.8	4
17	101104021	Dhruv Srivastav	4	5
18	101104022	Gagandeep Singh	3	4
19	101104023	Harkaran Tiwana	3.2	4
20	101104024	Harnoor Singh Ahluwalia	2.8	3
21	101104026	Harshit Nath	2.6	3
22	101104027	Harwinder Singh	3.2	4
23	101104028	Himanshu Goel	4.2	5
24	101104029	Isha Jhamb	3.4	4
25	101104030	Jagpreet Singh	3.4	4
26	101104031	Kanika Lodha	3.2	4
27	101104032	Kanwaljot Singh	3.6	4
28	101104033	Karanpreet Kaur	3.8	4
29	101104034	Keshav Singla	3.6	4
30	101104035	Ketan Joshi	3.8	4
31	101104036	Kriti Bansal	4	5
32	101104037	Kunal Rawat	3.4	4

33	101104038	Manik Budhiraja	3.6	4
34	101104040	Mudit Kumar	3.2	4
35	101104042	Nand Nandan Arora	3.2	4
36	101104043	Narinderpal Singh Kaleka	4.2	5
37	101104044	Navjot Singh	3	4
38	101104045	Navjot Singh	3.8	4
39	101104046	Navneet Bansal	3.2	4
40	101104047	Nikhil Agarwal	3.6	4
41	101104048	Nitin Kumar	3.6	4
42	101104049	Nitish Singla	3.4	4
43	101104050	Perry Mittal	3.2	4
44	101104051	Piyush Gupta	4	5
45	101104052	Piyush Jain	2.8	3
46	101104054	Prabhleen Kaur	3.4	4
47	101104055	Prashant	3.2	4
48	101104056	Prateek Jain	3.8	4
49	101104057	Priya Saroha	3.4	4
50	101104058	Rajan Gaur	3.2	4
51	101104059	Rajat Gupta	3.8	4
52	101104060	Ratik Mittal	3.6	4
53	101104062	Rishika Kukreja	3.4	4
54	101104063	Rubbal Maggo	3.4	4
55	101104066	Shaurya Chopra	4	5
56	101104067	Shish Pal	3.2	4
57	101104068	Shubham Ahuja	3.6	4
58	101104069	Shubham Garg	3.4	4
59	101104070	Sunny Kumar Saini	3.2	4
60	101104071	Sunny Maheshwary	4	5
61	101104072	Suraj Pal Singh	4.2	5
62	101104074	Tanya Sofat	3.4	4
63	101104075	Tushar Garg	3.6	4
64	101104076	Udita Kapoor	3.4	4
65	101104077	Varun	3.6	4
66	101104078	Vikhyat Kansal	3.8	4
67	101104079	Vineet Sharma	3.8	4
68	101104080	Vishal Gupta	4	5
69	101104081	Vishesh Gupta	4	5
70	101104082	Vishvesh	3.2	4
71	101104083	Vivek Gupta	3.8	4
72	101104084	Harmanjasraj Grewal	3.6	4
73	101104085	Akhilesh Sharma	4	5

74	101154001	Anna Kathpal	3.8	4
75	101154002	Papiha Salhotra	3.2	4
76	101154003	Prateek Arora	3.6	4
77	101154004	Sandeep Singh	3.8	4
78	101284001	Ashish	3.6	4
79	101284002	Deepak Puri	3.8	4
80	101284004	Ishan Narang	3.6	4
81	101284005	Jatinder Singh Kapur	3	4
82	101284006	Navneet Kumar	3.2	4
83	101284007	Prikshit Singla	3.4	4
84	101284008	Sachin Sharma	4.2	5
85	101284010	Vikas Bansal	3.6	4
86	101284011	Gurdeep Singh	3	4

The performance of students through the course UEE802 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	
UEE802	16.28	76.74	5.81	0.00	1.16	4.07

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	
UEE603	30.38	60.76	8.86	0.00	0.00	4.22
UEE802	16.28	76.74	5.81	0.00	1.16	4.07
<b>Weighted Average Score</b>	<b>23.33</b>	<b>68.75</b>	<b>7.34</b>	<b>0.00</b>	<b>0.58</b>	<b>4.14</b>

**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)’.

UEE603	Select suitable protection scheme for different power system equipment
UEE802	Formulate hybrid intelligent algorithms for typical electrical application

**Table PO-09(A).6: Weighted average score of performance criterion ‘PO-09(A)’ based on student course surveys**

Courses	% of students in each score					Average Score
	5	4	3	2	1	
UEE603	27.46	29.41	25.10	9.55	8.49	<b>3.58</b>
UEE802	35.40	29.40	28.63	5.61	0.97	<b>3.93</b>
<b>Weighted Average Score</b>	<b>31.43</b>	<b>29.41</b>	<b>26.87</b>	<b>7.58</b>	<b>4.73</b>	<b>3.76</b>

**(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.

The Course Learning Outcome (CLO) as described below has been used for the measurement of attainment of ‘PO-09(A)’.

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	
<b>Graduating student survey</b>	19.75	49.38	27.16	3.70	0.00	<b>3.85</b>
<b>Employer survey</b>	53.33	33.33	13.33	0.00	0.00	<b>4.40</b>
<b>Alumni survey</b>	33.33	36.23	24.64	4.35	1.45	<b>3.96</b>
<b>Weighted average score surveys</b>	<b>35.47</b>	<b>39.65</b>	<b>21.71</b>	<b>2.68</b>	<b>0.48</b>	<b>4.07</b>

**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		
<b>Student class performance</b>	23.33	68.75	7.34	0.00	0.58	<b>4.14</b>	5
<b>Course surveys</b>	31.43	29.41	26.87	7.58	4.73	<b>3.76</b>	4
<b>Other surveys</b>	35.47	39.65	21.71	2.68	0.48	<b>4.07</b>	3
<b>Overall weighted score</b>	<b>29.07</b>	<b>48.36</b>	<b>17.44</b>	<b>3.20</b>	<b>1.94</b>	<b>4.00</b>	

## 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 *UEE801: Electric Drive* 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, 2015, 100 marks).

The performance of the students in the above course is then 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	Total (100.0)	Score (1-5)
1	101104082	Vishvesh	39.5	2
2	101204001	Aashna	47.5	3
3	101204002	Abhinav Sharma	57.5	3
4	101204003	Abhishek Jain	46.5	3
5	101204004	Aditya Jain	35.5	2
6	101204005	Akash Deep	63	4
7	101204006	Akash Ratna	60.5	4
8	101204009	Akshu Gupta	53	3
9	101204010	Aman Goyal	49.5	3
10	101204011	Amarpreet	14	1
11	101204012	Amit Bansal	58	3
12	101204013	Anshul Kumar	29.5	2
13	101204014	Anukriti Dwivedi	63.5	4
14	101204015	Arushi Nagpal	76	5
15	101204016	Ayush Vaid	35.5	2
16	101204018	Chahat Singla	71.5	4
17	101204019	Deeksha Goyal	69	4
18	101204020	Dhruv Sharma	51	3

19	101204021	Gaurav Arora	38.5	2
20	101204022	Gursharan Kaur	76.5	5
21	101204023	Gursimran Singh	61	4
22	101204024	Harjot Singh	70.5	4
23	101204025	Harsh Kothari	74	4
24	101204026	Hemanshu Garg	79	5
25	101204027	Himanshu Takkar	67	4
26	101204028	Iqbal Singh Garcha	63	4
27	101204030	Ishtjot Singh	39.5	2
28	101204031	Jasdeep Garg	44.5	3
29	101204033	Jasleen Kaur	72	4
30	101204035	Kapil Kinger	54	3
31	101204037	Karanbir Singh Kahlon	24	2
32	101204038	Karanveer Singh Bhangoo	45.5	3
33	101204039	Kartik Arora	46.5	3
34	101204040	Kashish Sethi	32	2
35	101204041	Kaustubh Singh	52	3
36	101204042	Krishnank Atrey	60	4
37	101204043	Lovely Goyal	55	3
38	101204045	Manik Mittal	50	3
39	101204046	Marshall	55	3
40	101204048	Mohit Kukkar	31	2
41	101204049	Mohit Manhas	44	3
42	101204051	Nalin Kaushik	54.5	3
43	101204053	Nishant Arora	58	3
44	101204054	P Siddharth	40	3
45	101204057	Rahul Kamboj	68	4
46	101204059	Rajat Sahore	55	3
47	101204060	Rajatdeep Singh	68	4
48	101204061	Ramanpreet Kaur	59	3
49	101204063	Sahil Arora	60.5	4
50	101204064	Sahil Mittal	59	3
51	101204065	Sanchit Goel	70	4
52	101204066	Sewak Ram	41.5	3
53	101204067	Sheenu	60	4
54	101204069	Shubham Bhatia	52.5	3
55	101204070	Shubham Goel	73	4
56	101204071	Shubham Kansal	42.5	3
57	101204074	Sukhdarshanpal Singh	31	2
58	101204075	Sultan Singh	48	3
59	101204076	Tejasvi Anand	52.5	3
60	101254001	Sahilpreet Singh	39.5	2

61	101254002	Naman Kumar	33.74	2
62	101254003	Sachin Pathak	53	3
63	101254004	Srijan Aditya	16.5	1
64	101254005	Navjot Kaur	40.5	3
65	101254006	Milan Jain	60	4
66	101254008	Gaurav	66	4
67	101254009	Varun Khanna	56	3
68	101254010	Swati Srivastava	45	3
69	101254012	Shubham Singla	51	3
70	101254013	Sorabh Devgun	54	3
71	101254014	Paras Ghai	43	3
72	101254015	Kuldeep Singh Deora	48	3
73	101254016	Sachin Gupta	76	5
74	101254017	Nakul Kumar	58	3
75	101384001	Ankur Singla	69.5	4
76	101384002	Gagandeep Singh	76	5
77	101384004	Himanshu Bansal	60.5	4
78	101384005	Navdeep Singh	56	3
79	101384006	Parampreet Singh	85.5	5
80	101384007	Saurav Goyal	84.5	5
81	101384008	Surjeet Singh	47	3

The performance of students through the course UEE601 for criteria 'PO-09(B)' is summarized above criterion 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	
<b>UEE601</b>	<b>8.64</b>	<b>27.16</b>	<b>46.91</b>	<b>14.81</b>	<b>2.47</b>	<b>3.25</b>

## UEE801: Electric Drives

The performance of course *UEE801: Electric Drives* is used to measure the attainment of outcome 'PO-09(B)' (July-Dec, 2014, 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 UEE801**

S.No.	Roll no.	Name of Student	Total (100.0)	Score (1-5)
1	101104001	Aakriti Singla	45.5	3
2	101104002	Abhay Goel	39	2
3	101104003	Abhinav Kumar Sardana	26.5	2
4	101104005	Achin Chetal	38	2
5	101104006	Akash Verma	39.5	2
6	101104007	Aman Bhatnagar	62	4
7	101104008	Amar Deep Singh	41	3
8	101104009	Ankit Bansal	62	4
9	101104010	Ankur Singhal	55.5	3
10	101104011	Anshuman Singh	41.5	3
11	101104012	Arunabh Choudhury	40.5	3
12	101104013	Ashish Gupta	50	3
13	101104016	Chetan Baria	57.5	3
14	101104017	Daksh Bansal	43	3
15	101104021	Dhruv Srivastav	65	4
16	101104022	Gagandeep Singh	52.5	3
17	101104023	Harkaran Tiwana	51.5	3
18	101104024	Harnoor Singh Ahluwalia	36	2
19	101104026	Harshit Nath	54.5	3
20	101104027	Harwinder Singh	50.5	3
21	101104028	Himanshu Goel	53.5	3
22	101104029	Isha Jhamb	32.5	2
23	101104030	Jagpreet Singh	42	3
24	101104031	Kanika Lodha	14.5	1
25	101104032	Kanwaljot Singh	52.5	3
26	101104033	Karanpreet Kaur	56	3
27	101104034	Keshav Singla	48	3
28	101104035	Ketan Joshi	42.5	3
29	101104036	Kriti Bansal	59.5	3
30	101104037	Kunal Rawat	22.5	2
31	101104038	Manik Budhiraja	46.5	3
32	101104040	Mudit Kumar	62.5	4
33	101104042	Nand Nandan Arora	50.5	3

34	101104043	Narinderpal Singh Kaleka	67	4
35	101104044	Navjot Singh	41.5	3
36	101104045	Navjot Singh	49.5	3
37	101104046	Navneet Bansal	50	3
38	101104047	Nikhil Agarwal	46	3
39	101104048	Nitin Kumar	63.5	4
40	101104049	Nitish Singla	47	3
41	101104050	Perry Mittal	47.5	3
42	101104051	Piyush Gupta	61.5	4
43	101104052	Piyush Jain	38.5	2
44	101104054	Prabhleen Kaur	50	3
45	101104055	Prashant	39	2
46	101104056	Prateek Jain	44.5	3
47	101104057	Priya Saroha	28	2
48	101104058	Rajan Gaur	50	3
49	101104059	Rajat Gupta	50	3
50	101104060	Ratik Mittal	54.5	3
51	101104062	Rishika Kukreja	51	3
52	101104063	Rubbal Maggo	46.5	3
53	101104066	Shaurya Chopra	45.5	3
54	101104067	Shish Pal	45	3
55	101104068	Shubham Ahuja	57.5	3
56	101104069	Shubham Garg	39.5	2
57	101104070	Sunny Kumar Saini	29.5	2
58	101104071	Sunny Maheshwary	35.5	2
59	101104072	Suraj Pal Singh	46	3
60	101104074	Tanya Sofat	58	3
61	101104075	Tushar Garg	57.5	3
62	101104076	Udita Kapoor	36	2
63	101104077	Varun	60	4
64	101104078	Vikhyat Kansal	54	3
65	101104079	Vineet Sharma	60.5	4
66	101104080	Vishal Gupta	72.5	4
67	101104081	Vishesh Gupta	41.5	3
68	101104082	Vishvesh	34.5	2
69	101104083	Vivek Gupta	59.5	3
70	101104084	Harmanjasraj Grewal	49.5	3
71	101104085	Akhilesh Sharma	55.5	3
72	101154001	Anna Kathpal	61	4
73	101154002	Papiha Salhotra	44.5	3
74	101154003	Prateek Arora	17.5	1
75	101154004	Sandeep Singh	40.5	3

76	101284002	Ashish	12	1
77	101284004	Deepak Puri	21	2
78	101284005	Ishan Narang	50.5	3
79	101284006	Jatinder Singh Kapur	77.5	5
80	101284007	Navneet Kumar	50.5	3
81	101284008	Prikshit Singla	38.5	2
82	101284010	Sachin Sharma	48.5	3

The performance of students through the course UEE801 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 UEE801 for criteria 'PO-09(B)'**

Course	% of students in each score					Average Score
	5	4	3	2	1	
<b>UEE801</b>	<b>1.22</b>	<b>13.41</b>	<b>60.98</b>	<b>20.73</b>	<b>3.66</b>	<b>2.88</b>

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)'**

Course	% of students in each score					Average Score
	5	4	3	2	1	
<b>UEE601</b>	8.64	27.16	46.91	14.81	2.47	<b>3.25</b>
<b>UEE801</b>	1.22	13.41	60.98	20.73	3.66	<b>2.88</b>
<b>Weighted Average Score</b>	<b>4.93</b>	<b>20.29</b>	<b>53.94</b>	<b>17.77</b>	<b>3.06</b>	<b>3.06</b>

## 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	<ul style="list-style-type: none"> <li>Describe the converter configuration for different power systems applications such as HVDC,</li> <li>FACTS etc.</li> <li>Evaluate the converters, harmonics on AC and DC side and filtering.</li> <li>Classify various compensators suited for various power system purposes.</li> <li>Analyze power system behaviour with different shunt compensators.</li> <li>Appraise series compensated power system behaviour with different series compensators.</li> <li>Analyse system behaviour with hybrid shunt-series compensators.</li> </ul>
UEE801	<ul style="list-style-type: none"> <li>Demonstrate non-linear system behaviour by phase plane and describing function methods</li> <li>Perform the stability analysis nonlinear systems by Lyapunov method develop design skills in optimal control problems</li> <li>Derive discrete-time mathematical models in both time domain (difference equations, state equations) and z-domain (transfer function using z-transform).</li> <li>Predict and analyze transient and steady-state responses and stability and sensitivity of both open-loop and closed-loop linear, time-invariant, discrete-time control systems.</li> <li>Acquire knowledge of state space and state feedback in modern control systems, pole placement, design of state observers and output feedback controllers</li> </ul>

**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	29.51	22.09	16.99	10.22	21.20	<b>3.28</b>
UEE801	31.66	28.28	29.83	29.83	5.19	<b>3.76</b>
<b>Weighted average score</b>	<b>30.585</b>	<b>25.185</b>	<b>23.41</b>	<b>20.025</b>	<b>13.195</b>	<b>3.52</b>

(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		
<b>Student class performance</b>	4.93	20.29	53.94	17.77	3.06	<b>3.06</b>	5
<b>Course surveys</b>	30.585	25.185	23.41	20.025	13.195	<b>3.52</b>	4
<b>Other surveys</b>	35.47	39.65	21.71	2.68	0.48	<b>4.07</b>	3
<b>Overall weighted score</b>	<b>21.12</b>	<b>26.76</b>	<b>35.71</b>	<b>14.75</b>	<b>5.79</b>	<b>3.47</b>	

## 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 *UEE791: Project Semester* are used to assess performance criteria 'PO-09(C)' as a direct measure. The analysis for each of these courses is provided below:

#### **UEE591: Summer Training**

The performance criteria *UEE591: Summer Training* is used to measure the attainment of outcome 'PO-09(C)' by considering evaluation of **knowledge gained** in six weeks summer training (June-July 2014, 100 marks).

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 targeting 'PO-09(C)': Course UEE591**

S. No.	Roll No.	Name of Student	Marks (100)	Score (1-5)
1	101204011	Amarpreet	41	3
2	101254014	Paras Ghai	41	3
3	101204074	Sukhdarshanpal Singh	48.63	3
4	101254009	Varun Khanna	48.63	3
5	101254017	Nakul Kumar	48.63	3
6	101204004	Aditya Jain	49.75	3
7	101204001	Aashna	51	3
8	101204031	Jasdeep Garg	52.58	3
9	101204016	Ayush Vaid	53	3
10	101204054	P Siddharth	54.13	3
11	101204057	Rahul Kamboj	55.05	3
12	101254015	Kuldeep Singh Deora	56.25	3
13	101204049	Mohit Manhas	56.63	3
14	101254010	Swati Srivastava	56.63	3
15	101204040	Kashish Sethi	58.24	3
16	101204028	Iqbal Singh Garcha	59.86	3

17	101254002	Naman Kumar	59.86	3
18	101204021	Gaurav Arora	61	4
19	101204075	Sultan Singh	61.47	4
20	101204076	Tejasvi Anand	61.47	4
21	101204035	Kapil Kinger	61.48	4
22	101204037	Karanbir Singh Kahlon	61.48	4
23	101254013	Sorabh Devgun	61.48	4
24	101204002	Abhinav Sharma	62.25	4
25	101204046	Marshall	62.29	4
26	101204067	Sheenu	62.39	4
27	101254005	Navjot Kaur	62.39	4
28	101254001	Sahilpreet Singh	63.1	4
29	101204059	Rajat Sahore	64.23	4
30	101204009	Akshu Gupta	64.5	4
31	101384005	Navdeep Singh	64.72	4
32	101384001	Ankur Singla	64.75	4
33	101204069	Shubham Bhatia	65.14	4
34	101204027	Himanshu Takkar	65.52	4
35	101204038	Karanveer Singh Bhangoo	65.52	4
36	101204020	Dhruv Sharma	65.75	4
37	101204053	Nishant Arora	66.06	4
38	101204064	Sahil Mittal	66.06	4
39	101204070	Shubham Goel	66.06	4
40	101384007	Saurav Goyal	66.06	4
41	101204033	Jasleen Kaur	66.33	4
42	101204041	Kaustubh Singh	66.33	4
43	101204051	Nalin Kaushik	66.33	4
44	101254003	Sachin Pathak	66.33	4
45	101204003	Abhishek Jain	66.5	4
46	101204060	Rajatdeep Singh	66.98	4
47	101204066	Sewak Ram	66.98	4
48	101204061	Ramanpreet Kaur	67.9	4
49	101204071	Shubham Kansal	67.9	4
50	101254012	Shubham Singla	67.9	4
51	101204013	Anshul Kumar	68.25	4
52	101204010	Aman Goyal	68.75	4
53	101204030	Ishtjot Singh	68.76	4
54	101204043	Lovely Goyal	68.76	4
55	101254004	Srijan Aditya	68.82	4
56	101204019	Deeksha Goyal	69.25	4
57	101204022	Gursharan Kaur	69.5	4
58	101204025	Harsh Kothari	69.5	4

59	101204045	Manik Mittal	69.57	4
60	101204048	Mohit Kukkar	69.57	4
61	101204065	Sanchit Goel	69.73	4
62	101204015	Arushi Nagpal	69.75	4
63	101204024	Harjot Singh	70.25	4
64	101254016	Sachin Gupta	70.65	4
65	101204039	Kartik Arora	71.19	4
66	101204012	Amit Bansal	71.25	4
67	101204018	Chahat Singla	71.25	4
68	101204005	Akash Deep	71.5	4
69	101204014	Anukriti Dwivedi	72.25	4
70	101204026	Hemanshu Garg	72.5	4
71	101384004	Himanshu Bansal	72.81	4
72	101384006	Parampreet Singh	72.81	4
73	101204023	Gursimran Singh	73.5	4
74	101204063	Sahil Arora	75.24	4
75	101254008	Gaurav	75.24	4
76	101384008	Surjeet Singh	75.24	4
77	101204042	Krishnank Atrey	76.04	4
78	101254006	Milan Jain	76.16	4
79	101384002	Gagandeep Singh	79.5	4
80	101204006	Akash Ratna	81	5

The performance of students through the course UEE591 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 UEE591 for criteria 'PO-09(C)'**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE591	1.25	77.50	21.25	0.00	0.00	3.80

## UEE791: Project Semester

The performance of course UEE791: Project Semester is used to measure the attainment of outcome 'PO-09(C)' through **Goal Report** (Jan-June 2015, 5 marks) which includes adaptation of new ideas to do the project.

The performance of the students in the above question is then summarized as given below in Table PO-09(C).1 using rubrics defined in Table PO-09.1(a).

**Table PO-09(C).3: Students' performance in targeting 'PO-09(C)': Course UEE791**

S. No.	Roll No.	Name of Student	Total Marks (5)	Score (1-5)
1	101104001	Aakriti Singla	4	5
2	101104002	Abhay Goel	4	5
3	101104003	Abhinav Kumar Sardana	3	4
4	101104006	Akash Verma	3	4
5	101104007	Aman Bhatnagar	4	5
6	101104008	Amar Deep Singh	3	4
7	101104009	Ankit Bansal	4	5
8	101104010	Ankur Singhal	3	4
9	101104011	Anshuman Singh	4	5
10	101104012	Arunabh Choudhury	3	4
11	101104013	Ashish Gupta	4	5
12	101104016	Chetan Baria	4	5
13	101104021	Dhruv Srivastav	5	5
14	101104022	Gagandeep Singh	3	4
15	101104023	Harkaran Tiwana	3	4
16	101104024	Harnoor Singh Ahluwalia	3	4
17	101104026	Harshit Nath	4	5
18	101104027	Harwinder Singh	3	4
19	101104028	Himanshu Goel	4	5
20	101104029	Isha Jhamb	3	4
21	101104030	Jagpreet Singh	4	5
22	101104031	Kanika Lodha	2	3
23	101104032	Kanwaljot Singh	3	4
24	101104033	Karanpreet Kaur	4	5
25	101104034	Keshav Singla	3	4
26	101104035	Ketan Joshi	2	3
27	101104036	Kriti Bansal	4	5
28	101104037	Kunal Rawat	3	4
29	101104040	Mudit Kumar	3	4

30	101104042	Nand Nandan Arora	4	5
31	101104043	Narinderpal Singh Kaleka	4	5
32	101104045	Navjot Singh	4	5
33	101104046	Navneet Bansal	4	5
34	101104047	Nikhil Agarwal	4	5
35	101104048	Nitin Kumar	3	4
36	101104049	Nitish Singla	3	4
37	101104050	Perry Mittal	4	5
38	101104051	Piyush Gupta	3	4
39	101104052	Piyush Jain	4	5
40	101104054	Prabhleen Kaur	4	5
41	101104055	Prashant	3	4
42	101104056	Prateek Jain	4	5
43	101104058	Rajan Gaur	3	4
44	101104059	Rajat Gupta	4	5
45	101104060	Ratik Mittal	3	4
46	101104062	Rishika Kukreja	4	5
47	101104063	Rubbal Maggo	4	5
48	101104066	Shaurya Chopra	3	4
49	101104068	Shubham Ahuja	4	5
50	101104069	Shubham Garg	3	4
51	101104071	Sunny Maheshwary	4	5
52	101104072	Suraj Pal Singh	4	5
53	101104074	Tanya Sofat	4	5
54	101104075	Tushar Garg	4	5
55	101104076	Udita Kapoor	4	5
56	101104077	Varun	3	4
57	101104078	Vikhyat Kansal	4	5
58	101104079	Vineet Sharma	4	5
59	101104080	Vishal Gupta	4	5
60	101104081	Vishesh Gupta	4	5
61	101104083	Vivek Gupta	3	4
62	101104084	Harmanjasraj Grewal	4	5
63	101104085	Akhilesh Sharma	4	5
64	101154001	Anna Kathpal	4	5
65	101154002	Papiha Salhotra	3	4
66	101154003	Prateek Arora	3	4
67	101154004	Sandeep Singh	3	4
68	101284002	Deepak Puri	3	4

69	101284006	Navneet Kumar	4	5
70	101284007	Prikshit Singla	2	3
71	101284010	Vikas Bansal	4	5

The performance of students through the course UEE791 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 UEE791 for criteria 'PO-09(C)'**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE791	56.34	39.44	4.23	0.00	0.00	4.52

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)'**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UTE591	1.25	77.50	21.25	0.00	0.00	3.80
UEE791	56.34	39.44	4.23	0.00	0.00	4.52
Weighted Average Score	28.80	58.47	12.74	0.00	0.00	4.16

## 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)'.

UEE591	Use resources to adopt latest technologies. Experience the social, economic and administrative aspects of an organization. Exposure to choose better career decisions. Communicate their work effectively through writing and presentation.
UEE791	Acquire knowledge and experience of software and hardware practices in the area of project.

**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	
UEE591	34.06	33.13	28.75	0.94	3.13	<b>3.94</b>
UEE791	39.44	36.62	21.13	1.41	1.41	<b>4.11</b>
<b>Weighted average score</b>	<b>36.75</b>	<b>34.88</b>	<b>24.94</b>	<b>1.18</b>	<b>2.27</b>	<b>4.03</b>

(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	28.80	58.47	12.74	0.00	0.00	<b>4.16</b>	5
Course surveys	36.75	34.88	24.94	1.18	2.27	<b>4.03</b>	4
Other surveys	<b>35.47</b>	<b>39.65</b>	<b>21.71</b>	<b>2.68</b>	<b>0.48</b>	<b>4.07</b>	3
<b>Overall weighted score</b>	<b>33.12</b>	<b>45.90</b>	<b>19.05</b>	<b>1.06</b>	<b>0.88</b>	<b>4.09</b>	

**Assessment of Outcome 'PO-09' using Performance Criterion 'PO-09(A)', 'PO-09(B)' and 'PO-09(C)'**

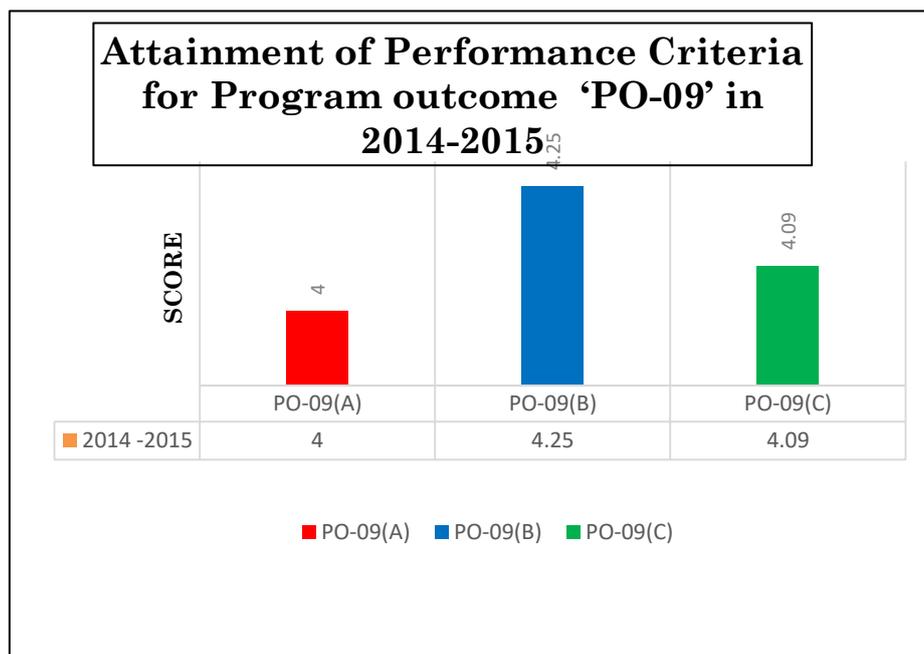
In the previous sections, each of the individual performance criteria PO-09(A), PO-09(B) and PO-09(C) have been assessed. The performance for attainment of outcome PO-09 has been completed using the attainment values for PO-09(A), PO-09(B) and PO-09(C) and is provided below:

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)	29.07	48.36	17.44	3.20	1.94	4.00	5
PO-09(B)	21.12	26.76	35.71	14.75	5.79	3.47	5
PO-09(C)	33.12	45.90	19.05	1.06	0.88	4.09	5
<b>Overall score</b>	<b>27.77</b>	<b>40.34</b>	<b>24.07</b>	<b>6.34</b>	<b>2.87</b>	<b>3.85</b>	

The performance criteria wise assessment score distribution of outcome 'PO-09' is shown in Fig. PO-09.2.



**Fig. 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 2014-15. 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 Student Outcome**

# **PO-10**

*A Knowledge Of Contemporary Issues*

**(2014-15)**

*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  
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### **Attainment of Student Outcome 'PO-10'**

The attainment of student outcome PO-10: *A knowledge of contemporary issues* has been measured using standard procedure for the BE Electrical Engineering program. The student 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 student 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 J 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 2014-15.

Performance Criteria	Subject -1	Subject-2
PO-10(A)	UEE303:Power Generation and Associated Economics	UEE603 : Switch Gear and Protection
PO-10(B)	UEE804: Operation and Control of Power Systems	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) 2014-15. The similar procedure is followed to measure the attainment of program outcome 'PO-10' for all three academic years under consideration.

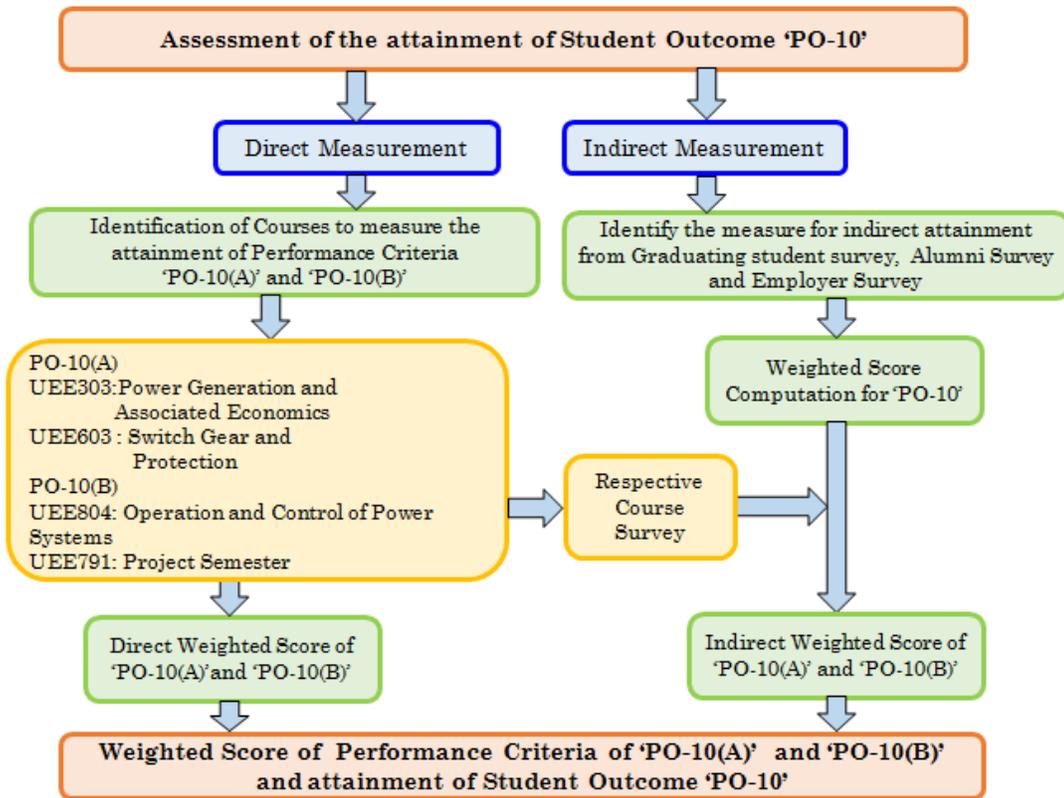


Fig. PO-10.1: Process for measurement of attainment of outcome 'PO-10(A)' for the year 2014-15

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 *UEE303: Power Generation and Associated Economics* and *UEE603 : Switch Gear and Protection* are used to assess performance criteria PO-10(A) as a direct measure. The analysis for each of these courses is provided below:

**UEE303: Power Generation and Associated Economics**

The performance of course *UEE303: Power Generation and Associated Economics* is used to measure the attainment of outcome 'PO-10(A)' through End Semester Examination (Question No. 3(b), July -Dec 2014, 5 marks).

**Question:**

Q. 3(b)	<p>A 200MW Thermal power plant is estimated to cost Rs1000millions. Other costs are as follows:</p> <ul style="list-style-type: none"> <li>i) Insurance and Taxes Rs 20 Lacs/Annum</li> <li>ii) Fuel and Lubricants Rs 200Lacs/Annum</li> <li>iii) Transport and Storage Rs 30Lacs/Annum</li> <li>iv) Salaries and Wages Rs 36Lacs/Annum</li> <li>v) Miscellaneous Rs 6Lacs/Annum</li> </ul> <p>Reckoning interest and depreciation at 15% per annum of capital cost, determine the cost of energy generated per unit if power station works at an average load factor of 60%. What would it be, if the load factor is increased to 75% with a consequent increase in fuel cost by 10% other costs remain same.</p>	(5)
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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 UEE303**

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1.	101304051	Kritika Singla	3	4
2.	101304061	Nazuk Aggarwal	4	5
3.	101304063	Nishtha Raheja	4	5
4.	101304064	Paras Bawa	3	4
5.	101304065	Parth Ahuja	2	3

6.	101304066	Parushi	3	4
7.	101304067	Pency Goyal	2	3
8.	101304068	Piyush Jindal	2	3
9.	101304069	Piyush Tripathi	2	3
10.	101304070	Prachi Garg	2	3
11.	101304071	Prashant Kataria	3	4
12.	101304072	Preeti Garg	3	4
13.	101304073	Priyank Arora	3	4
14.	101304074	Priyanka	2	3
15.	101304075	Priyanka Singh	4	5
16.	101304076	Priyansh Mahajan	2	3
17.	101304077	Rahul Meena	3	4
18.	101304078	Rajan	2	3
19.	101304079	Rajat Sharma	2	3
20.	101304080	Ratul Goyal	4	5
21.	101304081	Ravinder Singh	3	4
22.	101304082	Rishabh Juneja	3	4
23.	101304083	Robin Manktala	3	4
24.	101304084	Rohan Ghai	2	3
25.	101304085	Rohan Singla	2	3
26.	101304086	Rohan Wadhawan	3	4
27.	101304087	Rohit Goyal	3	4
28.	101304088	Rubina Bamba	4	5
29.	101304089	Sagar Pulani	3	4
30.	101304090	Sahil Kataria	4	5
31.	101304091	Sakshi	3	4
32.	101304092	Sandal Singh Sidhu	3	4
33.	101304093	Sandeep Kaur	2	3
34.	101304095	Saurabh Mohan	3	4
35.	101304096	Shagundeep Singh	1	2
36.	101304097	Shailly Gupta	3	4
37.	101304098	Shaina	2	3
38.	101304099	Shivika Gupta	3	4
39.	101304100	Shresth Rai	4	5
40.	101304101	Shubham Goyal	3	4
41.	101304102	Shubham Gupta	4	5
42.	101304103	Shubham Sharma	2	3
43.	101304104	Shubham Sharma	2	3
44.	101304105	Shubham Soin	4	5
45.	101304106	Siddharth Goyal	3	4
46.	101304107	Sidharth Garg	4	5
47.	101304108	Simran Kaur	3	4
48.	101304109	Simranjit Singh	2	3
49.	101304111	Sumit Dhingra	3	4

50.	101304112	Sumit Kaushik	4	5
51.	101304113	Tushar Dheer	4	5
52.	101304114	Tushar Sharma	3	4
53.	101304116	Utsav Chhabra	2	3
54.	101304117	Vaibhav Gupta	4	5
55.	101304118	Vaishali	3	4
56.	101304119	Varun Bansal	3	4
57.	101304120	Veni Jindal	4	5
58.	101304121	Vishal Arora	3	4
59.	101304122	Yugesh Goyal	2	3
60.	101484009	Jyoti Kaushal	2	3
61.	101484011	Pawan Kumar	4	5
62.	101484012	Rajat Singla	3	4
63.	101484013	Satveer Kaur	3	4
64.	101484014	Saurabh Kumar Wadhawan	4	5
65.	101484015	Shweta Sharma	2	3
66.	101484016	Sukhjeet Singh	3	4

The performance of students through the course UEE303 for 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 UEE303 for criteria PO-10(A)**

Course	% of Students in each score					Average Score
	5	4	3	2	1	
<b>UEE303</b>	24.24	43.94	30.30	1.52	0.00	<b>3.91</b>

### UEE603 : Switch Gear and Protection

The performance of course *UEE603 : Switch Gear and Protection* is used to measure the attainment of outcome 'PO-10(A)' through End Semester Examination (Question No. 3(a), Jan -June 2015, 8 marks).

#### Question:

Q1 (a)	Describe the construction and working principle of Puffer type SF <sub>6</sub> circuit breaker. (b) In a 220kV system, the reactance and capacitance up to the location of circuit breaker are 8Ω and 0.025μF respectively. A resistance of 600Ω is connected across the contacts of the circuit breaker. Determine the following: (i) Damped frequency of oscillation; (ii) Critical value of resistance which will give no transient oscillation. Derive the equations used.	(8)
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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).1: Students' performance in question targeting 'PO-10(A)'; Course UEE603**

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
1.	101204001	Aashna	2	2
2.	101204002	Abhinav Sharma	3	2
3.	101204003	Abhishek Jain	3	2
4.	101204004	Aditya Jain	1	1
5.	101204005	Akash Deep	3	2
6.	101204006	Akash Ratna	3	2
7.	101204009	Akshu Gupta	3	2
8.	101204010	Aman Goyal	3	2
9.	101204012	Amarpreet	4	3
10.	101204013	Amit Bansal	1	1
11.	101204014	Anshul Kumar	4	3
12.	101204015	Anukriti Dwivedi	5	4
13.	101204016	Arushi Nagpal	1	1
14.	101204018	Ayush Vaid	4	3
15.	101204019	Chahat Singla	3	2
16.	101204020	Deeksha Goyal	3	2
17.	101204021	Dhruv Sharma	2	2
18.	101204022	Gaurav Arora	6	5
19.	101204023	Gursharan Kaur	4	3
20.	101204024	Gursimran Singh	4	3
21.	101204025	Harjot Singh	3	2
22.	101204026	Harsh Kothari	6	5
23.	101204027	Hemanshu Garg	5	4

24.	101204028	Himanshu Takkar	4	3
25.	101204030	Iqbal Singh Garcha	3	2
26.	101204031	Ishtjot Singh	4	3
27.	101204033	Jasdeep Garg	5	4
28.	101204035	Jasleen Kaur	2	2
29.	101204037	Kapil Kinger	1	1
30.	101204038	Karanbir Singh Kahlon	3	2
31.	101204039	Karanveer Singh Bhangoo	2	2
32.	101204040	Kartik Arora	1	1
33.	101204041	Kashish Sethi	3	2
34.	101204042	Kaustubh Singh	2	2
35.	101204043	Krishnank Atrey	2	2
36.	101204045	Lovely Goyal	2	2
37.	101204046	Manik Mittal	2	2
38.	101204048	Marshall	2	2
39.	101204049	Mohit Kukkar	3	2
40.	101204051	Mohit Manhas	2	2
41.	101204053	Nalin Kaushik	4	3
42.	101204054	Nishant Arora	3	2
43.	101204057	P Siddharth	4	3
44.	101204059	Rahul Kamboj	3	2
45.	101204060	Rajat Sahore	4	3
46.	101204061	Rajatdeep Singh	2	2
47.	101204063	Ramanpreet Kaur	5	4
48.	101204064	Sahil Arora	4	3
49.	101204065	Sahil Mittal	4	3
50.	101204066	Sanchit Goel	2	2
51.	101204067	Sewak Ram	3	2
52.	101204069	Sheenu	1	1
53.	101204070	Shubham Bhatia	4	3
54.	101204071	Shubham Goel	2	2
55.	101204074	Shubham Kansal	2	2
56.	101204075	Sukhdarshanpal Singh	3	2
57.	101204076	Sultan Singh	4	3
58.	101254001	Tejasvi Anand	2	2
59.	101254002	Sahilpreet Singh	1	1
60.	101254003	Naman Kumar	3	2
61.	101254004	Sachin Pathak	1	1
62.	101254005	Srijan Aditya	2	2
63.	101254006	Navjot Kaur	4	3
64.	101254008	Milan Jain	3	2
65.	101254009	Gaurav	3	2
66.	101254010	Varun Khanna	3	2
67.	101254012	Swati Srivastava	3	2
68.	101254013	Shubham Singla	2	2

69.	101254014	Sorabh Devgun	3	2
70.	101254015	Paras Ghai	2	2
71.	101254016	Kuldeep Singh Deora	5	4
72.	101254017	Sachin Gupta	4	3
73.	101384001	Nakul Kumar	6	5
74.	101384002	Ankur Singla	3	2
75.	101384004	Gagandeep Singh	4	3
76.	101384005	Himanshu Bansal	3	2
77.	101384006	Navdeep Singh	6	5
78.	101384007	Parampreet Singh	5	4
79.	101384008	Saurav Goyal	3	2

The performance of students through the course UEE603 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 UEE603 for criteria PO-10(A)**

Course	% of Students in each score					Average Score
	5	4	3	2	1	
<b>UEE603</b>	5.06	7.59	21.52	55.70	10.13	<b>2.42</b>

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	
<b>UEE303</b>	24.24	43.94	30.30	1.52	0.00	<b>3.91</b>
<b>UEE603</b>	5.06	7.59	21.52	55.70	10.13	<b>2.42</b>
<b>Weighted Average Score</b>	<b>14.65</b>	<b>25.77</b>	<b>25.91</b>	<b>28.61</b>	<b>5.07</b>	<b>3.17</b>

**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)'.

<b>UEE303</b>	Select the methods and size of plant generating power for overall economy
<b>UEE603</b>	Select the protection elements such as fuse, circuit breakers and relays etc. for a given configuration.

**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	
<b>UEE303</b>	41.31	33.02	17.21	6.41	2	<b>4.05</b>
<b>UEE603</b>	27.46	29.41	25.10	9.55	8.49	<b>3.58</b>
<b>Weighted average score</b>	<b>34.39</b>	<b>31.22</b>	<b>21.16</b>	<b>7.98</b>	<b>5.25</b>	<b>3.82</b>

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

Graduating Survey	A knowledge of contemporary issues.
Alumni Survey	
Employer Survey	Do our students 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	
<b>Graduating student survey</b>	25.92	43.20	24.69	4.9	1.2	<b>4.06</b>
<b>Employer survey</b>	20	73.33	6.67	00	00	<b>4.33</b>
<b>Alumni survey</b>	30.43	36.23	24.64	5.80	2.90	<b>3.79</b>
<b>Weighted average score</b>	<b>25.45</b>	<b>50.92</b>	<b>18.66</b>	<b>3.56</b>	<b>1.36</b>	<b>4.06</b>

**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	14.65	25.77	25.91	28.61	5.07	3.17	5
Course surveys	34.39	31.22	21.16	7.98	5.25	3.82	4
Other surveys	25.45	50.92	18.66	3.56	1.36	4.06	3
Overall weighted score	23.93	33.87	22.51	15.47	4.198	3.60	-

## 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: Students' performance using course portfolio

Two courses namely *UEE804: Operation and Control in Power System* 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:

#### UEE804: Operation and Control in Power System

The performance of course *UEE804: Operation and Control in Power System* is used to measure the attainment of outcome 'PO-10(B)' through Mid Semester Examination (Question No. 1(b) and 5, Jul-Dec 2014, 8 marks).

#### Question:

Q.1(b)	Derive the transmission loss formula for a system consisting of n-generating plants supplying several loads interconnected through a transmission network.	(3)
Q.5	Obtain the economic operation schedule for three thermal units delivering a total load of 1000MW by neglecting network losses but considering generation limits. The data for units are as under: Unit 1 $F_c(P_1) = 500 + 7.5 P_1 + 0.0017 P_1^2$ Rs/Hr $200\text{MW} \leq P_1 \leq 700\text{MW}$ Unit 2 $F_c(P_2) = 350 + 7.8 P_2 + 0.002 P_2^2$ Rs/Hr $150\text{MW} \leq P_2 \leq 550\text{MW}$ Unit 3 $F_c(P_3) = 210 + 7.9 P_3 + 0.005 P_3^2$ Rs/Hr $200\text{MW} \leq P_3 \leq 650\text{MW}$	(5)

The performance of the students 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 UEE804**

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
1.	101004053	Pulkit Farsaiya	2	2
2.	101104001	Aakriti Singla	4	3
3.	101104002	Abhay Goel	3	2
4.	101104003	Abhinav Kumar Sardana	2	2
5.	101104005	Achin Chetal	3	2
6.	101104006	AkashVerma	3	2
7.	101104007	Aman Bhatnagar	6	5
8.	101104008	Amar Deep Singh	4	3

9.	101104009	Ankit Bansal	3	2
10.	101104010	Ankur Singhal	3	2
11.	101104011	Anshuman Singh	2	2
12.	101104012	Arunabh Choudhury	3	2
13.	101104013	Ashish Gupta	4	3
14.	101104016	Chetan Baria	3	2
15.	101104017	Daksh Bansal	5	4
16.	101104021	Dhruv Srivastav	7	5
17.	101104022	Gagandeep Singh	3	2
18.	101104023	Harkaran Tiwana	4	3
19.	101104024	Harnoor Singh Ahluwalia	3	2
20.	101104026	Harshit Nath	6	5
21.	101104027	Harwinder Singh	3	2
22.	101104028	Himanshu Goel	4	3
23.	101104029	Isha Jhamb	1	1
24.	101104030	Jagpreet Singh	3	2
25.	101104031	Kanika Lodha	1	1
26.	101104032	Kanwaljot Singh	3	2
27.	101104033	Karanpreet Kaur	5	4
28.	101104034	Keshav Singla	3	2
29.	101104035	Ketan Joshi	5	4
30.	101104036	Kriti Bansal	4	3
31.	101104037	Kunal Rawat	3	2
32.	101104038	Manik Budhiraja	4	3
33.	101104040	Mudit Kumar	4	3
34.	101104042	Nand Nandan Arora	4	3
35.	101104043	Narinderpal Singh Kaleka	4	3
36.	101104044	Navjot Singh	2	2
37.	101104045	Navjot Singh	5	4
38.	101104046	Navneet Bansal	3	2
39.	101104047	Nikhil Agarwal	4	3
40.	101104048	Nitin Kumar	3	2
41.	101104049	Nitish Singla	3	2
42.	101104050	Perry Mittal	2	2
43.	101104051	Piyush Gupta	5	4
44.	101104052	Piyush Jain	2	2
45.	101104054	PrabhleenKaur	4	3
46.	101104055	Prashant	3	2
47.	101104056	Prateek Jain	4	3
48.	101104057	PriyaSaroaha	2	2
49.	101104058	Rajan Gaur	2	2
50.	101104059	Rajat Gupta	6	5
51.	101104060	Ratik Mittal	4	3
52.	101104062	Rishika Kukreja	3	2

53.	101104063	Rubbal Maggo	4	3
54.	101104066	Shaurya Chopra	2	2
55.	101104067	Shish Pal	4	3
56.	101104068	Shubham Ahuja	2	2
57.	101104069	Shubham Garg	0	1
58.	101104070	Sunny Kumar Saini	2	2
59.	101104071	Sunny Maheshwary	3	2
60.	101104072	Suraj Pal Singh	3	2
61.	101104074	Tanya Sofat	3	2
62.	101104075	Tushar Garg	4	3
63.	101104076	Udita Kapoor	2	2
64.	101104077	Varun	4	3
65.	101104078	Vikhyat Kansal	3	2
66.	101104079	Vineet Sharma	6	5
67.	101104080	Vishal Gupta	5	4
68.	101104081	Vishesh Gupta	2	2
69.	101104082	Vishvesh	1	1
70.	101104083	Vivek Gupta	4	3
71.	101104084	Harmanjasraj Grewal	3	2
72.	101104085	Akhilesh Sharma	5	4
73.	101154001	Anna Kathpal	3	2
74.	101154002	Papiha Salhotra	4	3
75.	101154003	Prateek Arora	0	1
76.	101154004	Sandeep Singh	5	4
77.	101284001	Ashish	4	3
78.	101284002	Deepak Puri	1	1
79.	101284004	IshanNarang	1	1
80.	101284005	Jatinder Singh Kapur	3	2
81.	101284006	Navneet Kumar	6	5
82.	101284007	PrikshitSingla	4	3
83.	101284008	Sachin Sharma	1	1
84.	101284010	Vikas Bansal	3	2
85.	101284011	Gurdeep Singh	2	2

The performance of students through the course UEE804 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 UEE804 for criteria PO-10(B)**

Course	% of Students in each score					Average Score
	5	4	3	2	1	
<b>UEE804</b>	7.06	9.41	25.88	48.24	9.41	<b>2.56</b>

## 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, 2015, 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	Marks (5)	Score (1-5)
1.	101104001	Aakriti Singla	5	5
2.	101104002	Abhay Goel	5	5
3.	101104003	Abhinav Kumar Sardana	4	5
4.	101104006	Akash Verma	5	5
5.	101104007	Aman Bhatnagar	5	5
6.	101104008	Amar Deep Singh	4	5
7.	101104009	Ankit Bansal	5	5
8.	101104010	Ankur Singhal	4	5
9.	101104011	Anshuman Singh	5	5
10.	101104012	Arunabh Choudhury	5	5
11.	101104013	Ashish Gupta	5	5
12.	101104016	Chetan Baria	5	5
13.	101104021	Dhruv Srivastav	5	5
14.	101104022	Gagandeep Singh	5	5
15.	101104023	Harkaran Tiwana	4	5
16.	101104024	Harnoor Singh Ahluwalia	5	5
17.	101104026	Harshit Nath	5	5
18.	101104027	Harwinder Singh	5	5
19.	101104028	Himanshu Goel	5	5
20.	101104029	Isha Jhamb	5	5
21.	101104030	Jagpreet Singh	5	5
22.	101104031	Kanika Lodha	4	5
23.	101104032	Kanwaljot Singh	5	5
24.	101104033	Karanpreet Kaur	5	5
25.	101104034	Keshav Singla	4	5
26.	101104035	Ketan Joshi	5	5
27.	101104036	Kriti Bansal	5	5
28.	101104037	Kunal Rawat	5	5
29.	101104040	Mudit Kumar	5	5
30.	101104042	Nand Nandan Arora	5	5
31.	101104043	Narinderpal Singh Kaleka	5	5
32.	101104045	Navjot Singh	5	5
33.	101104046	Navneet Bansal	5	5

34.	101104047	Nikhil Agarwal	4	5
35.	101104048	Nitin Kumar	5	5
36.	101104049	Nitish Singla	5	5
37.	101104050	Perry Mittal	5	5
38.	101104051	Piyush Gupta	5	5
39.	101104052	Piyush Jain	5	5
40.	101104054	Prabhleen Kaur	4	5
41.	101104055	Prashant	5	5
42.	101104056	Prateek Jain	5	5
43.	101104058	Rajan Gaur	5	5
44.	101104059	Rajat Gupta	5	5
45.	101104060	Ratik Mittal	5	5
46.	101104062	Rishika Kukreja	5	5
47.	101104063	Rubbal Maggo	5	5
48.	101104066	Shaurya Chopra	4	5
49.	101104068	Shubham Ahuja	4	5
50.	101104069	Shubham Garg	3	4
51.	101104071	Sunny Maheshwary	5	5
52.	101104072	Suraj Pal Singh	5	5
53.	101104074	Tanya Sofat	5	5
54.	101104075	Tushar Garg	4	5
55.	101104076	Udita Kapoor	5	5
56.	101104077	Varun	5	5
57.	101104078	Vikhyat Kansal	5	5
58.	101104079	Vineet Sharma	5	5
59.	101104080	Vishal Gupta	5	5
60.	101104081	Vishesh Gupta	5	5
61.	101104083	Vivek Gupta	5	5
62.	101104084	Harmanjasraj Grewal	5	5
63.	101104085	Akhilesh Sharma	5	5
64.	101154001	Anna Kathpal	5	5
65.	101154002	Papiha Salhotra	5	5
66.	101154003	Prateek Arora	4	5
67.	101154004	Sandeep Singh	4	5
68.	101284002	Deepak Puri	5	5
69.	101284006	Navneet Kumar	5	5
70.	101284007	Prikshit Singla	5	5
71.	101284010	Vikas Bansal	5	5

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 student performance in the course UEE791 for criteria PO-10(B)**

Course	% of Students in each score					Average Score
	5	4	3	2	1	
<b>UEE791</b>	98.59	1.41	0.00	0.00	0.00	<b>4.99</b>

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(A).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	
<b>UEE804</b>	7.06	9.41	25.88	48.24	9.41	<b>2.56</b>
<b>UEE791</b>	98.59	1.41	0.00	0.00	0.00	<b>4.99</b>
<b>Weighted Average Score</b>	<b>52.83</b>	<b>5.41</b>	<b>12.94</b>	<b>24.12</b>	<b>4.71</b>	<b>3.78</b>

**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)'.

<b>UEE804</b>	Comprehend power system security and contingency
<b>UEE791</b>	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	
<b>UEE804</b>	15.91	25.64	32.18	14.17	12.62	<b>3.18</b>
<b>UEE791</b>	32.39	29.58	33.80	1.41	2.82	<b>3.87</b>
<b>Weighted average score</b>	<b>24.15</b>	<b>27.61</b>	<b>32.99</b>	<b>7.79</b>	<b>7.72</b>	<b>3.52</b>

**(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		
<b>Student class performance</b>	52.83	5.41	12.94	24.12	4.71	<b>3.78</b>	<b>5</b>
<b>Course surveys</b>	24.15	27.61	32.99	7.79	7.72	<b>3.52</b>	<b>4</b>
<b>Other surveys</b>	25.45	50.92	18.66	3.56	1.36	<b>4.06</b>	<b>3</b>
<b>Overall weighted score</b>	<b>36.42</b>	<b>24.18</b>	<b>21.05</b>	<b>13.53</b>	<b>4.87</b>	<b>3.76</b>	

**Overall assessment of student outcome J using scores of PO-10(A) and PO-10(B)**

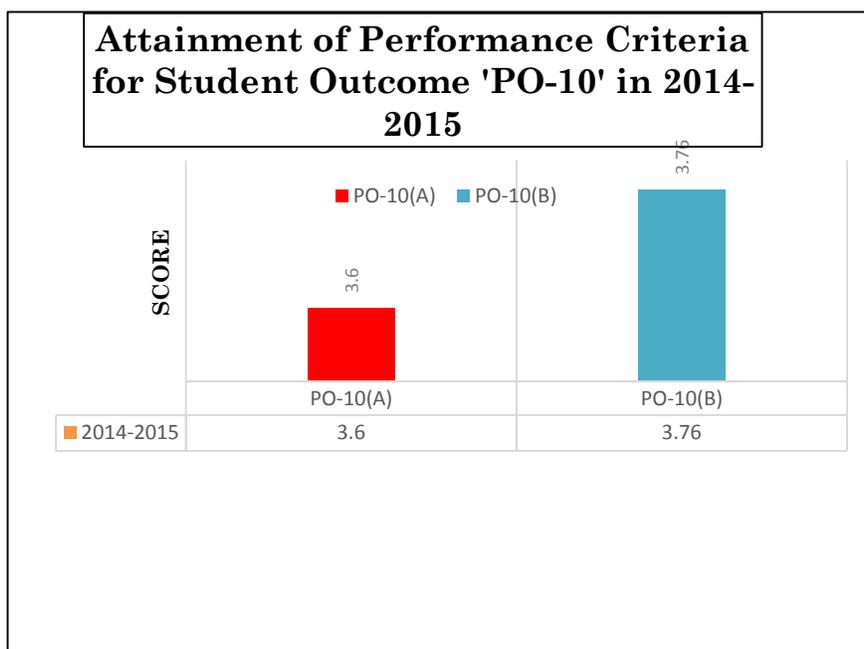
In the previous sections, each of the individual performance criteria PO-10(A) and PO-10(B) have been assessed. The performance for attainment of outcome PO-10 has been completed using the attainment values for PO-10(A) and PO-10(B) and is provided below:

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)	23.93	33.87	22.51	15.47	4.19	3.60	5
PO-10(B)	36.42	24.18	21.05	13.53	4.87	3.76	5
<b>Overall score</b>	<b>30.17</b>	<b>29.02</b>	<b>21.78</b>	<b>14.50</b>	<b>4.53</b>	<b>3.68</b>	

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 2014-15.

# Assessment of Attainment of Program Outcome

## PO-11

*An ability to use the techniques, skills, and modern engineering tools necessary  
for engineering practice*

**(2014-15)**

*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 use the techniques, skills, and modern engineering tools necessary for engineering practice* has been measured 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’:

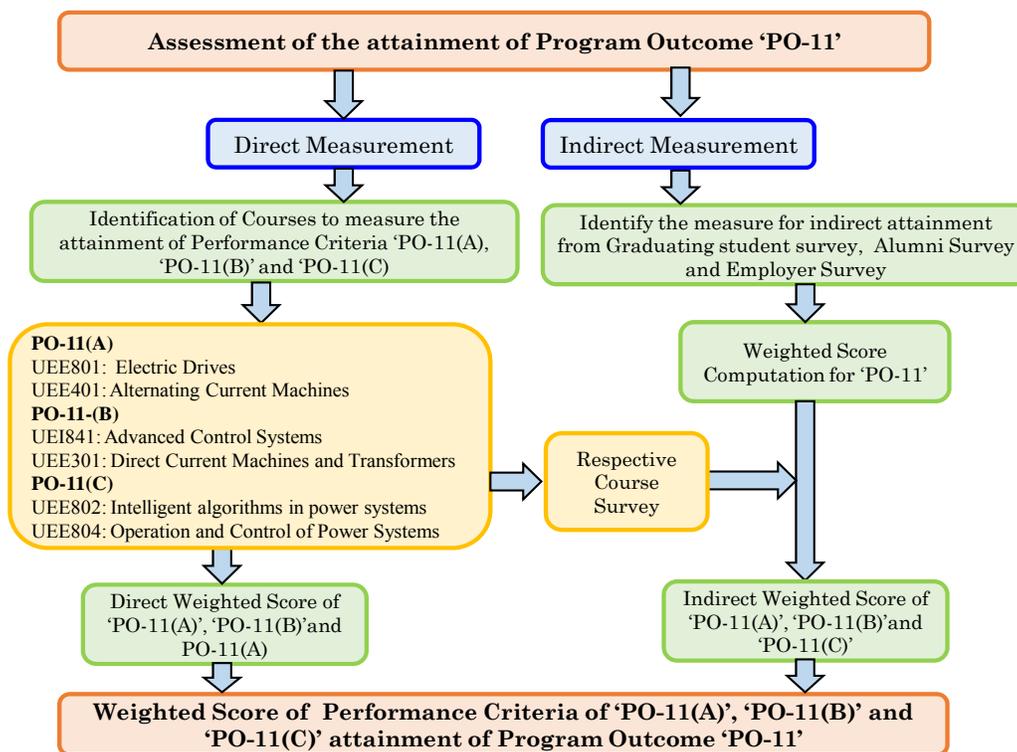
- **UEE301: Direct Current Machines and Transformers**
- **UEE401: Alternate Current Machines**
- UEI404: Digital Signal Processing Fundamentals
- UEE405: Network Theory and Design
- UEI501: Control Systems
- UEE502: High Voltage Engineering
- UEE504: Power Electronics
- UEE603: Switchgear & Protection
- UEE605: Power System Analysis and Stability
- UEI609: Fundamentals of Microprocessors and Microcontrollers
- UEE702: Intelligent Techniques in Electrical Engineering
- **UEE801: Electric Drives**
- **UEE802: Intelligent Algorithms in Power Systems**
- **UEE804: Operation and Control of Power Systems**
- UEE806: Alternate Sources of Energy
- **UEI841: Advanced Control Systems**
- UEE892: Design Project

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)’ in the academic year 2014-15.

Performance Criteria	Course -1	Course-2
PO-11(A)	UEE801: Electric Drives	UEE401: Alternating Current Machines
PO-11(B)	UEI841: Advanced Control Systems	UEE301: Direct Current Machines and Transformers

PO-11(C)	UEE802: Intelligent algorithms in power systems	UEE804: Operation and Control of Power Systems
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The step by step methodology used to measure the attainment of student outcome 'PO-11' is shown in Fig. PO-11.1 for academic year (AY) 2014-15. The similar procedure is followed to measure the attainment of student 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 2014-15**

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 PO11.1(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 measurement 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: Student's performance using Course Portfolio**

Two courses namely *UEE801: Electric Drives* and *UEE401: Alternating Current Machines* are used to assess performance criteria PO-11(A) 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-11(A)' through the End Semester Examination (Question No. 4, Jan-June 2015, 7 marks).

#### **Question:**

Q.4	<p>(a) Compare the slip power recovery methods of speed control for slip ring induction motor with appropriate circuit diagrams.</p> <p>(b) A 400V, 50Hz, 4-pole, 1350rpm star-connected induction motor is driving a load whose torque varies as square of speed. The motor speed is controlled by stator voltage control. Find torque and applied voltage at a speed of 900rpm. The parameters of the given motor are : <math>R_1 = 1.5 \Omega</math>, <math>R_2 = 4 \Omega</math>, <math>X_1 = X_2 = 4 \Omega</math>.</p>	(7)
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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 UEE801**

S. No	Roll No.	Name of Student	Marks (7)	Score (1-5)
1.	101104001	AakritiSingla	3	3
2.	101104002	AbhayGoel	3.5	3
3.	101104003	Abhinav Kumar Sardana	2	2
4.	101104005	Achin Chetal	2	2
5.	101104006	Akash Verma	4	3
6.	101104007	Aman Bhatnagar	5	4
7.	101104008	Amar Deep Singh	3	3
8.	101104009	Ankit Bansal	4	3
9.	101104010	Ankur Singhal	4.5	4
10.	101104011	Anshuman Singh	3.5	3
11.	101104012	Arunabh Choudhury	2.5	2
12.	101104013	Ashish Gupta	3.5	3
13.	101104016	ChetanBaria	5	4
14.	101104017	Daksh Bansal	3	3
15.	101104021	DhruvSrivastav	4	3
16.	101104022	Gagandeep Singh	4.5	4
17.	101104023	Harkaran Tiwana	4.5	4
18.	101104024	Harnoor Singh Ahluwalia	2.5	2
19.	101104026	Harshit Nath	4.5	4
20.	101104027	Harwinder Singh	4	3
21.	101104028	Himanshu Goel	4.5	4
22.	101104029	IshaJhamb	2.5	2
23.	101104030	Jagpreet Singh	2.5	2
24.	101104031	Kanika Lodha	0.5	1
25.	101104032	Kanwaljot Singh	3	3
26.	101104033	Karanpreet Kaur	4.5	4
27.	101104034	KeshavSingla	3.5	3
28.	101104035	Ketan Joshi	3.5	3
29.	101104036	Kriti Bansal	4.5	4
30.	101104037	Kunal Rawat	1.5	2
31.	101104038	Manik Budhiraja	3	3
32.	101104040	Mudit Kumar	6	5
33.	101104042	Nand Nandan Arora	4	3
34.	101104043	Narinderpal Singh Kaleka	4	3
35.	101104044	Navjot Singh	3	3
36.	101104045	Navjot Singh	4	3

S. No	Roll No.	Name of Student	Marks (7)	Score (1-5)
37.	101104046	Navneet Bansal	4	3
38.	101104047	Nikhil Agarwal	3.5	3
39.	101104048	Nitin Kumar	5	4
40.	101104049	NitishSingla	3.5	3
41.	101104050	Perry Mittal	3	3
42.	101104051	Piyush Gupta	5	4
43.	101104052	Piyush Jain	3	3
44.	101104054	Prabhleen Kaur	3.5	3
45.	101104055	Prashant	3	3
46.	101104056	Prateek Jain	3	3
47.	101104057	Priya Saroha	2.5	2
48.	101104058	Rajan Gaur	4	3
49.	101104059	Rajat Gupta	3.5	3
50.	101104060	Ratik Mittal	3	3
51.	101104062	RishikaKukreja	3	3
52.	101104063	RubbalMaggo	3	3
53.	101104066	Shaurya Chopra	4	3
54.	101104067	Shish Pal	3	3
55.	101104068	Shubham Ahuja	4	3
56.	101104069	Shubham Garg	4	3
57.	101104070	Sunny Kumar Saini	2	2
58.	101104071	Sunny Maheshwary	3	3
59.	101104072	Suraj Pal Singh	3.5	3
60.	101104074	Tanya Sofat	4.5	4
61.	101104075	Tushar Garg	5.5	5
62.	101104076	Udita Kapoor	2	2
63.	101104077	Varun	4.5	4
64.	101104078	VikhyatKansal	3.5	3
65.	101104079	Vineet Sharma	5.5	5
66.	101104080	Vishal Gupta	5.5	5
67.	101104081	Vishesh Gupta	4	3
68.	101104082	Vishvesh	2.5	2
69.	101104083	Vivek Gupta	4.5	4
70.	101104084	Harmanjasraj Grewal	4	3
71.	101104085	Akhilesh Sharma	5	4
72.	101154001	Anna Kathpal	5	4
73.	101154002	PapihaSalhotra	4	3

S. No	Roll No.	Name of Student	Marks (7)	Score (1-5)
74.	101154003	Prateek Arora	1	1
75.	101154004	Sandeep Singh	3	3
76.	101284004	Deepak Puri	1.5	2
77.	101284005	Ishan Narang	3.5	3
78.	101284006	Jatinder Singh Kapur	6	5
79.	101284007	Navneet Kumar	3.5	3
80.	101284008	PrikshitSingla	3	3
81.	101284010	Sachin Sharma	4	3

The performance of students through the course UEE801 for criterion PO-11(A) is summarized in Table PO-11(A).2

**Table PO-11(A).2: Average score of student performance in the course UEE801 for criteria PO-11(A)**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE801	6.17	19.75	56.79	14.81	2.47	3.12

### UEE401: Alternating Current Machines

The performance of course UEE802: Intelligent Algorithms in Power Systems is used to measure the attainment of outcome 'PO-11(A)' through the End Semester Examination (Question No. 7 and 8, July-Dec 2014, 8 marks).

#### Question:

Q7	Calculate the value of resistance elements of a 5-step (or 6-stud) starter for a 3-phase, 400 V, wound-rotor induction motor. The full load slip is 2.5% and the maximum starting current is limited to its full load value. Rotor resistance per phase is $0.02 \Omega$	(8)
Q8	A 4-pole, star connected, 50 Hz, 11 kW, 40 MVA turbo generator, with a synchronous reactance of 0.8 p.u., is connected to a power network. This power network can be represented by 11 kW infinite bus with a series reactance of $j0.5 \Omega$ . A voltage regulator adjusts the field current such that alternator terminal voltage remains constant at 11 kV. The generator delivers an output of 40 MVA. Find the armature current, power factor and excitation emf.	

The performance of the students in the above question is then summarized as given below in Table PO-11(A).3 using rubrics defined in Table PO-11.1(a).

**Table PO-11(A).3: Students' performance in question targeting 'PO-11(A)'; Course UEE401**

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
1.	101304001	Aarushi Bajaj	3.5	3
2.	101304002	Abhey Arora	4	3
3.	101304003	Abhishek Taksali	4.5	3
4.	101304004	Adhikaansh Tayal	1.5	1
5.	101304005	Aditi Narang	6	5
6.	101304006	Aditya	5	4
7.	101304007	Akshat	5	4
8.	101304008	Akshay Kapoor	5.5	4
9.	101304009	Akshay Kumar	3.5	3
10.	101304010	Akshay Kumar Chaudhary	1	1
11.	101304011	Akshay Sharma	3.5	3
12.	101304012	Amandeep Kaur	2.5	2
13.	101304013	Amandeep Singh	4	3
14.	101304014	Amaninder Singh Randhawa	3.5	3
15.	101304015	Angad Kapoor	4	3
16.	101304016	Ankita Garg	5	4
17.	101304017	Ankur Malik	4	3
18.	101304018	Anmol Jawa	6	5
19.	101304019	Anmolpreet Singh	4	3
20.	101304020	Anyuti Tiwary	4	3
21.	101304021	Arpit Sharma	4	3
22.	101304022	Arsh Kundal	4	3
23.	101304023	Arshbir Kaur	6	5
24.	101304024	Arshdeep Singh Bagga	4	3
25.	101304025	Ashish	4.5	3
26.	101304026	Ashish Rajpal	4.5	3
27.	101304028	Berry Lubana	4	3
28.	101304029	Bhanu Duggal	5.5	4
29.	101304030	Bhanu Marwaha	3.5	3
30.	101304031	Chirag Gaba	4	3
31.	101304032	Dipin Garg	4	3
32.	101304033	Dishant Vanvari	3.5	3
33.	101304034	Divyesh Pratap Singh	5	4
34.	101304035	Elham Anwar	5	4

S. No	Roll No.	Name of Student	Marks (8)	Score (1-5)
35.	101304036	Gurseerat Singh Meen	2	2
36.	101304037	Gursewak Singh	3.5	3
37.	101304040	Hariansh Sehgal	2	2
38.	101304041	Hartejdeep Singh	2.5	2
39.	101304042	Himanshu Goyal	5	4
40.	101304044	Jasjit Singh	0.5	1
41.	101304045	Jassimran Singh Julka	4.5	3
42.	101304046	Jessica Dhaliwal	5	4
43.	101304047	Kanwarpal Singh	3	2
44.	101304048	Karan Kumar	2	2
45.	101304049	Karanjot Singh Kochar	3.5	3
46.	101304050	Kashish Aggarwal	4.5	3
47.	101304052	Love Gaba	3.5	3
48.	101304054	Manik Mittal	4.5	3
49.	101304055	Maninderjit Singh	3	2
50.	101304056	Mayank Singla	3	2
51.	101304057	Mridul Bhutani	3	2
52.	101304058	Naman Garg	7	5
53.	101304059	Navdeep Singh	3.5	3
54.	101304060	Navdeep Singh	5	4
55.	101304062	Nishant Garg	5	4
56.	101304094	Satripleen Kaur	4	3
57.	101484001	Amandeep Singh	5.5	4
58.	101484002	Amrinder Singh	6	5
59.	101484003	Ashmeen Singh	2	2
60.	101484004	Azad Singh	3	2
61.	101484005	Chandan Garg	5	4
62.	101484007	Deepak Singla	6	5
63.	101484008	Diljeet Singh	5	4

The performance of students through the course UEE401 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	

<b>UEE401</b>	<b>9.52</b>	<b>22.22</b>	<b>46.03</b>	<b>17.46</b>	<b>4.76</b>	<b>3.14</b>
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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	
<b>UEE801</b>	6.17	19.75	56.79	14.81	2.47	<b>3.12</b>
<b>UEE401</b>	9.52	22.22	46.03	17.46	4.76	<b>3.14</b>
<b>Student class performance score</b>	<b>7.84</b>	<b>20.98</b>	<b>51.41</b>	<b>16.13</b>	<b>3.62</b>	<b>3.13</b>

### 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)’.

<b>UEE801</b>	<ul style="list-style-type: none"> <li>• Conceptualize the basic drive system and analyse it for different types of loads.</li> </ul>
<b>UEE401</b>	<ul style="list-style-type: none"> <li>• Validate and identify the machine parameters.</li> <li>• Select the appropriate AC motor for different large power application.</li> </ul>

(i) **Assessment Tools: Student course surveys**

**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	
<b>UEE801</b>	31.66	28.28	29.83	29.83	5.19	3.76
<b>UEE401</b>	35.94	36.74	21.64	1.46	4.22	3.99
<b>Course survey score</b>	<b>33.8</b>	<b>32.51</b>	<b>25.73</b>	<b>15.65</b>	<b>4.71</b>	<b>3.87</b>

(i) **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?

**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	20.99	51.85	16.05	2.47	8.64	3.74
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
<b>Other surveys score</b>	<b>29.67</b>	<b>48.75</b>	<b>15.79</b>	<b>2.59</b>	<b>3.20</b>	<b>3.99</b>

**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	7.84	20.98	51.41	16.13	3.62	<b>3.13</b>	5
Course surveys score	33.8	32.51	25.73	15.65	4.71	<b>3.87</b>	4
Other surveys score	29.67	48.75	15.79	2.59	3.20	<b>3.99</b>	3
<b>Overall weighted score</b>	<b>21.95</b>	<b>31.76</b>	<b>33.94</b>	<b>12.58</b>	<b>3.88</b>	<b>3.59</b>	-

**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 *UEI841: Advanced Control Systems* and *UEE301: Direct Current Machines and Transformers* are used to assess performance criteria PO-11(B) as a direct measure. The analysis for each of these courses is provided below:

## UEI841: Advanced Control Systems

The performance of course UEI841: Advanced Control Systems is used to measure the attainment of outcome 'PO-11(B)' through the End Semester Examination (Question No. 4, July-Dec 2014, 10 marks).

### Question:

Q.4	Design a digital PI controller using root locus technique such that the dominant closed loop poles have a damping ratio of 0.5 and a settling time of 2 secs for 2% tolerance band from the block diagram shown in Fig. 1. Which is advantageous to use: bode plot in s domain or that in z domain? Give suitable arguments. How do we identify the need of lead or lag compensator in control system?	(10)
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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 UEI841**

S. No	Roll No.	Name of Student	Marks (10)	Score (1-5)
1	101204001	Aashna	4.9	3
2	101204002	Abhinav Sharma	5.4	3
3	101204003	Abhishek Jain	5.8	3
4	101204004	Aditya Jain	0	1
5	101204005	Akash Deep	5.2	3
6	101204006	Akash Ratna	6.4	4
7	101204009	Akshu Gupta	6.2	4
8	101204010	Aman Goyal	5	3
9	101204011	Amarpreet	0	1
10	101204012	Amit Bansal	6.2	4
11	101204013	Anshul Kumar	0	1
12	101204014	Anukriti Dwivedi	6.9	4
13	101204015	Arushi Nagpal	5.6	3
14	101204016	Ayush Vaid	2.8	2
15	101204018	Chahat Singla	7.2	4
16	101204019	Deeksha Goyal	7.5	5
17	101204020	Dhruv Sharma	6.1	4
18	101204021	Gaurav Arora	3.4	2
19	101204022	Gursharan Kaur	8.2	5
20	101204023	Gursimran Singh	8.7	5
21	101204024	Harjot Singh	8.2	5
22	101204025	Harsh Kothari	7.6	5
23	101204026	Hemanshu Garg	8.6	5
24	101204027	Himanshu Takkar	7.2	4
25	101204028	Iqbal Singh Garcha	7.3	4

26	101204030	Ishtjot Singh	2	2
27	101204031	Jasdeep Garg	5.5	3
28	101204033	Jasleen Kaur	7.4	4
29	101204035	Kapil Kinger	4.8	3
30	101204037	Karanbir Singh Kahlon	5	3
31	101204038	Karanveer Singh Bhangoo	5.6	3
32	101204039	Kartik Arora	2.4	2
33	101204040	Kashish Sethi	5.2	3
34	101204041	Kaustubh Singh	5.3	3
35	101204042	Krishnank Atrey	4.4	3
36	101204043	Lovely Goyal	6.4	4
37	101204045	Manik Mittal	5.8	3
38	101204046	Marshall	5.3	3
39	101204048	Mohit Kukkar	4.2	3
40	101204049	Mohit Manhas	5.7	3
41	101204051	Nalin Kaushik	5	3
42	101204053	Nishant Arora	6.1	4
43	101204054	P Siddharth	5.2	3
44	101204057	Rahul Kamboj	5.9	3
45	101204059	Rajat Sahore	4.2	3
46	101204060	Rajatdeep Singh	6.5	4
47	101204061	Ramanpreet Kaur	5.5	3
48	101204063	Sahil Arora	6.6	4
49	101204064	Sahil Mittal	5.4	3
50	101204065	Sanchit Goel	4.8	3
51	101204066	Sewak Ram	5.4	3
52	101204067	Sheenu	6.5	4
53	101204069	Shubham Bhatia	4.1	3
54	101204070	Shubham Goel	5.4	3
55	101204071	Shubham Kansal	4.8	3
56	101204074	Sukhdarshanpal Singh	5.6	3
57	101204075	Sultan Singh	6	4
58	101204076	Tejasvi Anand	6.3	4
59	101254001	Sahilpreet Singh	3	2
60	101254002	Naman Kumar	0	1
61	101254003	Sachin Pathak	6.2	4
62	101254004	Srijan Aditya	3	2
63	101254005	Navjot Kaur	3	2
64	101254006	Milan Jain	7.6	5
65	101254008	Gaurav	7	4
66	101254009	Varun Khanna	6	4

67	101254010	Swati Srivastava	2.8	2
68	101254012	Shubham Singla	4.6	3
69	101254013	Sorabh Devgun	6	4
70	101254014	Paras Ghai	5.1	3
71	101254015	Kuldeep Singh Deora	0	1
72	101254016	Sachin Gupta	7.6	5
73	101254017	Nakul Kumar	5.8	3
74	101384001	Ankur Singla	6.4	4
75	101384002	Gagandeep Singh	3.4	2
76	101384004	Himanshu Bansal	6.4	4
77	101384005	Navdeep Singh	7	4
78	101384006	Parampreet Singh	8.6	5
79	101384007	Saurav Goyal	7	4
80	101384008	Surjeet Singh	2.2	2

The performance of students through the course UEI841 for criteria PO-11(B) is summarized in Table PO-11(B).2

**Table PO-11(B).2: Average score of student performance in the course UEI841 for criteria PO-11(B)**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEI841	11.25	30.00	40.00	12.50	6.25	3.28

### UEE301: Direct Current Machines and Transformers

The performance of course UEE301: Direct Current Machines and Transformers is used to measure the attainment of outcome 'PO-11(B)' through the End Semester Examination (Question No. 3, July-Dec 2014, 5 marks).

#### Question:

Q.3	<p>(a) State the conditions to be satisfied for parallel operation of DC generators.</p> <p>(b) Two 240 V DC shunt generators operate in parallel. The first generator has a terminal voltage of 280V on no-load and 240 V when supplying 40 A. The second generator has a voltage of 300V when on no load and 240 V when supplying 50 A. Calculate the following:</p> <p>(i) The current supplied by each generator, (ii) the output voltage and (iii) the output kW of each machine. The total load current is 60 A.</p>	(5)
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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 UEE301**

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
1.	101304001	Aarushi Bajaj	2.5	3
2.	101304002	Abhey Arora	3.5	4
3.	101304003	Abhishek Taksali	2.5	3
4.	101304004	Adhikaansh Tayal	1.5	2
5.	101304005	Aditi Narang	3	4
6.	101304006	Aditya	3.5	4
7.	101304007	Akshat	3	4
8.	101304008	Akshay Kapoor	3.5	4
9.	101304009	Akshay Kumar	2.5	3
10.	101304010	Akshay Kumar Chaudhary	1	2
11.	101304011	Akshay Sharma	1	2
12.	101304012	Amandeep Kaur	1	2
13.	101304013	Amandeep Singh	2	3
14.	101304014	Amaninder Singh Randhawa	2.5	3
15.	101304015	Angad Kapoor	2.5	3
16.	101304016	Ankita Garg	3.5	4
17.	101304017	Ankur Malik	2.5	3
18.	101304018	Anmol Jawa	3.5	4
19.	101304019	Anmolpreet Singh	1.5	2
20.	101304020	Anyuti Tiwary	3	4
21.	101304021	Arpit Sharma	2.5	3
22.	101304022	Arsh Kundal	1	2
23.	101304023	Arshbir Kaur	3	4
24.	101304024	Arshdeep Singh Bagga	2	3
25.	101304025	Ashish	2.5	3
26.	101304026	Ashish Rajpal	2.5	3
27.	101304028	Berry Lubana	1.5	2
28.	101304029	Bhanu Duggal	3.5	4
29.	101304030	Bhanu Marwaha	3.5	4
30.	101304031	Chirag Gaba	1.5	2
31.	101304032	Dipin Garg	2.5	3
32.	101304033	Dishant Vanvari	1.5	2
33.	101304034	Divyesh Pratap Singh	2.5	3
34.	101304035	Elham Anwar	2.5	3
35.	101304036	Gurseerat Singh Meen	0.5	1
36.	101304037	Gursewak Singh	1.5	2

S. No	Roll No.	Name of Student	Marks (5)	Score (1-5)
37.	101304040	Hariansh Sehgal	2.5	3
38.	101304041	Hartejdeep Singh	1	2
39.	101304042	Himanshu Goyal	2.5	3
40.	101304044	Jasjit Singh	0.5	1
41.	101304045	Jassimran Singh Julka	1.5	2
42.	101304046	Jessica Dhaliwal	2	3
43.	101304047	Kanwarpal Singh	1	2
44.	101304048	Karan Kumar	2	3
45.	101304049	Karanjot Singh Kochar	2.5	3
46.	101304050	Kashish Aggarwal	3.5	4
47.	101304052	Love Gaba	2.5	3
48.	101304054	Manik Mittal	2.5	3
49.	101304055	Maninderjit Singh	1.5	2
50.	101304056	Mayank Singla	1.5	2
51.	101304057	Mridul Bhutani	2.5	3
52.	101304058	Naman Garg	4	5
53.	101304059	Navdeep Singh	1	2
54.	101304060	Navdeep Singh	2.5	3
55.	101304062	Nishant Garg	3	4
56.	101304094	Satripleen Kaur	3	4
57.	101484001	Amandeep Singh	2	3
58.	101484002	Amrinder Singh	3.5	4
59.	101484003	Ashmeen Singh	1	2
60.	101484004	Azad Singh	2	3
61.	101484005	Chandan Garg	4	5
62.	101484007	Deepak Singla	3	4
63.	101484008	Diljeet Singh	3.5	4

The performance of students through the course UEE301 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 UEE301 for criteria PO-11(B)**

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEE301	3.17	26.98	39.68	26.98	3.17	3.00

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	
<b>UEI841</b>	11.25	30.00	40.00	12.50	6.25	3.28
<b>UEE301</b>	3.17	26.98	39.68	26.98	3.17	3.00
<b>Course survey score</b>	7.21	28.49	39.84	19.74	4.71	<b>3.14</b>

**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.

**(ii) 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)’.

<b>UEI841</b>	Design and fine tune PID controllers and understand the roles of P, I and D in feedback control
<b>UEE301</b>	<ul style="list-style-type: none"> <li>Select appropriate DC motor for specific purpose and can compute their steady performance.</li> <li>Compute the performance with DC generators and can supply increasing load with parallel operation.</li> </ul>

**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	
<b>UEI841</b>	25.8	45.2	22.6	3.2	3.2	3.87
<b>UEE301</b>	55.33	27.82	15.92	0.77	0.15	4.37
<b>Other surveys score</b>	<b>40.56</b>	<b>36.51</b>	<b>19.26</b>	<b>1.98</b>	<b>1.68</b>	<b>4.12</b>

**(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?

**Table PO-11(B).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	20.99	51.85	16.05	2.47	8.64	3.74
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
<b>Other surveys score</b>	<b>29.67</b>	<b>48.75</b>	<b>15.79</b>	<b>2.59</b>	<b>3.20</b>	<b>3.99</b>

**c) Overall weighted average score of performance criterion ‘PO-11(B)’**

Finally overall weighted average score of performance criterion ‘PO-11(B)’ is evaluated as given below in Table PO-11(B).8:

**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	7.21	28.49	39.84	19.74	4.71	<b>3.14</b>	5
Course surveys score	40.56	36.51	19.26	1.98	1.68	<b>4.12</b>	4
Other surveys score	29.67	48.75	15.79	2.59	3.20	<b>3.99</b>	3
<b>Overall weighted score</b>	<b>23.94</b>	<b>36.23</b>	<b>26.97</b>	<b>9.53</b>	<b>3.32</b>	<b>3.68</b>	-

**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 Lab report (July-Dec14, 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	Total Marks (15)	Score (1-5)
1	101004053	Pulkit Farsaiya	8.4	3
2	101004076	Harshobit Singh	0.9	1
3	101104001	Aakriti Singla	10.2	4
4	101104002	Abhay Goel	10.8	4
5	101104003	Abhinav Kumar Sardana	9	4
6	101104005	Achin Chetal	9	4
7	101104006	Akash Verma	11.4	4
8	101104007	Aman Bhatnagar	12	5
9	101104008	Amar Deep Singh	8.4	3
10	101104009	Ankit Bansal	10.8	4
11	101104010	Ankur Singhal	10.2	4
12	101104011	Anshuman Singh	11.4	4
13	101104012	Arunabh Choudhury	10.8	4
14	101104013	Ashish Gupta	12	5
15	101104016	Chetan Baria	9	4
16	101104017	Daksh Bansal	11.4	4
17	101104021	Dhruv Srivastav	12	5
18	101104022	Gagandeep Singh	9	4
19	101104023	Harkaran Tiwana	9.6	4
20	101104024	Harnoor Singh Ahluwalia	8.4	3
21	101104026	Harshit Nath	7.8	3
22	101104027	Harwinder Singh	9.6	4
23	101104028	Himanshu Goel	12.6	5
24	101104029	Isha Jhamb	10.2	4
25	101104030	Jagpreet Singh	10.2	4
26	101104031	Kanika Lodha	9.6	4
27	101104032	Kanwaljot Singh	10.8	4
28	101104033	Karanpreet Kaur	11.4	4
29	101104034	Keshav Singla	10.8	4
30	101104035	Ketan Joshi	11.4	4
31	101104036	Kriti Bansal	12	5
32	101104037	Kunal Rawat	10.2	4
33	101104038	Manik Budhiraja	10.8	4

S. No	Roll No.	Name of Student	Total Marks (15)	Score (1-5)
34	101104040	Mudit Kumar	9.6	4
35	101104042	Nand Nandan Arora	9.6	4
36	101104043	Narinderpal Singh Kaleka	12.6	5
37	101104044	Navjot Singh	9	4
38	101104045	Navjot Singh	11.4	4
39	101104046	Navneet Bansal	9.6	4
40	101104047	Nikhil Agarwal	10.8	4
41	101104048	Nitin Kumar	10.8	4
42	101104049	Nitish Singla	10.2	4
43	101104050	Perry Mittal	9.6	4
44	101104051	Piyush Gupta	12	5
45	101104052	Piyush Jain	8.4	3
46	101104054	Prabhleen Kaur	10.2	4
47	101104055	Prashant	9.6	4
48	101104056	Prateek Jain	11.4	4
49	101104057	Priya Saroha	10.2	4
50	101104058	Rajan Gaur	9.6	4
51	101104059	Rajat Gupta	11.4	4
52	101104060	Ratik Mittal	10.8	4
53	101104062	Rishika Kukreja	10.2	4
54	101104063	Rubbal Maggo	10.2	4
55	101104066	Shaurya Chopra	12	5
56	101104067	Shish Pal	9.6	4
57	101104068	Shubham Ahuja	10.8	4
58	101104069	Shubham Garg	10.2	4
59	101104070	Sunny Kumar Saini	9.6	4
60	101104071	Sunny Maheshwary	12	5
61	101104072	Suraj Pal Singh	12.6	5
62	101104074	Tanya Sofat	10.2	4
63	101104075	Tushar Garg	10.8	4
64	101104076	Udita Kapoor	10.2	4
65	101104077	Varun	10.8	4
66	101104078	Vikhyat Kansal	11.4	4
67	101104079	Vineet Sharma	11.4	4
68	101104080	Vishal Gupta	12	5
69	101104081	Vishesh Gupta	12	5
70	101104082	Vishvesh	9.6	4

S. No	Roll No.	Name of Student	Total Marks (15)	Score (1-5)
71	101104083	Vivek Gupta	11.4	4
72	101104084	Harmanjasraj Grewal	10.8	4
73	101104085	Akhilesh Sharma	12	5
74	101154001	Anna Kathpal	11.4	4
75	101154002	Papiha Salhotra	9.6	4
76	101154003	Prateek Arora	10.8	4
77	101154004	Sandeep Singh	11.4	4
78	101284001	Ashish	10.8	4
79	101284002	Deepak Puri	11.4	4
80	101284004	Ishan Narang	10.8	4
81	101284005	Jatinder Singh Kapur	9	4
82	101284006	Navneet Kumar	9.6	4
83	101284007	Prikshit Singla	10.2	4
84	101284008	Sachin Sharma	12.6	5
85	101284010	Vikas Bansal	10.8	4
86	101284011	Gurdeep Singh	9	4

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	16.28	76.74	5.81	0.00	1.16	4.07

### 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)' by giving the Laboratory assignments to develop programs for solutions to Power System steady state and short circuit studies using MATLAB s/w in laboratory sessions during July-Dec 2015 to the students. This component carries weightage of 20 marks.

Laboratory assignments using MATLAB s/w are:

1. Assemble Bus Admittance Matrix using direct method with and without mutual coupling.
2. Assemble Bus Admittance Matrix using singular transformation technique with and without mutual coupling.
3. Assemble Bus Impedance Matrix using building algorithm.

4. Obtain load flow solution of three bus system with Gauss Seidal Iteration method. Plot convergence curve
5. Obtain load flow solution of three bus system with Newton Raphson method. Plot convergence curve
6. Obtain short circuit studies solution of three bus system with Short Circuit algorithm.
7. Implement assignment 1-6 on IEEE 6bus/11bus/30 bus system.
8. Obtain transient stability solution of system subjected to disturbance using point-by-point method. Plot Swing Curve.

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 (15)	Score (1-5)
1	101104001	Aakriti Singla	10	4
2	101104002	Abhay Goel	10	4
3	101104005	Achin Chetal	8	3
4	101104006	Akash Verma	7	3
5	101104007	Aman Bhatnagar	12	5
6	101104008	Amar Deep Singh	8	3
7	101104009	Ankit Bansal	8.5	3
8	101104010	Ankur Singhal	6	3
9	101104011	Anshuman Singh	7.5	3
10	101104013	Ashish Gupta	14	5
11	101104016	Chetan Baria	8	3
12	101104017	Daksh Bansal	9	4
13	101104021	Dhruv Srivastav	12	5
14	101104022	Gagandeep Singh	12	5
15	101104023	Harkaran Tiwana	10	4
16	101104024	Harnoor Singh Ahluwalia	8.5	3
17	101104026	Harshit Nath	9	4
18	101104027	Harwinder Singh	8.5	3
19	101104028	Himanshu Goel	8.5	3
20	101104029	Isha Jhamb	10	4
21	101104030	Jagpreet Singh	9.5	4
22	101104032	Kanwaljot Singh	13	5
23	101104033	Karanpreet Kaur	9	4
24	101104034	Keshav Singla	10	4
25	101104035	Ketan Joshi	11	4
26	101104036	Kriti Bansal	11.5	4
27	101104037	Kunal Rawat	9	4

S. No	Roll No.	Name of Student	Marks (15)	Score (1-5)
28	101104038	Manik Budhiraja	13	5
29	101104040	Mudit Kumar	9	4
30	101104042	Nand Nandan Arora	9.5	4
31	101104043	Narinderpal Singh Kaleka	11	4
32	101104044	Navjot Singh	11	4
33	101104045	Navjot Singh	10.5	4
34	101104046	Navneet Bansal	11.5	4
35	101104047	Nikhil Agarwal	12	5
36	101104048	Nitin Kumar	13	5
37	101104049	Nitish Singla	13	5
38	101104050	Perry Mittal	10	4
39	101104051	Piyush Gupta	14	5
40	101104052	Piyush Jain	10	4
41	101104054	Prabhleen Kaur	8	3
42	101104055	Prashant	12	5
43	101104056	Prateek Jain	8.5	3
44	101104058	Rajan Gaur	9	4
45	101104059	Rajat Gupta	11	4
46	101104060	Ratik Mittal	9.5	4
47	101104062	Rishika Kukreja	8.5	3
48	101104063	Rubbal Maggo	9	4
49	101104066	Shaurya Chopra	8	3
50	101104067	Shish Pal	7	3
51	101104068	Shubham Ahuja	15	5
52	101104069	Shubham Garg	8	3
53	101104070	Sunny Kumar Saini	6	3
54	101104071	Sunny Maheshwary	7.5	3
55	101104072	Suraj Pal Singh	9	4
56	101104074	Tanya Sofat	6.5	3
57	101104075	Tushar Garg	7	3
58	101104077	Varun	13	5
59	101104078	Vikhyat Kansal	13	5
60	101104079	Vineet Sharma	11	4
61	101104080	Vishal Gupta	12	5
62	101104081	Vishesh Gupta	7.5	3
63	101104082	Vishvesh	5	2
64	101104083	Vivek Gupta	10.5	4

S. No	Roll No.	Name of Student	Marks (15)	Score (1-5)
65	101104084	Harmanjasraj Grewal	10	4
66	101104085	Akhilesh Sharma	9	4
67	101154001	Anna Kathpal	11	4
68	101154002	Papiha Salhotra	8.5	3
69	101154004	Sandeep Singh	7.5	3
70	101284001	Ashish	15	5
71	101284004	Ishan Narang	8.5	3
72	101284006	Navneet Kumar	12	5
73	101284007	Prikshit Singla	9	4

The performance of students through the course UEE605 for criteria PO-11(C) 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	23.29	42.47	32.88	1.37	0.00	3.88

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	16.28	76.74	5.81	0.00	1.16	4.07
UEE804	23.29	42.47	32.88	1.37	0.00	3.88
Student class performance score	19.78	59.61	19.34	0.68	0.58	3.97

## 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(C)'.

<b>UEE802</b>	<ul style="list-style-type: none"> <li>• Implement fuzzy controllers by modelling the human intelligence into mathematical model.</li> <li>• Mathematically model the human learning capability and solve classification, control system and optimization problem.</li> <li>• Obtain the optimum solution of well formulated optimisation problem using evolutionary approach.</li> </ul>
<b>UEE804</b>	<ul style="list-style-type: none"> <li>• Develop small scale model of alternator, excitation and governing systems.</li> <li>• Design and apply control for frequency and voltage of power system represented by single or multi-area.</li> </ul>

**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?

**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	
<b>UEE802</b>	35.40	29.40	28.63	5.61	0.97	3.93
<b>UEE804</b>	15.91	25.64	32.18	14.17	12.62	3.18
<b>Course survey score</b>	<b>25.66</b>	<b>27.52</b>	<b>30.41</b>	<b>9.89</b>	<b>6.79</b>	<b>3.56</b>

**(ii) Assessment Tool:** Graduating Student Survey, Alumni Survey and Employer Survey (Other surveys)

**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	
<b>Graduating student survey</b>	20.99	51.85	16.05	2.47	8.64	3.74
<b>Employer survey</b>	40.00	53.33	6.67	0.00	0.00	4.33
<b>Alumni survey</b>	28.02	41.06	24.64	5.31	0.97	3.90
<b>Other surveys score</b>	<b>29.67</b>	<b>48.75</b>	<b>15.79</b>	<b>2.59</b>	<b>3.20</b>	<b>3.99</b>

**c) Overall weighted average score of performance criterion ‘PO-11(C)’**

Finally overall weighted average score of performance criterion ‘PO-11(B)’ is evaluated as given below in Table PO-11(B).8:

**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	19.78	59.61	19.34	0.68	0.58	<b>3.97</b>	5
Course surveys score	25.66	27.52	30.41	9.89	6.79	<b>3.56</b>	4
Other surveys score	29.67	48.75	15.79	2.59	3.20	<b>3.99</b>	3
Overall weighted score	<b>24.21</b>	<b>46.20</b>	<b>22.14</b>	<b>4.23</b>	<b>3.31</b>	<b>3.84</b>	-

**Overall assessment of program outcome PO-11 using scores of PO-11(A), PO-11(B) and PO-11(C)**

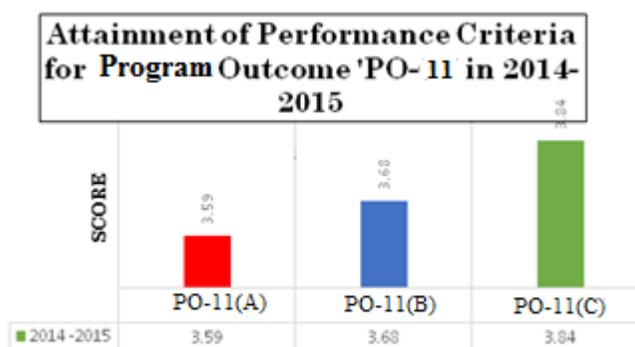
In the previous sections, each of the individual performance criteria PO-11(A), PO-11(B) and PO-11(C) have been assessed. The performance for attainment of outcome K has been completed using the attainment values for PO-11(A), PO-11(B) and PO-11(C) are given below:

Table PO-11.2 summarizes the scores of each of the three performance criteria and these scores have been used to assess an overall score for outcome PO-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)	<b>21.95</b>	<b>31.76</b>	<b>33.94</b>	<b>12.58</b>	<b>3.88</b>	<b>3.59</b>	5
PO-11(B)	<b>23.94</b>	<b>36.23</b>	<b>26.97</b>	<b>9.53</b>	<b>3.32</b>	<b>3.68</b>	5
PO-11(C)	<b>24.21</b>	<b>46.20</b>	<b>22.14</b>	<b>4.23</b>	<b>3.31</b>	<b>3.84</b>	5
Overall score	<b>23.37</b>	<b>38.06</b>	<b>27.68</b>	<b>8.78</b>	<b>3.50</b>	<b>3.70</b>	

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 2014-15**