

**Assessment of Attainment of Program Outcomes (POs)
(Year 2015)**

for the

***Bachelor of Engineering
in
Mechanical Engineering***



**Thapar University
Patiala (Punjab) - 147004
INDIA**

**Assessment of Attainment of Program Outcome
'A'
(Year 2015)**

for the

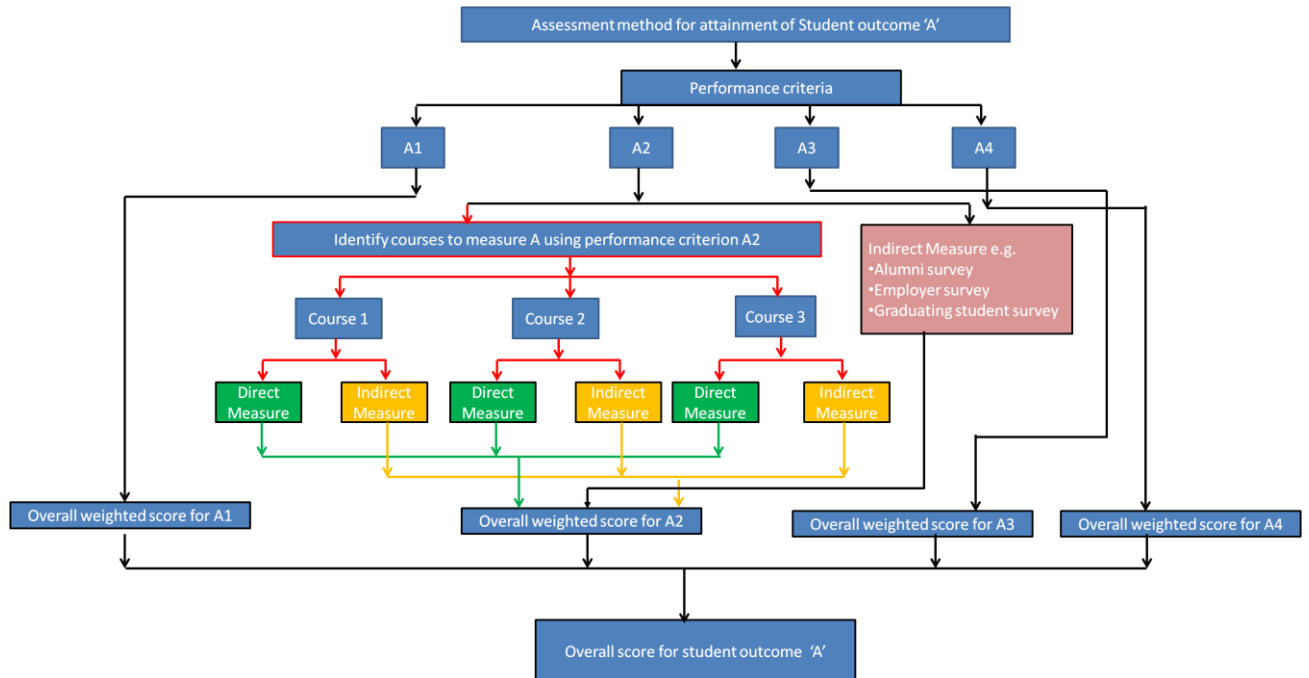
***Bachelor of Engineering
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Attainment of Outcome A

The attainment of each outcome has been measured using a standard procedure explained in the Self Assessment Report for the program. A flow chart depicting the step by step methodology used to measure each attainment is provided below for ready reference.



The following courses have been considered for the assessment of student outcome 'A'

Courses:

1. Kinematics of Machines (UME302),
2. Machine Design (UME504),
3. Numerical and Statistical Methods (UMA032),
4. Total Quality Management (UHU033)

Outcome A has been assessed by four performance criteria A1, A2, A3 and A4. The sections below provide data for separate assessments for each of these performance criteria and in the end the results for these four performance criteria has been used to measure the overall measure of outcome A.

1) Assessment of Outcome 'A' using performance criterion A1

Performance criteria 'A1': Applying mathematics (multivariate calculus, differential equations, linear algebra etc.) to obtain analytical and numerical solutions.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Kinematics of Machines (UME302) and Machine Design (UME504) were used to assess performance criteria A1 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Kinematics of Machines (UME302)

The above performance criteria has been used to measure the attainment of outcome 'A1' by giving the following question (Question No. 1: during MST in September in 2015, weightage 20 marks) to the students.

Question:

- Derive an equation to find out the degree of freedom in terms of the number of links n , k -pairs of j_1 , and j_2 type for planer mechanisms. Extend this concept to write equations for spherical and spatial mechanisms.
- Define Grashof's criterion for 4-bar mechanisms. Sketch out distinct mechanisms obtained satisfying this criterion.
- Define quality of motion transmission in 4- bar mechanisms. How much is the range of angles for optimum transmission? Show the position of the links of the mechanism of maximum and minimum transmission angles.

Student's performance in the above question is given below in Table A4.1:

Table A4.1: Student's performance in question targeting 'A1'; course: UME 302

Sr.No.	Roll no.	Marks(MM:20)	Score (Scale 1 to 5)
1.	101408001	03	2
2.	101408002	15	5
3.	101408003	10	4
4.	101408004	09	3
5.	101408005	10	4
6.	101408006	08	3
7.	101408007	14	5
8.	101408008	05	2
9.	101408009	15	5
10.	101408010	18	5
11.	101408011	18	5
12.	101408012	03	2
13.	101408013	10	4
14.	101408014	18	5
15.	101408016	00	1
16.	101408017	09	3
17.	101408019	13	4
18.	101408020	09	3

19.	101408021	11	4
20.	101408022	03	2
21.	101408023	16	5
22.	101408024	20	5
23.	101408025	11	4
24.	101408026	03	2
25.	101408028	10	4
26.	101408029	14	5
27.	101408030	03	2
28.	101408031	10	4
29.	101408033	13	4
30.	101408034	16	5
31.	101408035	08	3
32.	101408036	05	2
33.	101408037	10	4
34.	101408038	18	5
35.	101408039	09	4
36.	101408040	08	3
37.	101408041	03	2
38.	101408042	06	3
39.	101408043	18	5
40.	101408044	06	3
41.	101408045	16	5
42.	101408046	04	2
43.	101408047	00	1
44.	101408048	00	1
45.	101408049	01	2
46.	101408050	09	3
47.	101408051	06	3
48.	101408052	15	5
49.	101408055	13	4
50.	101408056	08	3
51.	101408057	01	2
52.	101408058	08	3
53.	101408059	06	3
54.	101408060	15	5
55.	101408061	03	2
56.	101408062	09	3
57.	101408063	15	5
58.	101408064	12	4
59.	101408065	10	4
60.	101408066	00	1
61.	101408067	13	4
62.	101408068	04	2
63.	101408069	02	2
64.	101408070	10	4
65.	101408071	13	4
66.	101408073	00	1

67.	101408074	11	4
68.	101408075	07	3
69.	101408076	03	2
70.	101408077	17	5
71.	101408078	17	5
72.	101408079	02	2
73.	101408080	11	4
74.	101409001	04	2
75.	101409002	00	1
76.	101409003	15	5
77.	101409004	12	4
78.	101409005	03	2
79.	101409006	20	5
80.	101409007	15	5
81.	101409009	12	4
82.	101409010	09	3
83.	101409011	15	5
84.	101409012	14	5
85.	101409013	05	2
86.	101409015	11	4
87.	101409016	02	2
88.	101409018	00	1
89.	101409019	16	5
90.	101409020	02	2
91.	101409021	17	5
92.	101409022	09	3
93.	101409025	14	5
94.	101409027	06	3
95.	101409028	09	3
96.	101409029	18	5
97.	101409030	09	3
98.	101409031	19	5
99.	101409032	15	5
100.	101409033	07	3
101.	101409034	10	4
102.	101409035	11	4
103.	101409036	04	2
104.	101409037	18	5
105.	101409038	15	5
106.	101409039	06	3
107.	101409040	10	4
108.	101409041	07	3
109.	101459001	08	3
110.	101459002	09	3
111.	101459003	14	5
112.	101459004	17	5
113.	101459005	06	3
114.	101588001	18	5

115.	101588002	11	4
116.	101588004	13	4
117.	101588005	17	5
118.	101588006	19	5
119.	101588010	14	5
120.	101588011	08	3
121.	101588013	17	5
122.	101588015	20	5
123.	101589002	12	4
124.	101589003	16	5
125.	101589004	17	5

The overall performance of student in the above question is then summarised as given below in Table A4.2:

Table A4.2: average score of the student performance in the course UME302 for criteria A1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME302	31.2	23.2	20.8	19.2	5.6	3.55

(ii) Course: Machine Design (UME504)

The above performance criteria is used to measure the attainment of outcome ‘A1’ by giving the following question (Question No. 1: during MST in September 2015, weightage 13 marks) to the students.

Question: In the figure 1 shown, shaft A, made of AISI 1050 annealed steel is welded to a fixed support and is subjected to loading by equal and opposite forces F via shaft B. A theoretical stress concentration K_t of 1.6 is induced by the 3-mm fillet. The length of shaft A from the fixed support to the connection at shaft B is 1 m. The load F fluctuates from 0.5 to 2 kN. A nominal reliability of 90 per cent is desired. For shaft A, find the factor of safety for infinite life using the modified Goodman fatigue failure criterion.

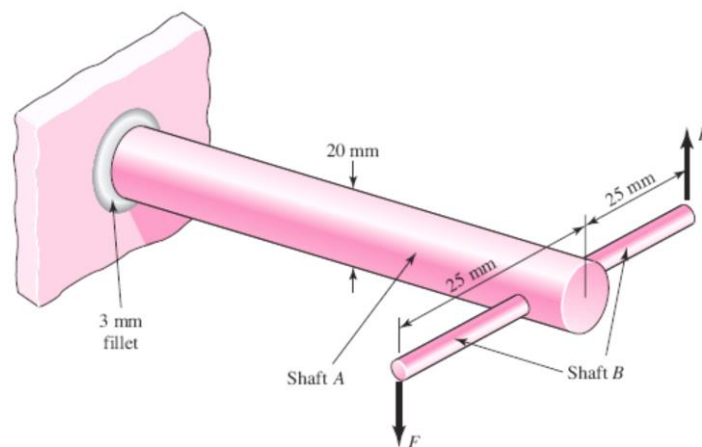


Figure 1

Student's performance in the above question is given below in Table A4.3:

Table A4.3: Student's performance in question targeting 'A1'; course: UME504

S. No.	Roll No. and Name	Marks (MM: 13)	Score (Scale 1 to 5)
1	101308001 [Ankit Juneja]	6	4
2	101308002 [Abhinav]	0	0
3	101308003 [Abhishek Kumar Verma]	0	0
4	101308004 [Abhyuday Singh]	7	5
5	101308006 [Aditya Agrawal]	7	5
6	101308007 [Ajeet Pal Singh]	5	4
7	101308008 [Akash Malhotra]	4	4
8	101308009 [Akash Reddy Kakularam]	0	0
9	101308010 [Akash Sharma]	4	4
10	101308011 [Akashdeep S.Gandhi]	3	3
11	101308012 [Akshay Kumar]	5	4
12	101308014 [Aneesh Kejariwal]	3	3
13	101308016 [Ankur Goyal]	4	4
14	101308017 [Ankush Bansal]	6	4
15	101308018 [Anoop]	2	3
16	101308019 [Anshaj Jindal]	4	4
17	101308020 [Anuj Jain]	6	4
18	101308021 [Arshdeep Singh]	4	4
19	101308023 [Bhabuk Goyal]	5	4
20	101308024 [Bhajanpreet Singh]	4	4
21	101308025 [Bhuvanyu]	3	3
22	101308026 [Bipin Loi]	2	3
23	101308027 [Brhamjyot Singh Sandhu]	10	5
24	101308028 [Deepak Dalal]	8	5
25	101308029 [Deepak Sharma]	7	5
26	101308031 [Dhiraj Dureja]	7	5
27	101308032 [Dildeep Singh]	6	4
28	101308034 [Ekjyot Singh]	7.5	5
29	101308035 [Gagandeep Singh]	10	5
30	101308036 [Gautam Dawar]	5	4
31	101308037 [Gurkirat Pal Singh]	5	4
32	101308038 [Gurkirat Singh Sangha]	6	4
33	101308039 Gurpreet Singh	5	4
34	101308040 Gurpreet Singh	3	3
35	101308042 Gurtej Singh	4	4
36	101308043 Guruteshwar Singh	1	3
37	101308044 Harjot Singh	4	4
38	101308045 Harnoor Singh	7	5

S. No.	Roll No. and Name	Marks (MM: 13)	Score (Scale 1 to 5)
39	101308046 Harsh Narang	13	5
40	101308047 Harsimranpreet Singh	6	4
41	101308048 Hemant Aggarwal	6	4
42	101308050 Iknoor Singh	8	5
43	101308051 Ishdeep Arora	8	5
44	101308052 Japdanish Singh	5	4
45	101308053 Jashanpreet Singh	5	4
46	101308054 Jaskaran Singh	5	4
47	101308055 Jatin Khosla	10.5	5
48	101308057 Kanav Bansal	5	4
49	101308060 Karan Chopra	5.5	4
50	101308061 Karan Goyal	7	5
51	101308063 Karan Veer Dewan	9	5
52	101308064 Karanbir Singh	7.5	5
53	101308065 Kashish Khurana	6	4
54	101308066 Keshav Jindal	7	5
55	101308068 Khushwinder Singh	5	4
56	101308072 Lovedeep Garg	5	4
57	101308073 Manavdeep Singh Grover	10	5
58	101308076 Manpreet Singh	0	0
59	101308100 Shikhar Bhardwaj	7	5

The overall performance of students in the above question is then summarized as given below in Table A4.4:

Table A4.4: Average score of student performance in the course UME504 for criteria A1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME504	32.2	49.15	11.86	0	6.7	4

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria A1 as given below in Table A4.5:

Table A4.5: Weighted Average Student class performance (course portfolio) for criteria A1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME302	31.2	23.2	20.8	19.2	5.6	3.55	4
UME504	32.2	49.15	11.86	0	6.7	4.00	5

Weighted average score	31.76	37.62	15.83	8.53	6.21	3.80	9
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b) Indirect measures for Performance criteria A1 (Surveys)

i.) Assessment Tool: Student Course Survey

Table A4.6: Average score of student course survey for criteria A1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME302	24	68	7	0	0	4.13	4
UME504	12.85	24.76	38.56	16.66	7.14	3.19	5
Weighted average score	17.81	43.98	24.53	9.26	3.97	3.61	9

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table A4.7: Assessment for criteria A1 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	26.67	51.67	18.33	1.67	1.67	4.00
Alumni survey	48.72	20.09	31.82	0	0	4.19
Employer Survey	31.82	68.18	0	0	0	4.3182

c) Overall weighted average score of performance criterion 'A1'

Finally overall weighted average score of performance criterion 'A1' is evaluated as given below in Table A4.8:

Table A4.8: Overall weighted average score of performance criterion 'A1'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	31.76	37.62	15.83	8.53	6.21	3.80	5
Weighted average student course survey	17.81	43.98	24.53	9.26	3.97	3.61	4
Graduating student survey	26.67	51.67	18.33	1.67	1.67	4.00	3
Alumni survey	48.72	20.09	31.82	0	0	4.19	3
Employer survey	31.82	68.18	0	0	0	4.32	3
Overall weighted score	30.65	43.55	18.21	4.71	2.89	3.94	18

Assessment of Outcome 'A' using performance criterion A2

Performance criteria 'A2': Demonstrate knowledge of fundamentals, scientific and/or engineering principles.

a.) Assessment Tool: Student's performance using course portfolio

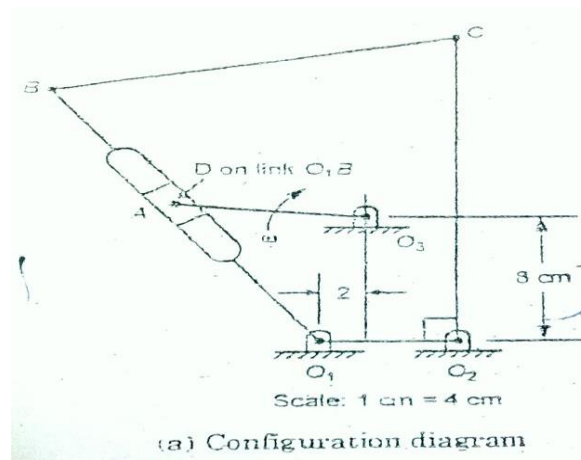
Step 1: Two courses namely Kinematics of Machines (UME302) and Machine Design (UME504) were used to assess performance criteria A2 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Kinematics of Machines (UME302)

The above performance criteria is used to measure the attainment of outcome 'A2' by giving the following question (question No. 2: during MST in September in 2015, weightage 20 marks) to the students.

Question: The dimensions of mechanism shown in fig.1 are $O_1O_2 = 6\text{cm}$, $O_3A = 8\text{cm}$, $O_1B = 20\text{cm}$, $BC = 18\text{cm}$, $O_2C = 20\text{cm}$, $\angle O_1O_2C = 90^\circ$. Draw the mechanism.

The crank O_3A rotates uniformly at 20 rad/sec clockwise. Determine the velocity of slider A and angular velocity link BC. Use relative velocity (vector) method. Why is it required in developing or analysing mechanisms/ machines.



Student's performance in the above question is given below in Table A4.9:

Table A4.9: Student's performance in question targeting 'A2'; course: UME302

Sr.No.	Roll no.	Marks(MM:20)	Score (Scale 1 to 5)
1.	101408001	04	2
2.	101408002	03	2
3.	101408003	03	2
4.	101408004	06	3
5.	101408005	14	5
6.	101408006	13	5
7.	101408007	05	2
8.	101408008	00	1

9.	101408009	08	3
10.	101408010	19	5
11.	101408011	04	2
12.	101408012	00	1
13.	101408013	06	3
14.	101408014	03	2
15.	101408016	11	4
16.	101408017	17	5
17.	101408019	08	3
18.	101408020	03	2
19.	101408021	00	1
20.	101408022	00	1
21.	101408023	15	5
22.	101408024	10	3
23.	101408025	10	3
24.	101408026	10	3
25.	101408028	05	2
26.	101408029	11	4
27.	101408030	15	5
28.	101408031	00	1
29.	101408033	05	2
30.	101408034	18	5
31.	101408035	04	2
32.	101408036	03	2
33.	101408037	00	1
34.	101408038	06	3
35.	101408039	04	2
36.	101408040	16	5
37.	101408041	06	3
38.	101408042	02	2
39.	101408043	06	3
40.	101408044	13	5
41.	101408045	02	2
42.	101408046	01	1
43.	101408047	03	2
44.	101408048	00	1
45.	101408049	03	2
46.	101408050	06	3
47.	101408051	04	2
48.	101408052	03	2
49.	101408055	01	1
50.	101408056	07	3
51.	101408057	03	2
52.	101408058	05	2
53.	101408059	04	2
54.	101408060	02	2
55.	101408061	02	2
56.	101408062	07	3

57.	101408063	06	3
58.	101408064	15	5
59.	101408065	04	2
60.	101408066	00	1
61.	101408067	08	3
62.	101408068	03	2
63.	101408069	00	1
64.	101408070	05	2
65.	101408071	11	4
66.	101408073	07	3
67.	101408074	05	2
68.	101408075	00	1
69.	101408076	03	2
70.	101408077	06	3
71.	101408078	06	3
72.	101408079	14	5
73.	101408080	06	3
74.	101409001	05	2
75.	101409002	00	1
76.	101409003	05	2
77.	101409004	12	4
78.	101409005	04	2
79.	101409006	18	5
80.	101409007	06	3
81.	101409009	03	2
82.	101409010	07	3
83.	101409011	04	2
84.	101409012	08	3
85.	101409013	04	2
86.	101409015	06	3
87.	101409016	04	2
88.	101409018	00	1
89.	101409019	14	5
90.	101409020	00	1
91.	101409021	04	2
92.	101409022	04	2
93.	101409025	04	2
94.	101409027	00	1
95.	101409028	01	2
96.	101409029	13	5
97.	101409030	04	2
98.	101409031	18	5
99.	101409032	04	2
100.	101409033	02	2
101.	101409034	04	2
102.	101409035	06	2
103.	101409036	02	2
104.	101409037	18	5

105.	101409038	16	5
106.	101409039	04	2
107.	101409040	07	3
108.	101409041	01	2
109.	101459001	03	2
110.	101459002	09	3
111.	101459003	06	3
112.	101459004	10	3
113.	101459005	01	2
114.	101588001	04	2
115.	101588002	05	2
116.	101588004	14	5
117.	101588005	14	5
118.	101588006	04	2
119.	101588010	06	3
120.	101588011	09	3
121.	101588013	06	3
122.	101588015	20	5
123.	101589002	05	2
124.	101589003	06	3
125.	101589004	05	2

The overall performance of student in the above question is then summarised as given below in Table A4.10:

Table A4.10: average score of the student performance in the course UME302 for criteria A2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME302	16	4	24.8	42.4	12.8	2.68

(ii) Course: Machine Design (UME504)

The above performance criteria is used to measure the attainment of outcome 'A2' by giving the following question (Question No. 4: during MST in September 2015, weightage 12 marks) to the students.

Question: A drive shaft supporting a spur gear and overhung pulley wheel is mounted on two bearings as illustrated in figure 2. The power to be transmitted is 8 kW at 900 rpm. The masses of the gear and pulley are 8 and 10 kg, respectively. The ratio of belt tensions should be taken as 2.5. Sunk keys are used to transmit torque through the gear and pulley. Determine the minimum diameter for the shaft using the ASME equation for the design of transmission shafting. Assume the combined shock and fatigue factor for bending and torsion as 1.5 and 1.0, respectively.

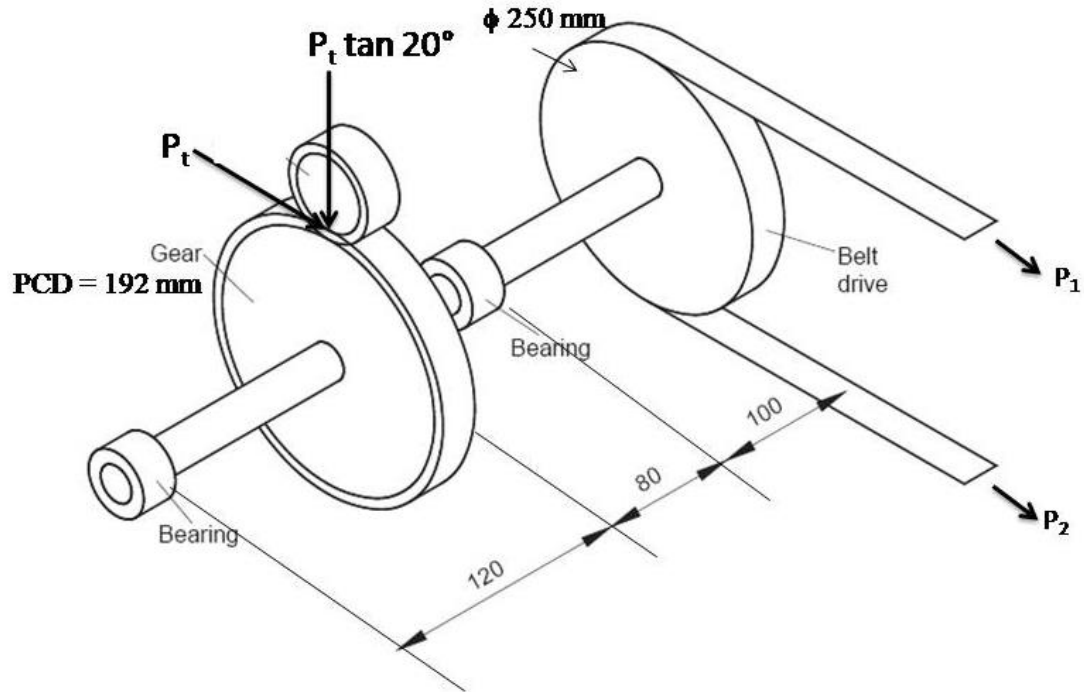


Figure 2

Student's performance in the above question is given below in Table A4.11:

Table A4.11: Student's performance in question targeting 'A2'; course: UME504

S. No.	Roll No. and Name	Marks (MM: 12)	Score (Scale 1 to 5)
1	101308001 [Ankit Juneja]	4	3
2	101308002 [Abhinav]	2	2
3	101308003 [Abhishek Kumar Verma]	2	2
4	101308004 [Abhyuday Singh]	9.5	5
5	101308006 [Aditya Agrawal]	3	3
6	101308007 [Ajeet Pal Singh]	9.5	5
7	101308008 [Akash Malhotra]	9.5	5
8	101308009 [Akash Reddy Kakularam]	3	3
9	101308010 [Akash Sharma]	3	3
10	101308011 [Akashdeep S.Gandhi]	2.5	2
11	101308012 [Akshay Kumar]	6	4
12	101308014 [Aneesh Kejariwal]	8	5
13	101308016 [Ankur Goyal]	5.5	4
14	101308017 [Ankush Bansal]	7	5
15	101308018 [Anoop]	5	4

S. No.	Roll No. and Name	Marks (MM: 12)	Score (Scale 1 to 5)
16	101308019 [Anshaj Jindal]	7.5	5
17	101308020 [Anuj Jain]	6.5	4
18	101308021 [Arshdeep Singh]	10.5	5
19	101308023 [Bhabuk Goyal]	5	4
20	101308024 [Bhajanpreet Singh]	3	3
21	101308025 [Bhuvanyu]	2	2
22	101308026 [Bipin Loi]	0	0
23	101308027 [Brhamjyot Singh Sandhu]	2	2
24	101308028 [Deepak Dalal]	8.5	5
25	101308029 [Deepak Sharma]	10	5
26	101308031 [Dhiraj Dureja]	5.5	4
27	101308032 [Dildeep Singh]	5	4
28	101308034 [Ekjyot Singh]	5	4
29	101308035 [Gagandeep Singh]	7	5
30	101308036 [Gautam Dawar]	4.5	3
31	101308037 [Gurkirat Pal Singh]	4	3
32	101308038 [Gurkirat Singh Sangha]	4	3
33	101308039 Gurpreet Singh	8	5
34	101308040 Gurpreet Singh	0	0
35	101308042 Gurtej Singh	5	4
36	101308043 Guruteshwar Singh	0	0
37	101308044 Harjot Singh	1	1
38	101308045 Harnoor Singh	10	5
39	101308046 Harsh Narang	6.5	4
40	101308047 Harsimranpreet Singh	3.5	3
41	101308048 Hemant Aggarwal	5.5	4
42	101308050 Iknoor Singh	0	0
43	101308051 Ishdeep Arora	7	5
44	101308052 Japdanish Singh	3.5	3
45	101308053 Jashanpreet Singh	10.5	5
46	101308054 Jaskaran Singh	4	3
47	101308055 Jatin Khosla	12	5

S. No.	Roll No. and Name	Marks (MM: 12)	Score (Scale 1 to 5)
48	101308057 Kanav Bansal	10	5
49	101308060 Karan Chopra	3	3
50	101308061 Karan Goyal	6	4
51	101308063 Karan Veer Dewan	9	5
52	101308064 Karanbir Singh	1.5	2
53	101308065 Kashish Khurana	6.5	4
54	101308066 Keshav Jindal	10	5
55	101308068 Khushwinder Singh	7.5	5
56	101308072 Lovedeep Garg	11	5
57	101308073 Manavdeep Singh Grover	7.5	5
58	101308076 Manpreet Singh	1	1
59	101308100 Shikhar Bhardwaj	2	2

The overall performance of students in the above question is then summarized as given below in Table A4.12:

Table A4.12: Average score of student performance in the course UME504 for criteria A2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME504	44.68	27.65	14.89	4.25	8.51	3.96

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria A2 as given below in Table A4.13:

Table A4.13: Weighted Average Student class performance (course portfolio) for criteria A2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME302	16	4	24.8	42.4	12.8	2.68	4
UME504	44.68	27.65	14.89	4.25	8.51	3.96	5
Weighted average score	31.93	17.14	19.29	21.21	10.42	3.39	9

b.) Assessment Tool: Student Course Survey

Table A4.14: Average score of student course survey for criteria A2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME302	24	68	7	0	0	4.13	4
UME504	12.85	24.76	38.56	16.66	7.14	3.19	5
Weighted average score	17.81	43.98	24.53	9.26	3.97	3.61	9

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table A4.15: Assessment for criteria A2 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	26.67	51.67	18.33	1.67	1.67	4.00
Alumni survey	48.72	20.09	31.82	0	0	4.19
Employer Survey	31.82	68.18	0	0	0	4.3182

Finally overall weighted average score of performance criterion ‘A2’ is evaluated as given below in Table A4.16:

Table A4.16.: Overall weighted average score of performance criterion ‘A2’

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	31.93	17.14	19.29	21.21	10.42	3.39	5
Weighted average student course survey	17.81	43.98	24.53	9.26	3.97	3.61	4
Graduating student survey	26.67	51.67	18.33	1.67	1.67	4.00	3
Alumni survey	48.72	20.09	31.82	0	0	4.19	3
Employer survey	31.82	68.18	0	0	0	4.32	3
Overall weighted score	30.70	37.86	19.17	8.23	4.05	3.83	18

Assessment of Outcome ‘A’ using performance criterion A3

Performance criteria ‘A3’: Applying scientific and/or engineering principles towards solving engineering problems.

a.) Assessment Tool: Student’s performance using course portfolio

Step 1: Two courses namely Kinematics of Machines (UME302) and Machine Design (UME504) were used to assess performance criteria A3 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Kinematics of Machines (UME302)

The above performance criteria is used to measure the attainment of outcome 'A3' by giving the following question (question No. 3: during MST in September in 2015, weightage 20 marks) to the students.

Question: In the mechanism shown in Fig 3. Determine the acceleration of the slider C. $O_1A = 100\text{mm}$, $AB = 120\text{mm}$, $O_2B = 150\text{mm}$, and $BC = 350\text{mm}$. The crank O_1A rotates at 240rpm. Draw space diagram, velocity diagram and acceleration diagram to find out acceleration of slider C.

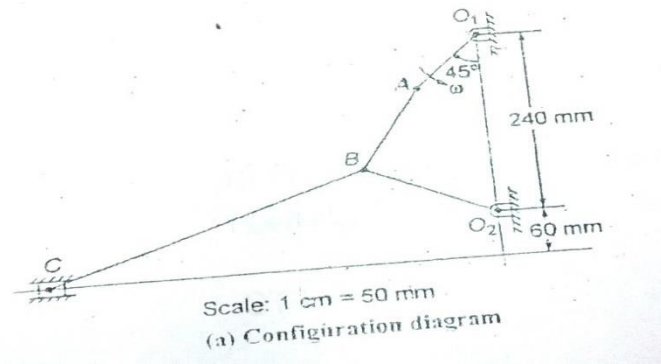


Figure 3

Student's performance in the above question is given below in Table A4.17:

Table A4.17: Student's performance in question targeting 'A3'; course: UME302

Sr.No.	Roll no.	Marks(MM:20)	Score (Scale 1 to 5)
1.	101408001	07	4
2.	101408002	04	3
3.	101408003	00	1
4.	101408004	06	3
5.	101408005	10	4
6.	101408006	07	4
7.	101408007	03	2
8.	101408008	03	2
9.	101408009	05	3
10.	101408010	00	1
11.	101408011	11	5
12.	101408012	00	1
13.	101408013	06	3
14.	101408014	03	2
15.	101408016	09	4
16.	101408017	05	3
17.	101408019	09	4

18.	101408020	09	4
19.	101408021	00	1
20.	101408022	05	3
21.	101408023	15	5
22.	101408024	03	2
23.	101408025	05	3
24.	101408026	07	4
25.	101408028	10	4
26.	101408029	05	3
27.	101408030	00	1
28.	101408031	14	5
29.	101408033	07	4
30.	101408034	10	4
31.	101408035	03	2
32.	101408036	10	4
33.	101408037	05	3
34.	101408038	03	2
35.	101408039	05	3
36.	101408040	03	2
37.	101408041	03	2
38.	101408042	07	4
39.	101408043	12	5
40.	101408044	00	1
41.	101408045	12	5
42.	101408046	09	4
43.	101408047	07	4
44.	101408048	03	2
45.	101408049	05	3
46.	101408050	07	4
47.	101408051	03	2
48.	101408052	00	1
49.	101408055	01	2
50.	101408056	00	1
51.	101408057	03	2
52.	101408058	03	2
53.	101408059	00	1
54.	101408060	03	2
55.	101408061	00	1
56.	101408062	03	2
57.	101408063	02	2
58.	101408064	06	3
59.	101408065	00	1
60.	101408066	09	4
61.	101408067	02	2
62.	101408068	03	2
63.	101408069	03	2
64.	101408070	07	4
65.	101408071	16	5

66.	101408073	06	3
67.	101408074	03	2
68.	101408075	00	1
69.	101408076	03	2
70.	101408077	07	4
71.	101408078	03	2
72.	101408079	09	4
73.	101408080	03	2
74.	101409001	03	2
75.	101409002	07	4
76.	101409003	07	4
77.	101409004	05	3
78.	101409005	03	2
79.	101409006	00	1
80.	101409007	10	4
81.	101409009	08	4
82.	101409010	03	2
83.	101409011	03	2
84.	101409012	20	5
85.	101409013	03	2
86.	101409015	07	4
87.	101409016	05	3
88.	101409018	07	4
89.	101409019	07	4
90.	101409020	06	3
91.	101409021	06	3
92.	101409022	00	1
93.	101409025	05	3
94.	101409027	03	2
95.	101409028	00	1
96.	101409029	03	2
97.	101409030	05	3
98.	101409031	06	3
99.	101409032	03	2
100.	101409033	03	2
101.	101409034	10	4
102.	101409035	05	3
103.	101409036	02	2
104.	101409037	15	5
105.	101409038	10	4
106.	101409039	07	4
107.	101409040	04	3
108.	101409041	07	4
109.	101459001	06	3
110.	101459002	03	2
111.	101459003	03	2
112.	101459004	07	4
113.	101459005	00	1

114.	101588001	00	1
115.	101588002	04	3
116.	101588004	09	4
117.	101588005	13	5
118.	101588006	02	2
119.	101588010	03	2
120.	101588011	07	4
121.	101588013	07	4
122.	101588015	09	4
123.	101589002	03	2
124.	101589003	00	1
125.	101589004	06	3

The overall performance of student in the above question is then summarised as given below in Table A4.18:

Table A4.18: average score of the student performance in the course UME302 for criteria A3

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME302	7.2	28	20	30.4	14.4	2.83

(II) Course: Machine Design (UME504)

The above performance criteria is used to measure the attainment of outcome 'A2' by giving the following question (Question No. 3: during MST in September 2015, weightage 13 marks) to the students.

Question: The machine elements of an assembly shown in figure 3 are designed to transmit 1000 Nm torque. Determine the factor of safety for each element for all possible modes of failure by strength considerations.

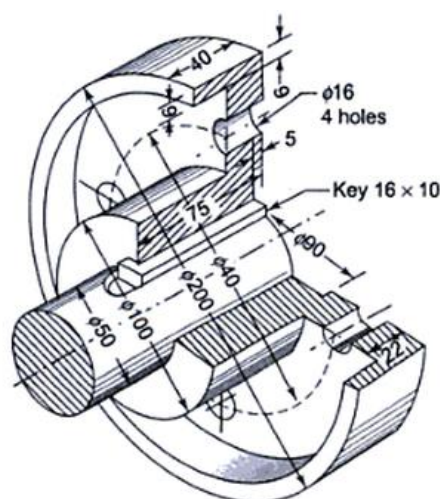


Figure 3

Student's performance in the above question is given below in Table A4.19:

Table A4.19: Student's performance in question targeting 'A3'; course: UME504

S. No.	Roll No.	Marks (MM: 13)	Score (Scale 1 to 5)
1	101308001 [Ankit Juneja]	2.5	3
2	101308002 [Abhinav]	0	1
3	101308003 [Abhishek Kumar Verma]	0	1
4	101308004 [Abhyuday Singh]	3.5	3
5	101308006 [Aditya Agrawal]	4	4
6	101308007 [Ajeet Pal Singh]	7.5	5
7	101308008 [Akash Malhotra]	0	1
8	101308009 [Akash Reddy Kakularam]	1	3
9	101308010 [Akash Sharma]	3	3
10	101308011 [Akashdeep S.Gandhi]	2	3
11	101308012 [Akshay Kumar]	0	1
12	101308014 [Aneesh Kejariwal]	0	1
13	101308016 [Ankur Goyal]	6	4
14	101308017 [Ankush Bansal]	0	1
15	101308018 [Anoop]	2.5	3
16	101308019 [Anshaj Jindal]	5.5	4
17	101308020 [Anuj Jain]	7	5
18	101308021 [Arshdeep Singh]	0	1
19	101308023 [Bhabuk Goyal]	8	5
20	101308024 [Bhajanpreet Singh]	6.5	4
21	101308025 [Bhuvanyu]	1.5	3
22	101308026 [Bipin Loi]	0	1
23	101308027 [Brhamjyot Singh Sandhu]	5	4
24	101308028 [Deepak Dalal]	1	3
25	101308029 [Deepak Sharma]	4.5	4
26	101308031 [Dhiraj Dureja]	2.5	3
27	101308032 [Dildeep Singh]	8	5
28	101308034 [Ekjyot Singh]	11.5	5
29	101308035 [Gagandeep Singh]	11.5	5
30	101308036 [Gautam Dawar]	11	5
31	101308037 [Gurkirat Pal Singh]	9.5	5

S. No.	Roll No.	Marks (MM: 13)	Score (Scale 1 to 5)
32	101308038 [Gurkirat Singh Sangha]	8.5	5
33	101308039 Gurpreet Singh	3.5	3
34	101308040 Gurpreet Singh	6	4
35	101308042 Gurtej Singh	0	1
36	101308043 Guruteshwar Singh	0	1
37	101308044 Harjot Singh	2	3
38	101308045 Harnoor Singh	6.5	4
39	101308046 Harsh Narang	8	5
40	101308047 Harsimranpreet Singh	0	1
41	101308048 Hemant Aggarwal	5.5	4
42	101308050 Iknoor Singh	1	3
43	101308051 Ishdeep Arora	7	5
44	101308052 Japdanish Singh	7.5	5
45	101308053 Jashanpreet Singh	2.5	3
46	101308054 Jaskaran Singh	4	4
47	101308055 Jatin Khosla	7.5	5
48	101308057 Kanav Bansal	11	5
49	101308060 Karan Chopra	0	1
50	101308061 Karan Goyal	7.5	5
51	101308063 Karan Veer Dewan	5.5	4
52	101308064 Karanbir Singh	0	1
53	101308065 Kashish Khurana	11	5
54	101308066 Keshav Jindal	4	4
55	101308068 Khushwinder Singh	9	5
56	101308072 Lovedeep Garg	6	4
57	101308073 Manavdeep Singh Grover	8	5
58	101308076 Manpreet Singh	0	1
59	101308100 Shikhar Bhardwaj	1	3

The overall performance of students in the above question is then summarized as given below in Table A4.20:

Table A4.20: Average score of student performance in the course UME504 for criteria A3

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME504	30.5	22.03	15.25	8.4	23.72	3.27

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria A3 as given below in Table A4.21:

Table A4.21: Weighted Average Student class performance (course portfolio) for criteria A3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME302	7.2	28	20	30.4	14.4	2.83	4
UME504	30.5	22.03	15.25	8.4	23.72	3.27	5
Weighted average score	20.14	24.68	17.36	18.18	19.58	3.07	9

b.) Assessment Tool: Student Course Survey

Table A4.22: Average score of student course survey for criteria A3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME302	24	68	7	0	0	4.13	4
UME504	12.85	24.76	38.56	16.66	7.14	3.19	5
Weighted average score	17.81	43.98	24.53	9.26	3.97	3.61	9

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table A4.23: Assessment for criteria A3 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	26.67	51.67	18.33	1.67	1.67	4.00
Alumni survey	48.72	20.09	31.82	0	0	4.19
Employer Survey	31.82	68.18	0	0	0	4.3182

Finally overall weighted average score of performance criterion 'A3' is evaluated as given below in Table A4.24:

Table A4.24.: Overall weighted average score of performance criterion 'A3'

Assessment tools	% of students in each score					Average weighte	Assessme nt tool
	5	4	3	2	1		

						d score	weight
Weighted average student class performance	20.14	24.68	17.36	18.18	19.58	3.07	5
Weighted average student course survey	17.81	43.98	24.53	9.26	3.97	3.61	4
Graduating student survey	26.67	51.67	18.33	1.67	1.67	4.00	3
Alumni survey	48.72	20.09	31.82	0	0	4.19	3
Employer survey	31.82	68.18	0	0	0	4.32	3
Overall weighted score	27.42	39.95	18.63	7.38	6.60	3.74	18

Assessment of Outcome 'A' using performance criterion A4

Performance criteria 'A4' : Applying statistical methods in analyzing data.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Numerical and Statistical Methods (UMA032) and Total Quality Management (UHU-033) were used to assess performance criteria A4 as a direct measure. The analysis for each of these courses is provided below:

(I) Course: Numerical and Statistical Methods (UMA032)

The above performance criteria is used to measure the attainment of outcome by giving the following question (Question No. 3, 4 and 5: during EST in December 2014) to the students.

Q. 3. (A) The two lines of regression are $x + 2y = 5$ and $2x + 3y = 8$. The variance of x data is 12. Calculate the mean of x and y data, correlation coefficient r and variance of y data. Also obtain the angle between two regression lines.

(B) Find the least square approximation of second degree for the discrete data by solving the 3×3 system of normal equations using the Gauss elimination method.

x	0	1	2	3	4
f(x)	-5	-3	3	10	12

[3.0+4.0]

Q 4. (A) Write the probability mass function of Poisson distribution and calculate its mean and variance using usual notations.

(B) It has been claimed that in 60% of all solar-heat installations the utility bill is reduced. Accordingly, what are the probabilities that the utility bill will be reduced in (i) four of five installations, (ii) at least four of five installations?

(C) Define memoryless property of a probability distribution and show that the exponential distribution (with parameter λ) has memoryless property. [3.0+3.0+2.0]

Q. 5 (A) The Probability distribution of a random variable X is

$$f(x) = k \sin \frac{\pi x}{5}, 0 \leq x \leq 5$$

Determine the constant k, the median, and cumulative distribution function.

(B) A bird watcher sitting in a park has spotted 54 birds belonging to six categories. The exact classification is given below :

Category :	1	2	3	4	5	6
Frequency :	6	7	13	17	6	5

Test at 5% level of significance whether or not the data is compatible with the assumption that the particular park is visited by the birds belonging to these six categories in the ratio 1 : 1 : 2 : 3 : 1 : 1. Given that the chi-square variate at 5 and 6 degree of freedom are respectively 11.07 and 12.59 at the 5% level of significance.

(C) In a normal distribution of marks, 10.03% students score less than 25 marks and 89.97% students score less than 70 marks. What are the mean and variance of the distribution? Given that $P(0 < Z < 1.27) = 0.3980$, $P(0 < Z < 1.28) = 0.3997$, $P(0 < Z < 1.29) = 0.4015$, where Z is a standard normal variate. [3.0+3.0+3.0]

Student's performance in the above question is given below in Table A4.25:

Table A4.25: Student's performance in question targeting 'A4'; course: UMA032

S. No.	Roll No.	Q3 7 points	Q4 8 points	Q5 9 points	Total 24 points	Score (Scale 1 to 5)
1	101308033	5	3.5	2.5	11	4
2	101308059	5	2.5	1.5	9	4
3	101308067	0	1	0	1	1
4	101308069	7	5.5	8	20.5	5
5	101308070	0	0	2.5	2.5	2
6	101308071	2.5	0	1	3.5	2
7	101308074	0	0	0	0	1
8	101308075	4	3	1.5	8.5	4
9	101308077	1	1	1	3	2
10	101308078	2	3	2	7	3
11	101308079	5	5.5	8	18.5	5
12	101308080	7	4	6.5	17.5	5
13	101308081	6.5	7	8	21.5	5
14	101308082	0	0	0	0	1
15	101308083	1.5	3.5	2.5	7.5	3
16	101308084	0	0	0	0	1
17	101308085	3.5	0.5	0.5	4.5	2
18	101308088	6.5	4	7	17.5	5
19	101308089	0	0	0	0	1
20	101308090	1.5	5.5	0.5	7.5	3
21	101308091	5.5	6	9	20.5	5
22	101308093	1	3	0	4	2
23	101308094	1.5	6	4	11.5	4
24	101308096	6	1.5	5	12.5	5
25	101308097	0	2.5	0	2.5	2
26	101308098	3	0	0	3	2
27	101308099	2	0.5	3	5.5	2
28	101308101	6.5	5.5	2.5	14.5	5
29	101308102	5.5	0.5	2	8	4

30	101308103	7	4	5.5	16.5	5
31	101308104	2	0.5	5	7.5	3
32	101308105	3	0	6.5	9.5	4
33	101308106	7	3.5	1.5	12	5
34	101308108	1.5	3.5	1	6	3
35	101308109	5.5	3.5	2.5	11.5	4
36	101308110	3	3	2.5	8.5	4
37	101308111	0.5	1.5	2	4	2
38	101308112	0	3	1.5	4.5	2
39	101308113	7	6.5	4.5	18	5
40	101308114	3	3	1	7	3
41	101308115	5	0.5	4	9.5	4
42	101308116	7	0	1.5	8.5	4
43	101308117	4	3.5	1	8.5	4
44	101308119	5.5	3	5	13.5	5
45	101308120	5.5	6.5	7	19	5
46	101308121	0	0	0	0	1
47	101308122	5	2.5	2.5	10	4
48	101308123	5.5	3.5	6.5	15.5	5
49	101308124	3	3	7.5	13.5	5
50	101308125	6.5	2	2.5	11	4

The overall performance of student in the above question is then summarised as given below in Table A4.26:

Table A4.26: average score of the student performance in the course UMA032 for criteria A4

Course	% of students in each score					Average Score
	5	4	3	2	1	
UMA032	30	26	12	20	12	3.42

(II) Course: Total Quality Management (UHU-033)

The above performance criteria is used to measure the attainment of outcome 'CLO-5' by giving the following question (Question No. 2-d: during EST in May, 2015, weightage 8 marks) to the students.

Question: The number of non-conformities is determined for 15 samples, with the amount of each sample varies. Construct an appropriate control chart for the number of non-conformities per 100m.

Subgroup	N(Length)	C(non-conformities)
1	110	120
2	82	94
3	96	89

4	115	162
5	108	150
6	56	82
7	120	143
8	98	134
9	102	97
10	115	145
11	88	128
12	71	83
13	95	120
14	103	116
15	113	127

Student's performance in the above question is given below in Table A4.27:

Table A4.27: Student's performance in question targeting 'A4'; course: UHU033

S. No.	Roll No.	Marks (MM: 08)	Score (Scale 1 to 5)
1	101308015	4	3
2	101308033	4	3
3	101308059	1.5	2
4	101308067	3	3
5	101308069	8	5
6	101308070	2	3
7	101308071	2	3
8	101308074	4	3
9	101308075	6.5	5
10	101308077	2.5	3
11	101308078	1.5	2
12	101308079	7	5
13	101308080	7.5	5
14	101308081	8	5
15	101308082	5	4
16	101308083	4.5	4
17	101308084	1.5	2
18	101308085	1.5	2
19	101308088	8	5
20	101308089	2	3

21	101308090	5	3
22	101308091	4.5	4
23	101308093	1.5	2
24	101308094	1.5	2
25	101308096	3.5	3
26	101308097	1.5	2
27	101308098	1.5	2
28	101308099	6	5
29	101308101	2.5	3
30	101308102	6	5
31	101308103	7.5	5
32	101308104	8	5
33	101308105	1.5	2
34	101308106	8	5
35	101308108	1.5	2
36	101308109	7.5	5
37	101308110	7.5	5
38	101308111	1.5	2
39	101308112	4.5	4
40	101308113	7.5	5
41	101308114	2	3
42	101308115	1.5	2
43	101308116	3.5	3
44	101308117	7	5
45	101308118	8	5
46	101308119	3.5	3
47	101308120	2	3
48	101308121	2	3
49	101308122	4	3
50	101308123	8	5
51	101308124	2	3
52	101308125	1.5	2
53	101488008	2	3

54	1014880012	5.5	4
55	1014880013	2	3
56	1014880014	8	5
57	1014880015	2.5	3
58	1014880016	6	4
59	1014880017	4.5	4
60	1014880018	2.5	3

The overall performance of students in the above question is then summarized as given below in Table A4.28:

Table A4.28: Average score of student performance in the course UHU-033 for criteria A4

Course	% of students in each score					Average Score
	5	4	3	2	1	
UTA002	30	11.6	33.3	25	0	3.5

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria A4 as given below in Table A4.29:

Table A4.29: Weighted Average Student class performance (course portfolio) for criteria A4

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UMA032	30	26	12	20	12	3.42	5
UMA033	30	11.6	33.3	25	0	3.46	4
Weighted average score	30.00	19.60	21.47	22.22	6.67	3.44	9

b.) Assessment Tool: Student Course Survey

Table A4.30: Average score of student course survey for criteria A4

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UMA032	24.66	33.45	28.72	9.46	3.72	3.66	5
UMA033	24	68	7	0	0	4.13	4
Weighted average score	24.37	48.81	19.07	5.26	2.07	3.87	9

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table A4.31.: Assessment for criteria A4 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	26.67	51.67	18.33	1.67	1.67	4.00
Alumni survey	48.72	20.09	31.82	0	0	4.19
Employer Survey	31.82	68.18	0	0	0	4.3182

Finally overall weighted average score of performance criterion 'A4' is evaluated as given below in Table A4.32:

Table A4.32: Overall weighted average score of performance criterion 'A4'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	30.00	19.60	21.47	22.22	6.67	3.44	5
Weighted average student course survey	24.37	48.81	19.07	5.26	2.07	3.87	4
Graduating student survey	26.67	51.67	18.33	1.67	1.67	4.00	3
Alumni survey	48.72	20.09	31.82	0	0	4.19	3
Employer survey	31.82	68.18	0	0	0	4.32	3
Overall weighted score	31.62	39.61	18.56	7.62	2.59	3.90	18

Overall assessment of student outcome A using scores of A1, A2, A3 and A4

In the above sections, each of the individual performance criteria A1, A2, A3 and A4 have been assessed. The performance for attainment of outcome A has been completed using the attainment values for A1, A2, A3 and A4 and is provided below:

Table A4.33 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome A.

Table A4.33: Overall score for outcome A at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
A1	30.65	43.55	18.21	4.71	2.89	3.94	5
A2	30.70	37.86	19.17	8.23	4.05	3.83	5
A3	27.42	39.95	18.63	7.38	6.60	3.74	4
A4	31.62	39.61	18.56	7.62	2.59	3.90	3
Overall score	30.07	40.33	18.65	6.89	4.82	3.85	17

Track Record and assessment of attainment of student outcome over the last three academic years

The performance criteria-wise assessment score distribution and overall weighted score for outcome 'A' for last three years, i.e., 2013-2014, 2014-2015 and 2015-2016 are presented in this section.

The following table shows the performance criteria-wise assessment score distribution for outcome 'A'

Student outcomes and performance criteria		Year		
		2013-14	2014-15	2015-16
A	A1	4.4	3.78	3.94
	A2	4.49	3.82	3.83
	A3	4.48	3.93	3.74
	A4	4.5	--	3.90

The above data has been plotted to visualize performance criteria-wise assessment score distribution for outcome 'A' over a period of last three years.

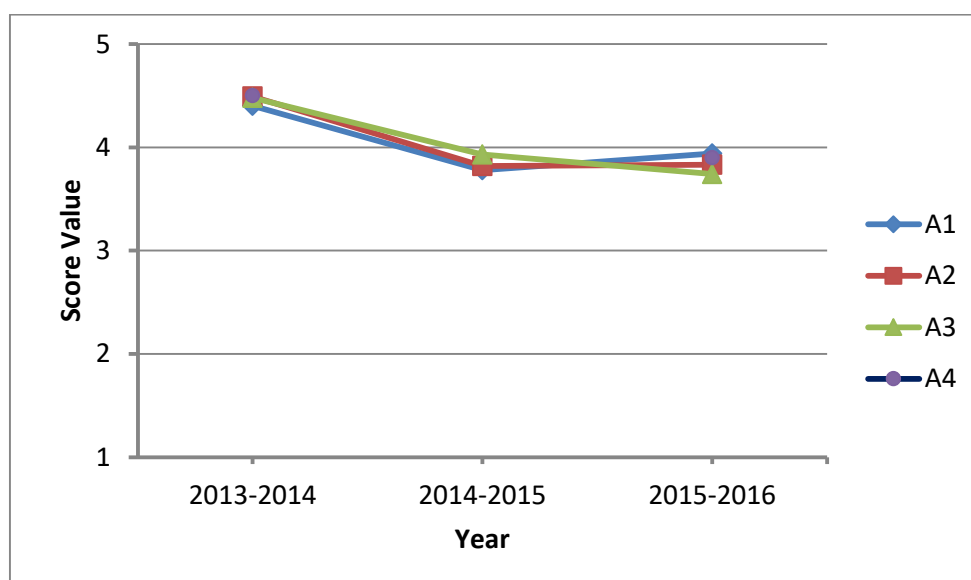


Figure 4.5: Performance criteria-wise assessment score distribution of outcome A

Level of attainment of student outcome over the last three academic years

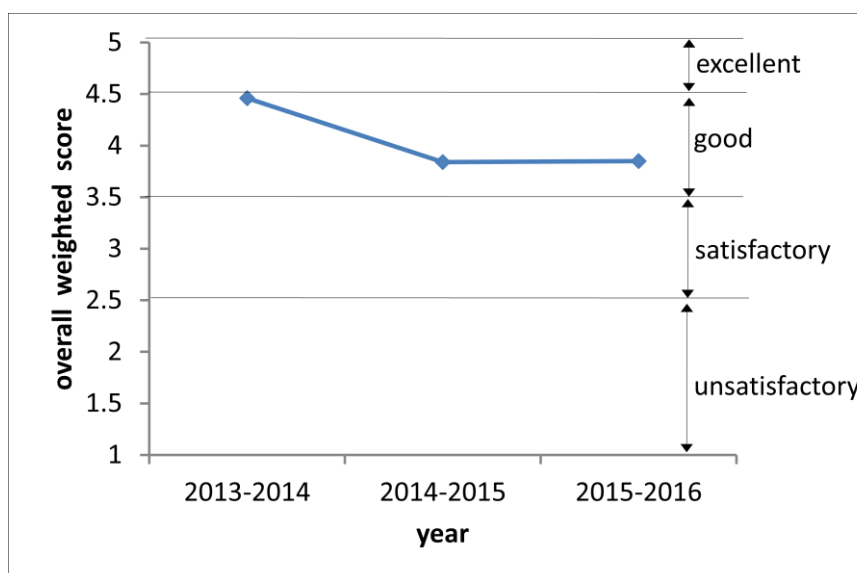
Level of attainment for each outcome is categorized into three categories as given below:

- **Excellent:** Overall weighted score for the outcome ≥ 4.5 on a scale of 1 to 5
- **Good:** Overall weighted score for the outcome between 3.5 to 4.5 on a scale of 1 to 5
- **Satisfactory:** Overall weighted score for the outcome between 2.5 to 3.5 on a scale of 1 to 5
- **Unsatisfactory:** Overall weighted score for the outcome ≤ 2.5 on a scale of 1 to 5

The following table shows the overall weighted score of outcome 'A' over the last three academic years

Year	Overall weighted score	Level of attainment
2013-2014	4.46	good
2014-2015	3.84	good
2015-2016	3.85	good

The above data has been plotted to visualize the overall weighted score of outcome 'A' over a period of last three years.



**Assessment of Attainment of Program Outcome
'B'
(Year 2015)**

for the

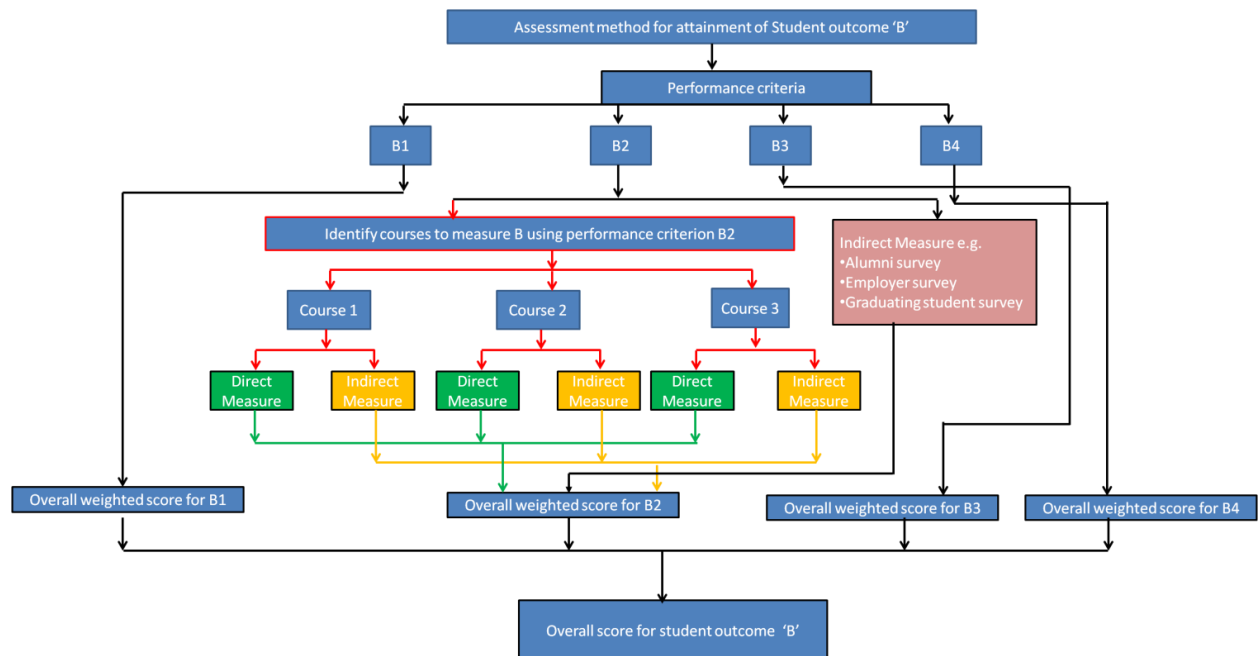
***Bachelor of Engineering
in
Mechanical Engineering***



**Thapar University
Patiala (Punjab) - 147004
INDIA**

Attainment of Outcome B

The attainment of each outcome has been measured using a standard procedure explained in the Self Assessment Report for the program. A flow chart depicting the step by step methodology used to measure each attainment is provided below for ready reference.



The following courses have been considered for the assessment of student outcome 'B'

Courses:

1. Engineering Metrology (UME403)
2. Fluid Machinery (UME703)
3. Heat and Mass Transfer (UME704)
4. Machining Science (UME705)

Outcome B has been assessed by four performance criteria B1, B2, B3 and B4. The sections below provide data for separate assessments for each of these performance criteria and in the end the results for these four performance criteria has been used to measure the overall measure of outcome B.

1) Assessment of Outcome 'B' using performance criterion B1

Performance criteria ‘B1’: Identifying the constraints, assumptions and models for the experiments.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Three courses namely Engineering Metrology (UME403), Fluid Machinery (UME703) and Heat and Mass Transfer (UME704) were used to assess performance criteria B1 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Engineering Metrology (UME403)

The above performance criteria is used to measure the attainment of outcome 'B1' by giving the following question (Question No.:4(a) (ii) in EST, held on May 2015) to the students. The question carries 5 marks.

Question:

Q. 4	(a)	An emblem manufacturing company produces plastic parts in an injection molding machine. The parts are prepared by three operators in different shifts from Monday to Saturday. Overall equipment effectiveness (OEE) is calculated on real time production three times. The company has a policy of maintaining minimum OEE of 92%. The OEE data for each operator are given as under: <table> <tr> <th></th><th>Mon</th><th>Tues</th><th>Wed</th><th>Thurs</th><th>Fri</th><th>Sat</th></tr> <tr> <td rowspan="3">Operator A</td><td>89.14</td><td>88.57</td><td>88.57</td><td>83.42</td><td>86.11</td><td>89.14</td></tr> <tr> <td>97.14</td><td>95.83</td><td>98.57</td><td>93.88</td><td>91.66</td><td>95.27</td></tr> <tr> <td>96.07</td><td>94.44</td><td>95.55</td><td>93.05</td><td>93.05</td><td>93.05</td></tr> <tr> <td rowspan="3">Operator B</td><td>89.14</td><td>86.39</td><td>86.11</td><td>88.85</td><td>85.71</td><td>82.85</td></tr> <tr> <td>96.85</td><td>93.61</td><td>95.56</td><td>93.88</td><td>91.94</td><td>92.22</td></tr> <tr> <td>93.89</td><td>93.33</td><td>92.22</td><td>85.55</td><td>86.27</td><td>88.76</td></tr> <tr> <td rowspan="3">Operator C</td><td>91.42</td><td>90.57</td><td>90.57</td><td>91.42</td><td>91.42</td><td>90.57</td></tr> <tr> <td>95.42</td><td>95.42</td><td>93.33</td><td>94.70</td><td>92.77</td><td>91.94</td></tr> <tr> <td>94.44</td><td>96.91</td><td>93.61</td><td>94.44</td><td>94.44</td><td>94.44</td></tr> </table>		Mon	Tues	Wed	Thurs	Fri	Sat	Operator A	89.14	88.57	88.57	83.42	86.11	89.14	97.14	95.83	98.57	93.88	91.66	95.27	96.07	94.44	95.55	93.05	93.05	93.05	Operator B	89.14	86.39	86.11	88.85	85.71	82.85	96.85	93.61	95.56	93.88	91.94	92.22	93.89	93.33	92.22	85.55	86.27	88.76	Operator C	91.42	90.57	90.57	91.42	91.42	90.57	95.42	95.42	93.33	94.70	92.77	91.94	94.44	96.91	93.61	94.44	94.44	94.44
	Mon	Tues	Wed	Thurs	Fri	Sat																																																												
Operator A	89.14	88.57	88.57	83.42	86.11	89.14																																																												
	97.14	95.83	98.57	93.88	91.66	95.27																																																												
	96.07	94.44	95.55	93.05	93.05	93.05																																																												
Operator B	89.14	86.39	86.11	88.85	85.71	82.85																																																												
	96.85	93.61	95.56	93.88	91.94	92.22																																																												
	93.89	93.33	92.22	85.55	86.27	88.76																																																												
Operator C	91.42	90.57	90.57	91.42	91.42	90.57																																																												
	95.42	95.42	93.33	94.70	92.77	91.94																																																												
	94.44	96.91	93.61	94.44	94.44	94.44																																																												
		(i) Following the standard gage R&R calculation, calculate upper and lower control limit of range, % appraiser variation, % equipment variation, % R&R variation with respect to the acceptable OEE. (8)																																																																
		(ii) Mention the assumptions used in the above Gage R&R calculation. (5)																																																																
		(iii) Based on the results obtained in Part (i), validate the assumptions and decide the corrective measures to be taken, if needed. (5)																																																																

Student's performance in the above question is given below in Table B4.1 :

Table B4.1: Student's performance in question targeting 'B1'; course: UME403

S. No.	Roll No.	B1	
		(Q. No. 4(a) (ii) in EST) (5 Marks)	Weight (Scale 1 to 5)
1.	101308001	2	4
2.	101308002	0	1
3.	101308003	1	3
4.	101308004	2	4

5.	101308005	1	3
6.	101308006	1	3
7.	101308007	0	1
8.	101308008	0.5	2
9.	101308009	0	1
10.	101308010	3	5
11.	101308011	1	3
12.	101308012	1	3
13.	101308013	2	4
14.	101308014	0	1
15.	101308015	1	3
16.	101308016	2	4
17.	101308017	0	1
18.	101308018	0	1
19.	101308019	2.5	5
20.	101308020	0.5	2
21.	101308021	0.5	2
22.	101308023	0	1
23.	101308024	2.5	5
24.	101308025	2	4
25.	101308026	0	1
26.	101308027	0	1
27.	101308028	1	3
28.	101308029	3.5	5
29.	101308031	2	4
30.	101308032	3	5
31.	101308033	0	1
32.	101308034	3	5
33.	101308035	0	1
34.	101308036	2	4
35.	101308037	0.5	2
36.	101308038	0.5	2
37.	101308039	0	1
38.	101308040	1	3
39.	101308041	0	1
40.	101308042	0	1
41.	101308043	0	1
42.	101308044	0	1
43.	101308045	0.5	2
44.	101308046	0	1
45.	101308047	0	1
46.	101308048	1	3
47.	101308050	1.5	4
48.	101308051	2	4
49.	101308052	0.5	2

50.	101308053	0	1
51.	101308054	1	3
52.	101308055	3	5
53.	101308057	3	5
54.	101308058	0	1
55.	101308059	0	1
56.	101308060	0	1
57.	101308061	4	5
58.	101308063	0	1
59.	101308064	0	1
60.	101308065	1.5	4
61.	101308066	0.5	2
62.	101308067	0	1
63.	101308068	1	3
64.	101308069	0	1
65.	101308070	0	1
66.	101308071	1.5	4
67.	101308072	0.5	2
68.	101308073	1.5	4
69.	101308074	0	1
70.	101308075	0.5	2
71.	101308076	0.5	2
72.	101308077	0.5	2
73.	101308078	0	1
74.	101308079	2.5	5
75.	101308080	0	1
76.	101308081	3	5
77.	101308082	0	1
78.	101308083	3	5
79.	101308084	2	4
80.	101308085	0	1
81.	101308088	3	5
82.	101308089	0	1
83.	101308090	2	4
84.	101308091	0	1
85.	101308093	0	1
86.	101308094	0	1
87.	101308096	0.5	2
88.	101308097	0	1
89.	101308098	0	1
90.	101308099	0	1
91.	101308100	0	1
92.	101308101	2	4
93.	101308102	2.5	5
94.	101308103	2	4

95.	101308104	1.5	4
96.	101308105	0	1
97.	101308106	1	3
98.	101308108	0	1
99.	101308109	0	1
100.	101308110	1	3
101.	101308111	0.5	2
102.	101308112	0	1
103.	101308113	3.5	5
104.	101308114	0	1
105.	101308115	0.5	2
106.	101308116	2	4
107.	101308117	3	5
108.	101308118	2	4
109.	101308119	0.5	2
110.	101308120	0.5	2
111.	101308121	0	1
112.	101308122	0	1
113.	101308123	0.5	2
114.	101308124	0	1
115.	101308125	0	1
116.	101488001	0	1
117.	101488002	0.5	2
118.	101488003	3.5	5
119.	101488004	1	3
120.	101488005	2	4
121.	101488006	0	1
122.	101488007	0	1
123.	101488008	1.5	4
124.	101488009	0	1
125.	101488010	1	3
126.	101488011	0	1
127.	101488012	1	3
128.	101488013	1	3
129.	101488014	1.5	4
130.	101488015	0	1
131.	101488016	0	1
132.	101488017	1	3
133.	101488018	1	3

The overall performance of student in the above question is then summarised as given below in Table B4.2:

Table B4.2: average score of the student performance in the course UME403 for criteria B1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME403	13	17	14	14	42	2.45

(ii) Course: Fluid Machinery (UME703)

The above performance criterion is used to measure the attainment of outcome 'B1' by conducting viva-voce examination for the experimental work conducted in the laboratory (Viva before MST in Sep. 2015, weightage 5 marks).

Student's performance in the above question is given below in Table B4.3:

Table B4.3: Student's performance in question targeting 'B1'; course: UME703

S. No.	Roll No.	Marks (MM: 05)	Score (Scale 1 to 5)
1	101208001	04	05
2	101208002	04	05
3	101208003	01	02
4	101208004	03	04
5	101208005	03	04
6	101208006	02	03
7	101208007	04	05
8	101208008	03	04
9	101208009	03	04
10	101208010	04	05
11	101208011	03	04
12	101208012	03	04
13	101208013	03	04
14	101208016	04	05
15	101208017	04	05
16	101208019	04	05
17	101208020	04	05
18	101208022	00	01
19	101388001	03	04

20	101388002	04	05
21	101208023	04	05
22	101208024	03	04
23	101208025	02	03
24	101208026	04	05
25	101208027	04	05
26	101208028	04	05
27	101208030	04	05
28	101208031	03	04
29	101208032	01	02
30	101208034	01	02
31	101208035	03	04
32	101208036	04	05
33	101208037	03	04
34	101208038	02	03
35	101208039	02	03
36	101208040	04	05
37	101208042	04	05
38	101208076	02	03
39	101208140	03	04
40	101388004	02	03
41	101388005	04	05
42	101208044	04	05
43	101208045	02	03
44	101208046	04	05
45	101208048	03	04
46	101208049	04	05
47	101208051	03	04
48	101208052	04	05
49	101208053	02	03
50	101208054	03	04
51	101208055	03	04
52	101208056	03	04

53	101208057	03	04
54	101208059	02	03
55	101208060	02	03
56	101208061	00	01
57	101208062	00	01
58	101208063	04	05
59	101208064	03	04
60	101208081	04	05
61	101388003	03	04
62	101388007	04	05

The overall performance of students in the above question is then summarized as given below in Table B4.4:

Table B4.4: Average score of student performance in the course UME703 for criteria B1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME703	35.2	32.1	22.2	6.2	4.2	3.87

(III) Course: Heat and Mass Transfer (UME704)

The above performance criteria is used to measure the attainment of outcome ‘B1’ by giving the following experiment (Experiment No. 3: during the Laboratory Classes, weightage 10 marks) to the students.

Experiment: To determine the thermal conductivity of a metal bar.

Student’s performance in the above experiments given below in Table B4.5:

Table B4.5: Student’s performance in question targeting ‘B1’; course: UME704

S. No.	Roll No.	Marks (MM: 10)	Score (Scale 1 to 5)
1	101208027	7	5
2	101208035	7	5
3	101208038	7	5
4	101208039	7	5
5	101208024	6.5	4
6	101208031	6.5	4
7	101208040	6.5	4

8	101208140	6.5	4
9	101208023	6.5	4
10	101208025	6.5	4
11	101388005	6.5	4
12	101208026	5.5	3
13	101208034	5.5	3
14	101208037	5.5	3
15	101208042	5.5	3
16	101208032	6	4
17	101208076	6	4
18	101388004	6	4
19	101208028	5.5	3
20	101208030	5.5	3
21	101208036	5.5	3

The overall performance of students in the above question is then summarized as given below in Table B4.6

Table B4.6: Average score of student performance in the course UME704 for criteria B1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME704	19.04	47.61	33.33	0	0	3.85

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria B1 as given below in Table B4.7:

Table B4.7: Weighted Average Student class performance (course portfolio) for criteria B1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME403	13	17	14	14	42	2.45	4
UME703	35.2	32.1	22.2	6.2	4.2	3.88	5
UME704	19.04	47.61	33.33	0	0	3.86	5
Weighted average score	23.09	33.33	23.83	6.21	13.50	3.46	14

b) Indirect measures for Performance criteria B1 (Surveys)

i.) Assessment Tool: Student Course Survey

Table B4.8: Average score of student course survey for criteria B1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME403	4	51	40	5	0	3.54	4
UME703	28.5	44	23.75	3.5	0	3.9675	5
UME704	20.105	32.06	33.1475	12.495	2.1725	3.55	5
Weighted average score	18.50	41.74	31.75	7.14	0.78	3.70	14

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table B4.9: Assessment for criteria B1 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	21.67	46.67	28.33	3.33	0	3.87
Alumni survey	46.15	28.21	23.08	2.56	0	4.18
Employer Survey	36.36	50	13.64	0	0	4.2272

c) Overall weighted average score of performance criterion 'B1'

Finally overall weighted average score of performance criterion 'B1' is evaluated as given below in Table B4.10:

Table B4.10: Overall weighted average score of performance criterion 'B1'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	23.09	33.33	23.83	6.21	13.50	3.46	5
Weighted average student course survey	18.50	41.74	31.75	7.14	0.78	3.70	4
Graduating student survey	21.67	46.67	28.33	3.33	0	3.86	3
Alumni survey	46.15	28.21	23.08	2.56	0	4.17	3
Employer survey	36.36	50	13.64	0	0	4.23	3
Overall weighted score	27.89	39.34	24.52	4.29	3.92	3.83	18

Assessment of Outcome 'B' using performance criterion B2

Performance criteria 'B2': Use appropriate equipment and techniques for data collection

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Four courses namely Engineering Metrology (UME403), Fluid Machinery (UME703), Heat and Mass Transfer (UME704) and Machining Science (UME705) were used to assess performance criteria B2 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Engineering Metrology (UME403)

The above performance criteria is used to measure the attainment of outcome 'B2' by evaluating the Projects where different parts of machine tool (assembled) are given to students. Students first disassemble the components, take their individual measurements of all dimensions using suitable measuring instruments to collect the dimensions and make their drawing (individual part drawing and assembly drawing) and submitted the report. Different parts/assemblies given as projects are like Lathe tool post, taper turning attachment, small pumps, automobile parts, transmission pulley & gear assembly etc. The table below shows the marks assigned for three projects and out of total marks 20.

Student's performance in the above question is given below in Table B4.11:

Table B4.11: Student's performance in question targeting 'B2'; course: UME403

S. No.	Roll No.	B2	Weight (Scale 1 to 5)
		(Project Evaluation in Lab) (20 Marks)	
1.	101308001	17.00	5
2.	101308002	17.00	5
3.	101308003	17.00	5
4.	101308004	17.00	5
5.	101308005	17.00	5
6.	101308006	16.50	5
7.	101308007	16.50	5
8.	101308008	16.50	5
9.	101308009	16.50	5
10.	101308010	16.50	5
11.	101308011	16.50	5
12.	101308012	16.50	5
13.	101308013	16.50	5
14.	101308014	16.50	5
15.	101308015	11.00	2
16.	101308016	16.50	5
17.	101308017	16.50	5
18.	101308018	16.50	5
19.	101308019	16.50	5
20.	101308020	16.50	5
21.	101308021	16.50	5
22.	101308023	17.00	5

23.	101308024	17.00	5
24.	101308025	13.50	3
25.	101308026	14.00	4
26.	101308027	12.50	3
27.	101308028	14.00	4
28.	101308029	13.75	3
29.	101308031	12.75	3
30.	101308032	11.25	2
31.	101308033	11.00	2
32.	101308034	12.25	3
33.	101308035	11.25	2
34.	101308036	11.75	2
35.	101308037	11.50	2
36.	101308038	11.50	2
37.	101308039	11.50	2
38.	101308040	11.50	2
39.	101308041	11.50	2
40.	101308042	11.50	2
41.	101308043	13.00	3
42.	101308044	13.00	3
43.	101308045	13.50	3
44.	101308046	13.50	3
45.	101308047	13.00	3
46.	101308048	15.00	4
47.	101308050	15.00	4
48.	101308051	15.00	4
49.	101308052	16.33	5
50.	101308053	16.33	5
51.	101308054	16.33	5
52.	101308055	16.33	5
53.	101308057	16.00	5
54.	101308058	15.67	4
55.	101308059	11.00	2
56.	101308060	16.00	5
57.	101308061	16.00	5
58.	101308063	16.67	5
59.	101308064	16.67	5
60.	101308065	16.67	5
61.	101308066	16.67	5
62.	101308067	11.00	2
63.	101308068	15.33	4
64.	101308069	14.67	4
65.	101308070	14.67	4
66.	101308071	14.67	4
67.	101308072	15.00	4

68.	101308073	15.33	4
69.	101308074	12.00	3
70.	101308075	17.00	5
71.	101308076	15.00	4
72.	101308077	17.00	5
73.	101308078	17.00	5
74.	101308079	17.00	5
75.	101308080	17.67	5
76.	101308081	18.00	5
77.	101308082	17.67	5
78.	101308083	17.67	5
79.	101308084	17.33	5
80.	101308085	16.67	5
81.	101308088	16.67	5
82.	101308089	16.67	5
83.	101308090	16.67	5
84.	101308091	16.67	5
85.	101308093	16.67	5
86.	101308094	16.67	5
87.	101308096	16.67	5
88.	101308097	16.67	5
89.	101308098	16.67	5
90.	101308099	16.67	5
91.	101308100	13.33	3
92.	101308101	17.00	5
93.	101308102	13.00	3
94.	101308103	16.67	5
95.	101308104	13.33	3
96.	101308105	13.17	3
97.	101308106	13.00	3
98.	101308108	15.67	4
99.	101308109	16.00	5
100.	101308110	15.67	4
101.	101308111	16.00	5
102.	101308112	16.67	5
103.	101308113	16.67	5
104.	101308114	16.67	5
105.	101308115	16.67	5
106.	101308116	18.00	5
107.	101308117	17.67	5
108.	101308118	18.00	5
109.	101308119	18.00	5
110.	101308120	17.33	5
111.	101308121	17.33	5
112.	101308122	17.33	5

113.	101308123	17.33	5
114.	101308124	15.67	4
115.	101308125	15.33	4
116.	101488001	17.00	5
117.	101488002	17.00	5
118.	101488003	17.00	5
119.	101488004	17.00	5
120.	101488005	15.50	4
121.	101488006	16.00	5
122.	101488007	15.75	4
123.	101488008	17.00	5
124.	101488009	13.33	3
125.	101488010	13.00	3
126.	101488011	13.33	3
127.	101488012	17.33	5
128.	101488013	17.33	5
129.	101488014	17.33	5
130.	101488015	17.00	5
131.	101488016	17.00	5
132.	101488017	15.67	4
133.	101488018	15.33	4

The overall performance of student in the above question is then summarised as given below in Table B4.12:

Table B4.12: average score of the student performance in the course UME403 for criteria B2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME403	60	16	14	10	0	4.26

(ii) Course: Fluid Machinery (UME703)

The above performance criterion is used to measure the attainment of outcome ‘B2’ by assigning the following experimental work in the laboratory, students were asked to perform the same experiment number of times for the given set of input conditions and the data collected were compared. (Experiment: before MST in Sep. 2015, weightage 5 marks) to the students.

Experiment:

To draw the main characteristic curves (i.e. at constant head) for Francis turbine for the given guide vanes opening.

Student’s performance in the above question is given below in Table B4.13:

Table B4.13: Student's performance in question targeting 'B2'; course: UME703

S. No.	Roll No.	Marks (MM: 05)	Score (Scale 1 to 5)
1	101208001	03	04
2	101208002	03	04
3	101208003	02	03
4	101208004	02	03
5	101208005	02	03
6	101208006	02	03
7	101208007	04	05
8	101208008	03	04
9	101208009	03	04
10	101208010	03	04
11	101208011	03	04
12	101208012	03	04
13	101208013	03	04
14	101208016	04	05
15	101208017	03	04
16	101208019	03	04
17	101208020	03	04
18	101208022	01	02
19	101388001	03	04
20	101388002	04	05
21	101208023	04	05
22	101208024	01	02
23	101208025	03	04
24	101208026	04	05
25	101208027	04	05
26	101208028	03	04
27	101208030	04	05
28	101208031	03	04
29	101208032	01	02
30	101208034	02	03
31	101208035	03	04

32	101208036	03	04
33	101208037	03	04
34	101208038	02	03
35	101208039	02	03
36	101208040	04	05
37	101208042	04	05
38	101208076	00	01
39	101208140	01	02
40	101388004	00	01
41	101388005	04	05
42	101208044	04	05
43	101208045	01	02
44	101208046	04	05
45	101208048	03	04
46	101208049	04	05
47	101208051	03	04
48	101208052	04	05
49	101208053	01	02
50	101208054	03	04
51	101208055	03	04
52	101208056	03	04
53	101208057	03	04
54	101208059	01	02
55	101208060	02	03
56	101208061	01	02
57	101208062	02	03
58	101208063	03	04
59	101208064	03	04
60	101208081	04	05
61	101388003	03	04
62	101388007	04	05

The overall performance of students in the above question is then summarized as given below in Table B4.14:

Table B4.14: Average score of student performance in the course UME703 for criteria B2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME703	22.5	43.4	14.1	11.2	3.2	3.54

(iii) Course: Heat and Mass Transfer (UME704)

The above performance criteria is used to measure the attainment of outcome 'B2' by giving the following experiment (Experiment No. 1: during the Laboratory Classes, weightage 10 marks) to the students.

Experiment: To determine the thermal resistance and thermal conductivity of composite slab.

Student's performance in the above experiments given below in Table B4.15:

Table B4.15: Student's performance in question targeting 'B2'; course: UME704

S. No.	Roll No.	Marks (MM: 10)	Score (Scale 1 to 5)
1	101208027	6.5	5
2	101208035	6.5	5
3	101208038	6.5	5
4	101208039	6.5	5
5	101208024	6	4
6	101208031	6	4
7	101208040	6	4
8	101208140	6	4
9	101208023	6.5	5
10	101208025	6.5	5
11	101388005	6.5	5
12	101208026	5.5	3
13	101208034	5.5	3
14	101208037	5.5	3
15	101208042	5.5	3
16	101208032	5.5	5
17	101208076	5.5	5
18	101388004	5.5	5
19	101208028	6.5	5
20	101208030	6.5	5

21	101208036	6.5	5
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The overall performance of students in the above question is then summarized as given below in Table B4.16

Table B4.16: Average score of student performance in the course UME704 for criteria B2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME704	33.33	19.04	47.61	0	0	3.85

(iv) Course: Machining Science (UME705)

The above performance criterion is used to measure the attainment of outcome ‘B2’ by evaluating the performance of the students during experiment on “To Determine the Chip-Reduction Coefficient and Shear Angle of a Given Material in Orthogonal Machining”.

Student’s performance is given below in Table B4.17:

Table B4.17: Student’s performance targeting ‘B2’; course: UME705

S. No.	Roll No.	Marks	Score
		(MM: 05)	(Scale 1 to 5)
1	101208001	4	4
2	101208002	4	4
3	101208003	4	4
4	101208004	4	4
5	101208005	3	3
6	101208006	3	3
7	101208007	4	4
8	101208008	3	3
9	101208009	4	4
10	101208010	3	3
11	101208011	2	2
12	101208012	5	5
13	101208013	3	3
14	101208016	4	4
15	101208017	5	5
16	101208019	4	4
17	101208020	4	4
18	101208022	3	3
19	101388001	4	4

20	101388002	4	4
21	101208114	1	1
22	101208115	4	4
23	101208116	3	3
24	101208117	4	4
25	101208118	3	3
26	101208120	3	3
27	101208121	1	1
28	101208123	2	2
29	101208125	5	5
30	101208126	3	3
31	101208129	4	4
32	101208131	5	5
33	101208132	3	3
34	101208133	4	4
35	101208134	4	4
36	101208136	4	4
37	101208138	4	4
38	101208139	4	4
39	101388006	3	3
40	101388008	3	3

The overall performance of students in the above question is then summarized as given below in Table B4.18

Table B4.18: Average score of student performance in the course UME705 for criteria B2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME705	10	47.5	32.5	05	2.5	3.5

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria B2 as given below in Table B4.19:

Table B4.19: Weighted Average Student class performance (course portfolio) for criteria B2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME403	60	16	14	10	0	4.26	5
UME703	22.5	43.4	14.1	11.2	3.2	3.54	5
UME704	33.33	19.04	47.61	0	0	3.86	5

UME705	10	47.5	32.5	5	2.5	3.50	4
Weighted average score	32.59	30.64	26.77	6.63	1.37	3.80	19

b.) Assessment Tool: Student Course Survey

Table B4.20: Average score of student course survey for criteria B2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME403	4	51	40	5	0	3.54	5
UME703	28.5	44	23.75	3.5	0	3.97	5
UME704	20.10	32.06	33.14	12.4	2.17	3.55	5
UME705	28	34.66	29.67	7	0.67	3.82	4
Weighted average score	19.74	40.74	31.74	7.00	0.71	3.72	19

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table B4.21: Assessment for criteria B2 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	21.67	46.67	28.33	3.33	0	3.87
Alumni survey	46.15	28.21	23.08	2.56	0	4.18
Employer Survey	36.36	50	13.64	0	0	4.22

Finally overall weighted average score of performance criterion 'B2' is evaluated as given below in Table B4.22:

Table B4.22.: Overall weighted average score of performance criterion 'B2'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	32.59	30.64	26.77	6.63	1.37	3.80	5
Weighted average student course survey	19.74	40.74	31.74	7.00	0.71	3.72	4
Graduating student survey	21.67	46.67	28.33	3.33	0	3.86	3
Alumni survey	46.15	28.21	23.08	2.56	0	4.17	3
Employer survey	36.36	50	13.64	0	0	4.23	3
Overall weighted score	30.80	38.38	25.33	4.38	0.54	3.93	18

7.	101308007	6	5
8.	101308008	7	5
9.	101308009	5.5	4
10.	101308010	3	2
11.	101308011	3.5	3
12.	101308012	7.5	5
13.	101308013	2	2
14.	101308014	7	5
15.	101308015	3	2
16.	101308016	5	4
17.	101308017	4	3
18.	101308018	3	2
19.	101308019	4	3
20.	101308020	6.5	5
21.	101308021	7.5	5
22.	101308023	5.5	4
23.	101308024	7.5	5
24.	101308025	7.5	5
25.	101308026	4.5	4
26.	101308027	5	4
27.	101308028	7.5	5
28.	101308029	8	5
29.	101308031	7	5
30.	101308032	5	4
31.	101308033	6	5
32.	101308034	7.5	5
33.	101308035	4	3
34.	101308036	6.5	5
35.	101308037	4.5	4
36.	101308038	5.5	4
37.	101308039	5	4
38.	101308040	6	5
39.	101308041	4	3
40.	101308042	2	2
41.	101308043	3	2
42.	101308044	2.5	2
43.	101308045	5.5	4
44.	101308046	2	2
45.	101308047	3.5	3
46.	101308048	7.5	5
47.	101308050	7	5
48.	101308051	6	5
49.	101308052	7	5
50.	101308053	2	2
51.	101308054	4	3

52.	101308055	4.5	4
53.	101308057	5	4
54.	101308058	5	4
55.	101308059	4	3
56.	101308060	5	4
57.	101308061	7	5
58.	101308063	7	5
59.	101308064	6	5
60.	101308065	7	5
61.	101308066	4	3
62.	101308067	4.5	4
63.	101308068	6	5
64.	101308069	7.5	5
65.	101308070	4	3
66.	101308071	3	2
67.	101308072	7.5	5
68.	101308073	5	4
69.	101308074	7	5
70.	101308075	7.5	5
71.	101308076	7	5
72.	101308077	7	5
73.	101308078	4	3
74.	101308079	6	5
75.	101308080	3.5	3
76.	101308081	7.5	5
77.	101308082	3	2
78.	101308083	7.5	5
79.	101308084	2	2
80.	101308085	6.5	5
81.	101308088	5.5	4
82.	101308089	3	2
83.	101308090	7.5	5
84.	101308091	4	3
85.	101308093	7.5	5
86.	101308094	4.5	4
87.	101308096	6	5
88.	101308097	4	3
89.	101308098	7.5	5
90.	101308099	5	4
91.	101308100	5.5	4
92.	101308101	4	3
93.	101308102	6.5	5
94.	101308103	7	5
95.	101308104	6.5	5
96.	101308105	7	5

97.	101308106	7	5
98.	101308108	5	4
99.	101308109	6	5
100.	101308110	4	3
101.	101308111	5	4
102.	101308112	4.5	4
103.	101308113	7.5	5
104.	101308114	3.5	3
105.	101308115	6.5	5
106.	101308116	7.5	5
107.	101308117	7.5	5
108.	101308118	6	5
109.	101308119	3.5	3
110.	101308120	7	5
111.	101308121	3.5	3
112.	101308122	3	2
113.	101308123	7	5
114.	101308124	6.5	5
115.	101308125	6.5	5
116.	101488001	6.5	5
117.	101488002	7	5
118.	101488003	6	5
119.	101488004	5	4
120.	101488005	6.5	5
121.	101488006	4.5	4
122.	101488007	2.5	2
123.	101488008	7	5
124.	101488009	4.5	4
125.	101488010	3	2
126.	101488011	6	5
127.	101488012	6	5
128.	101488013	7	5
129.	101488014	7.5	5
130.	101488015	5	4
131.	101488016	5	4
132.	101488017	3	2
133.	101488018	7.5	5

The overall performance of student in the above question is then summarised as given below in Table B4.24:

Table B4.24: average score of the student performance in the course UME403 for criteria B3

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME403	49	22	15	14	0	4.06

(II) Course: Machining Science (UME705)

The above performance criterion is used to measure the attainment of outcome ‘B3’ by evaluating the performance of the students during experiment on “To study the variation of Thrust and Torque in Drilling with the Cutting Parameters using a Drill Dynamometer”

Student’s performance in the above question is given below in Table B4.25:

Table B4.25: Student’s performance in question targeting ‘B3’; course: UME705

S. No.	Roll No.	Marks	Score
		(MM: 05)	(Scale 1 to 5)
1	101208001	4	4
2	101208002	4	4
3	101208003	3	3
4	101208004	4	4
5	101208005	2	2
6	101208006	4	4
7	101208007	4	4
8	101208008	1	1
9	101208009	5	5
10	101208010	4	4
11	101208011	2	2
12	101208012	5	5
13	101208013	2	2
14	101208016	4	4
15	101208017	5	5
16	101208019	3	3
17	101208020	5	5
18	101208022	2	2
19	101388001	5	5
20	101388002	4	4
21	101208114	1	1
22	101208115	5	5
23	101208116	2	2
24	101208117	4	4
25	101208118	3	3

26	101208120	3	3
27	101208121	1	1
28	101208123	2	2
29	101208125	5	5
30	101208126	3	3
31	101208129	5	5
32	101208131	5	5
33	101208132	3	3
34	101208133	3	3
35	101208134	4	4
36	101208136	4	4
37	101208138	5	5
38	101208139	4	4
39	101388006	2	2
40	101388008	3	3

The overall performance of students in the above question is then summarized as given below in Table B4.26:

Table B4.26: Average score of student performance in the course UME705 for criteria B3

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME705	30	25	20	17.5	7.5	3.60

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria B3 as given below in Table B4.27:

Table B4.27: Weighted Average Student class performance (course portfolio) for criteria B3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME403	49	22	15	14	0	4.06	5
UME705	30	25	20	17.5	7.5	3.53	5
Weighted average score	39.50	23.50	17.50	15.75	3.75	3.79	10

b.) Assessment Tool: Student Course Survey

Table B4.28: Average score of student course survey for criteria B3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME403	4	51	40	5	0	3.54	5

UME705	28	34.66667	29.66667	7	0.666667	3.82	5
Weighted average score	16.00	42.83	34.83	6.00	0.33	3.68	10

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table B4.29: Assessment for criteria B3 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	21.67	46.67	28.33	3.33	0	3.87
Alumni survey	46.15	28.21	23.08	2.56	0	4.18
Employer Survey	36.36	50	13.64	0	0	4.2272

Finally overall weighted average score of performance criterion 'B3' is evaluated as given below in Table B4.30:

Table B4.30: Overall weighted average score of performance criterion 'B3'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	39.50	23.50	17.50	15.75	3.75	3.79	5
Weighted average student course survey	16.00	42.83	34.83	6.00	0.33	3.68	4
Graduating student survey	21.67	46.67	28.33	3.33	0	3.86	3
Alumni survey	46.15	28.21	23.08	2.56	0	4.17	3
Employer survey	36.36	50	13.64	0	0	4.23	3
Overall weighted score	31.89	36.86	23.44	6.69	1.12	3.92	18

Assessment of Outcome 'B' using performance criterion B4

Performance criteria 'B4' : Applying statistical methods in analyzing data.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Three courses namely Engineering Metrology (UME403), Fluid Machinery (UME703) and Heat and Mass Transfer (UME704) were used to assess performance criteria B4 as a direct measure. The analysis for each of these courses is provided below:

(I) Course: Engineering Metrology (UME403)

The above performance criteria is used to measure the attainment of outcome 'B4' by giving the following question (Question No.:4(a) (iii) in EST, held on May 2015) to the students. The question carries 5 marks.

Question:

Q. 4	(a)	An emblem manufacturing company produces plastic parts in an injection molding machine. The parts are prepared by three operators in different shifts from Monday to Saturday. Overall equipment effectiveness (OEE) is calculated on real time production three times. The company has a policy of maintaining minimum OEE of 92%. The OEE data for each operator are given as under: <table> <tr> <td></td><td>Mon</td><td>Tues</td><td>Wed</td><td>Thurs</td><td>Fri</td><td>Sat</td></tr> <tr> <td rowspan="3">Operator A</td><td>89.14</td><td>88.57</td><td>88.57</td><td>83.42</td><td>86.11</td><td>89.14</td></tr> <tr> <td>97.14</td><td>95.83</td><td>98.57</td><td>93.88</td><td>91.66</td><td>95.27</td></tr> <tr> <td>96.07</td><td>94.44</td><td>95.55</td><td>93.05</td><td>93.05</td><td>93.05</td></tr> <tr> <td rowspan="3">Operator B</td><td>89.14</td><td>86.39</td><td>86.11</td><td>88.85</td><td>85.71</td><td>82.85</td></tr> <tr> <td>96.85</td><td>93.61</td><td>95.56</td><td>93.88</td><td>91.94</td><td>92.22</td></tr> <tr> <td>93.89</td><td>93.33</td><td>92.22</td><td>85.55</td><td>86.27</td><td>88.76</td></tr> <tr> <td rowspan="3">Operator C</td><td>91.42</td><td>90.57</td><td>90.57</td><td>91.42</td><td>91.42</td><td>90.57</td></tr> <tr> <td>95.42</td><td>95.42</td><td>93.33</td><td>94.70</td><td>92.77</td><td>91.94</td></tr> <tr> <td>94.44</td><td>96.91</td><td>93.61</td><td>94.44</td><td>94.44</td><td>94.44</td></tr> </table>		Mon	Tues	Wed	Thurs	Fri	Sat	Operator A	89.14	88.57	88.57	83.42	86.11	89.14	97.14	95.83	98.57	93.88	91.66	95.27	96.07	94.44	95.55	93.05	93.05	93.05	Operator B	89.14	86.39	86.11	88.85	85.71	82.85	96.85	93.61	95.56	93.88	91.94	92.22	93.89	93.33	92.22	85.55	86.27	88.76	Operator C	91.42	90.57	90.57	91.42	91.42	90.57	95.42	95.42	93.33	94.70	92.77	91.94	94.44	96.91	93.61	94.44	94.44	94.44	
	Mon	Tues	Wed	Thurs	Fri	Sat																																																													
Operator A	89.14	88.57	88.57	83.42	86.11	89.14																																																													
	97.14	95.83	98.57	93.88	91.66	95.27																																																													
	96.07	94.44	95.55	93.05	93.05	93.05																																																													
Operator B	89.14	86.39	86.11	88.85	85.71	82.85																																																													
	96.85	93.61	95.56	93.88	91.94	92.22																																																													
	93.89	93.33	92.22	85.55	86.27	88.76																																																													
Operator C	91.42	90.57	90.57	91.42	91.42	90.57																																																													
	95.42	95.42	93.33	94.70	92.77	91.94																																																													
	94.44	96.91	93.61	94.44	94.44	94.44																																																													
		(i) Following the standard gage R&R calculation, calculate upper and lower control limit of range, % appraiser variation, % equipment variation, % R&R variation with respect to the acceptable OEE.	(8)																																																																
		(ii) Mention the assumptions used in the above Gage R&R calculation.	(5)																																																																
		(iii) Based on the results obtained in Part (i), validate the assumptions and decide the corrective measures to be taken, if needed.	(5)																																																																

Student's performance in the above question is given below in Table B4.31:

Table B4.31: Student's performance in question targeting 'B4'; course: UME403

S. No.	Roll No.	B4	Weight (Scale 1 to 5)
		(Q. No. 4(a) (iii) in EST) (5 Marks)	
1.	101308001	2.5	5
2.	101308002	0	1
3.	101308003	1	3
4.	101308004	0	1
5.	101308005	0	1
6.	101308006	0	1
7.	101308007	0	1
8.	101308008	0	1
9.	101308009	0	1
10.	101308010	0	1
11.	101308011	1	3
12.	101308012	0	1
13.	101308013	0	1
14.	101308014	1.5	4
15.	101308015	0	1
16.	101308016	0	1
17.	101308017	0.5	2

18.	101308018	0	1
19.	101308019	1	3
20.	101308020	2	4
21.	101308021	0	1
22.	101308023	0	1
23.	101308024	1	3
24.	101308025	1.5	4
25.	101308026	0	1
26.	101308027	0	1
27.	101308028	2	4
28.	101308029	2	4
29.	101308031	2	4
30.	101308032	0	1
31.	101308033	0	1
32.	101308034	3	5
33.	101308035	0	1
34.	101308036	2	4
35.	101308037	0	1
36.	101308038	0	1
37.	101308039	0	1
38.	101308040	0	1
39.	101308041	0	1
40.	101308042	0	1
41.	101308043	0	1
42.	101308044	0	1
43.	101308045	0	1
44.	101308046	0	1
45.	101308047	0	1
46.	101308048	1.5	4
47.	101308050	0	1
48.	101308051	0	1
49.	101308052	2.5	5
50.	101308053	1	3
51.	101308054	0	1
52.	101308055	0.5	2
53.	101308057	0	1
54.	101308058	0	1
55.	101308059	0	1
56.	101308060	0	1
57.	101308061	3	5
58.	101308063	0.5	2
59.	101308064	0	1
60.	101308065	2	4
61.	101308066	0	1
62.	101308067	0	1

63.	101308068	1.5	4
64.	101308069	0	1
65.	101308070	0	1
66.	101308071	0	1
67.	101308072	2	4
68.	101308073	0.5	2
69.	101308074	0	1
70.	101308075	2	4
71.	101308076	0	1
72.	101308077	0	1
73.	101308078	0	1
74.	101308079	2.5	5
75.	101308080	0	1
76.	101308081	2	4
77.	101308082	0	1
78.	101308083	3	5
79.	101308084	0	1
80.	101308085	0	1
81.	101308088	2.5	5
82.	101308089	0	1
83.	101308090	2	4
84.	101308091	1	3
85.	101308093	0.5	2
86.	101308094	1	3
87.	101308096	2	4
88.	101308097	0	1
89.	101308098	2	4
90.	101308099	2.5	5
91.	101308100	0	1
92.	101308101	0	1
93.	101308102	2.5	5
94.	101308103	2	4
95.	101308104	0.5	2
96.	101308105	0.5	2
97.	101308106	0	1
98.	101308108	1	3
99.	101308109	0	1
100.	101308110	1	3
101.	101308111	2	4
102.	101308112	0	1
103.	101308113	2	4
104.	101308114	0	1
105.	101308115	0	1
106.	101308116	2	4
107.	101308117	2.5	5

108.	101308118	1	3
109.	101308119	2	4
110.	101308120	1	3
111.	101308121	0	1
112.	101308122	0	1
113.	101308123	2.5	5
114.	101308124	0	1
115.	101308125	0	1
116.	101488001	1	3
117.	101488002	1	3
118.	101488003	1.5	4
119.	101488004	2	4
120.	101488005	0.5	2
121.	101488006	0	1
122.	101488007	0	1
123.	101488008	1.5	4
124.	101488009	0	1
125.	101488010	0	1
126.	101488011	1	3
127.	101488012	2	4
128.	101488013	3	5
129.	101488014	2	4
130.	101488015	0	1
131.	101488016	1	3
132.	101488017	0.5	2
133.	101488018	2	4

The overall performance of student in the above question is then summarised as given below in Table B4.32:

Table B4.32: average score of the student performance in the course UME403 for criteria B4

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME403	9	20	11	7	53	2.25

(II) Course: Fluid Machinery (UME703)

The above performance criterion is used to measure the attainment of outcome 'B4' by conducting minor project work examination (weightage 5 marks).

Student's performance in the above question is given below in Table B4.33:

Table B4.33: Student's performance in question targeting 'B4'; course: UME703

S. No.	Roll No.	Marks (MM: 05)	Score (Scale 1 to 5)
1	101208114	3.5	4
2	101208115	4.0	5
3	101208116	4.0	5
4	101208117	4.0	5
5	101208125	3.5	4
6	101208126	3.5	4
7	101208129	3.5	4
8	101208131	4.5	5
9	101208132	2.5	3
10	101208133	4.5	5
11	101208134	4.5	5
12	101208136	2.5	3
13	101208138	4.5	5
14	101208139	4.5	5
15	101388006	3.5	4
16	101388008	3.5	4
17	101208001	3.5	4
18	101208002	3.5	4
19	101208004	3.0	4
20	101208005	3.0	4
21	101208006	3.5	4
22	101208007	4.5	5
23	101208008	4.0	5
24	101208009	3.5	4
25	101208012	2.5	3
26	101208016	4.5	5
27	101208020	3.5	4
28	101208022	2.5	3
29	101388001	3.0	4
30	101388002	3.0	4

The overall performance of students in the above question is then summarized as given below in Table B4.34:

Table B4.34: Average score of student performance in the course UME703 for criteria B4

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME703	37.9	51.7	13.7	0	0	4.37

(iii) Course: Heat and Mass Transfer (UME704)

The above performance criteria is used to measure the attainment of outcome 'B4' by giving the following experiment (Experiment No. 5: during the Laboratory Classes, weightage 10 marks) to the students.

Experiment: To determine the surface heat transfer coefficient in forced convection heat

Student's performance in the above experiments given below in Table B4.35:

Table B4.35: Student's performance in question targeting 'B4'; course: UME704

S. No.	Roll No.	Marks (MM: 10)	Score (Scale 1 to 5)
1	101208027	7	5
2	101208035	7	5
3	101208038	7	5
4	101208039	7	5
5	101208024	6.5	4
6	101208031	6.5	4
7	101208040	6.5	4
8	101208140	6.5	4
9	101208023	6.5	4
10	101208025	6.5	4
11	101388005	6.5	4
12	101208026	6	3
13	101208034	6	3
14	101208037	6	3
15	101208042	6	3
16	101208032	7	5
17	101208076	7	5
18	101388004	7	5
19	101208028	7	5
20	101208030	7	5
21	101208036	7	5

The overall performance of students in the above question is then summarized as given below in Table B4.36

Table B4.36: Average score of student performance in the course UME704 for criteria B4

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME704	47.61	33.33	19.04	0	0	4.28

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria B4 as given below in Table B4.37:

Table B4.37: Weighted Average Student class performance (course portfolio) for criteria B4

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME403	9	20	11	7	53	2.25	4
UME703	37.9	51.7	13.7	0	0	4.37	5
UME704	47.61	33.33	19.04	0	0	4.28	5
Weighted average score	33.11	36.08	14.84	2.00	15.14	3.74	14

b.) Assessment Tool: Student Course Survey

Table B4.38: Average score of student course survey for criteria B4

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME403	4	51	40	5	0	3.54	4
UME703	28.5	44	23.75	3.5	0	3.97	5
UME704	20.10	32.06	33.14	12.49	2.17	3.55	5
Weighted average score	18.50	41.74	31.75	7.14	0.78	3.70	14

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table B4.39.: Assessment for criteria B4 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	21.67	46.67	28.33	3.33	0	3.87
Alumni survey	46.15	28.21	23.08	2.56	0	4.18
Employer Survey	36.36	50	13.64	0	0	4.22

Finally overall weighted average score of performance criterion 'B4' is evaluated as given below in Table B4.40:

Table B4.40: Overall weighted average score of performance criterion 'B4'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	33.11	36.08	14.84	2.00	15.14	3.74	5
Weighted average student course survey	18.50	41.74	31.75	7.14	0.78	3.70	4
Graduating student survey	21.67	46.67	28.33	3.33	0	3.86	3
Alumni survey	46.15	28.21	23.08	2.56	0	4.17	3
Employer survey	36.36	50	13.64	0	0	4.23	3
Overall weighted score	30.67	40.11	22.02	3.12	4.38	3.90	18

Overall assessment of student outcome B using scores of B1, B2, B3 and B4

In the above sections, each of the individual performance criteria B1, B2, B3 and B4 have been assessed. The performance for attainment of outcome B has been completed using the attainment values for B1, B2, B3 and B4 and is provided below:

Table B4.41 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome B.

Table B4.41: Overall score for outcome B at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
B1	27.89	39.34	24.52	4.29	3.92	3.83	4
B2	30.80	38.38	25.33	4.38	0.54	3.93	5
B3	31.89	36.86	23.44	6.69	1.12	3.92	5
B4	30.67	40.11	22.02	3.12	4.38	3.90	4
Overall score	30.43	38.56	23.89	4.72	2.11	3.90	18

**Assessment of Attainment of Program Outcome
'C'
(Year 2015)**

for the

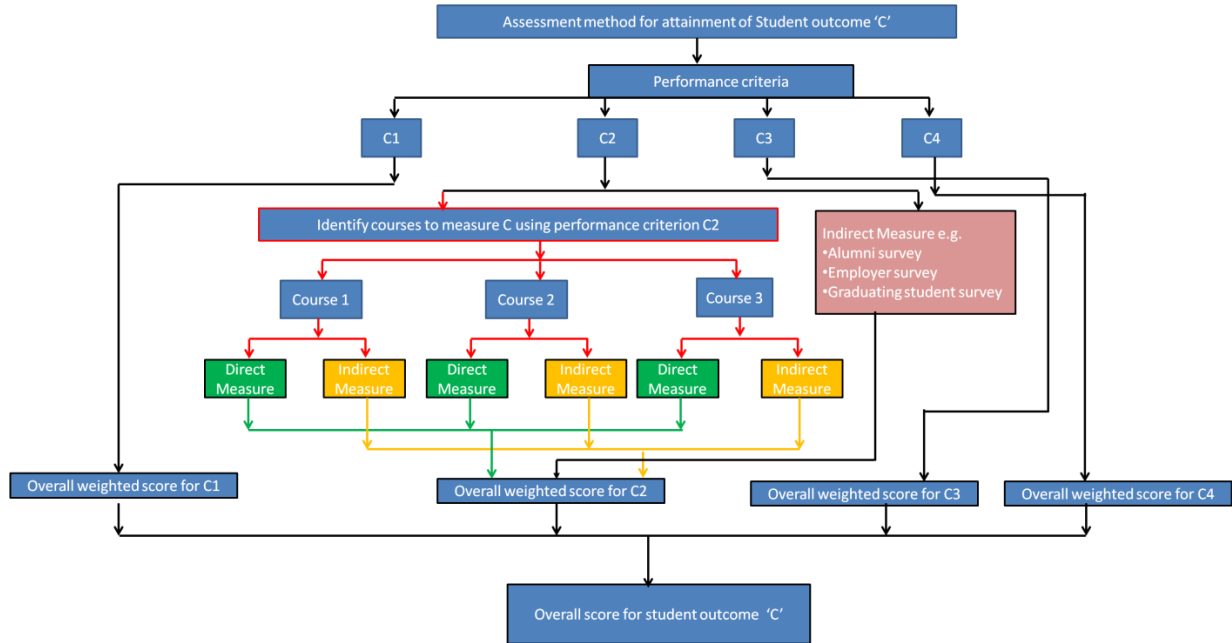
***Bachelor of Engineering
in
Mechanical Engineering***



**Thapar University
Patiala (Punjab) - 147004
INDIA**

Attainment of Outcome C

The attainment of each outcome has been measured using a standard procedure explained in the Self Assessment Report for the program. A flow chart depicting the step by step methodology used to measure each attainment is provided below for ready reference.



The following courses have been considered for the assessment of student outcome 'C'

Courses:

1. Summer Training (UME591)
2. Advance Machine Design (UME701)
3. Heat and Mass transfer (UME704)
4. Mechanical System Design (UME801)

Outcome C has been assessed by four performance criteria C1, C2, C3 and C4. The sections below provide data for separate assessments for each of these performance criteria and in the end the results for these four performance criteria has been used to measure the overall measure of outcome C.

1) Assessment of Outcome 'C' using performance criterion C1

Performance criteria 'C1': Analyzes needs to produce problem definition for thermal and mechanical systems.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Four courses namely Summer Training (UME591), Advance Machine Design (UME701), Heat and Mass transfer (UME704), Mechanical System Design (UME801) were used to assess performance criteria C1 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Summer Training (UME591)

The above performance criteria are used to measure the attainment of outcome 'C1' through PPT (weightage 7 marks) to the students.

Expectation: Student needs to be presented and explain about the need of the catapult project.

Student's performance in the above question is given below in Table C4.1:

Table C4.1: Student's performance in question targeting 'C1'; course: UME 591

Sr No.	Roll No.	Marks (MM:10)	Scale (1 to 5)
1	101308001	8.0	5
2	101308002	5.7	2
3	101308003	5.9	3
4	101308004	8.0	5
5	101308005	6.8	4
6	101308006	7.4	5
7	101308007	7.0	4
8	101308008	7.4	5
9	101308009	5.8	3
10	101308010	7.5	5
11	101308011	5.2	2
12	101308012	7.3	4
13	101308013	7.2	4
14	101308014	7.5	5
15	101308015	7.2	4
16	101308016	6.4	3
17	101308017	5.0	2
18	101308018	5.7	2
19	101308019	6.3	3
20	101308020	8.6	5
21	101308021	6.4	3
22	101308023	7.4	5
23	101308024	4.9	1
24	101308025	6.0	3
25	101308026	5.8	3
26	101308027	6.4	3
27	101308028	8.0	5

28	101308029	6.1	3
29	101308031	5.0	2
30	101308032	6.4	3
31	101308033	7.3	4
32	101308034	7.3	4
33	101308035	7.1	4
34	101308036	7.0	4
35	101308037	5.0	2
36	101308038	8.2	5
37	101308039	7.4	5
38	101308040	6.6	4
39	101308042	7.0	4
40	101308043	5.4	2
41	101308044	6.6	4
42	101308045	7.0	4
43	101308046	7.2	4
44	101308047	6.5	3
45	101308048	7.7	5
46	101308050	7.4	5
47	101308051	7.4	5
48	101308052	5.8	3
49	101308053	7.5	5
50	101308054	7.4	5
51	101308055	8.2	5
52	101308057	7.4	5
53	101308058	7.1	4
54	101308059	8.0	5
55	101308060	7.3	4
56	101308061	5.0	2
57	101308063	7.9	5
58	101308064	6.0	3
59	101308065	5.0	2
60	101308066	7.2	4
61	101308067	6.2	3
62	101308068	7.1	4
63	101308069	6.9	4
64	101308071	5.8	3
65	101308072	7.9	5
66	101308073	8.2	5
67	101308074	5.2	2
68	101308076	6.3	3

The overall performance of student in the above question is then summarised as given below in Table C4.2:

Table C 4.2: Average score of student performance in the course UME591 for criteria C1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME591	32.35	27.94	23.52	14.70	1.49	3.74

(ii) Course: Advance Machine Design (UME701)

The above performance criteria is used to measure the attainment of outcome ‘C1’ by giving the following questions (Questions No. 1 and 2: during MST in September 2015, weightage 15 marks) to the students.

Student’s performance in the above question is given below in Table C4.3:

Table C4.3: Student’s performance in question targeting ‘C1’; course: UME701

Sr. No	Roll No	Marks (M M 15)	Score (1 to 5)
1	101208065	3	2
2	101208066	6.5	3
3	101208068	5	3
4	101208069	10	5
5	101208070	8.5	4
6	101208072	7	4
7	101208073	10	5
8	101208075	2	1
9	101208077	4	3
10	101208078	5	3
11	101208079	7.5	4
12	101208080	3.5	2
13	101208082	13	5
14	101208083	5	3
15	101208084	8	4
16	101208086	8	4
17	101208088	6.5	3
18	101208142	3.5	2
19	101388012	0.5	1
20	101208090	0	1
21	101208091	7	4
22	101208092	12.5	5
23	101208093	7.5	4
24	101208095	5	3
25	101208096	9.5	4
26	101208097	2.5	2
27	101208101	10	5
28	101208102	6	3
29	101208104	9.5	4
30	101208106	6.5	3
31	101208107	8.5	4
32	101208108	7.5	4
33	101208110	6.5	3
34	101208111	10	5

35	101208112	7	4
36	101208113	6	3
37	101388009	3.5	2
38	101388010	4	3
39	101208058	4	3
40	101208114	8.5	4
41	101208115	8	4
42	101208116	7.5	4
43	101208117	10.5	5
44	101208120	7	4
45	101208121	1.5	1
46	101208125	13	5
47	101208126	9.5	4
48	101208129	3.5	2
49	101208131	12	5
50	101208132	7.5	4
51	101208133	8.5	4
52	101208134	2	1
53	101208136	5.5	3
54	101208138	5	3
55	101208139	7.5	4
56	101388006	2.5	2
57	101388008	4	3

The overall performance of students in the above question is then summarized as given below in Table C4.4:

Table C4.4: Average score of student performance in the course UME701 for criteria C1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME701	15.79	35.09	28.07	12.28	8.77	3.37

(iii) Course: Heat and Mass transfer (UME704)

The above performance criteria is used to measure the attainment of outcome ‘C1’ by giving the following problem (Question No. 4 in MST, 4 marks) to the students.

Question: (4) A person puts a few apples into the freezer at -15°C to cool them quickly for guests who are about to arrive. Initially, the apples are at a uniform temperature of 20°C , and the heat transfer coefficient on the surfaces is $8 \text{ W/m}^2\text{K}$. Treating the apples as 9-cm-diameter spheres and taking their properties to be $\rho = 840 \text{ kg/m}^3$, $C_p = 3.81 \text{ kJ/kgK}$, $K = 0.418 \text{ W/mK}$, and $\alpha = 1.3 \times 10^{-7} \text{ m}^2/\text{s}$, determine the surface temperatures of the apples after 1 hr. Also, determine the amount of heat transfer from each apple.

Student’s performance in the above question is given below in Table C4.5:

Table C4.5: Student's performance in question targeting 'C1'; course: UME704

S. No.	Roll No.	Marks (MM: 4)	Score (Scale 1 to 5)
1	101208001	4	5
2	101208002	4	5
3	101208003	2.5	3
4	101208004	2.5	3
5	101208005	4	5
6	101208006	3	4
7	101208007	4	5
8	101208008	3	4
9	101208009	3	4
10	101208010	2	3
11	101208011	3.5	5
12	101208012	3	4
13	101208013	3	4
14	101208016	3	4
15	101208017	3.5	5
16	101208019	4	5
17	101208020	3	4
18	101208022	3	4
19	101208023	3.5	5
20	101208024	3	4
21	101208025	4	5
22	101208026	4	5
23	101208027	3	4
24	101208028	4	5
25	101208030	4	5
26	101208031	3	4
27	101208032	2.5	3
28	101208034	2.5	3
29	101208035	3	4
30	101208036	0	1
31	101208037	0.5	1
32	101208038	3	4
33	101208039	3.5	5
34	101208040	2.5	3
35	101208042	0	1
36	101208044	1	2
37	101208045	3	4
38	101208046	3.5	5
39	101208048	3	4
40	101208049	1.5	2
41	101208051	3	4

42	101208052	4	5
43	101208053	0.5	1
44	101208054	2.5	3
45	101208055	3	4
46	101208056	2	3
47	101208057	3	4
48	101208060	2.5	3
49	101208061	2.5	3
50	101208062	1	2
51	101208063	1.5	2
52	101208064	3	4
53	101208076	2	3
54	101208081	3	4
55	101208140	3	4
56	101388001	2.5	3
57	101388002	3	4
58	101388003	3	4
59	101388004	2.5	3
60	101388005	4	5
61	101388007	3	4

The overall performance of students in the above question is then summarized as given below in Table C4.6:

Table C4.6: Average score of student performance in the course UME704 for criteria C1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME704	26	39	21	7	7	3.7

(iv) Course: Mechanical System Design (UME801)

The above performance criteria is used to measure the attainment of outcome ‘C’ by giving the following question (Question No.: 2 in the final report and evaluation) to the students.

Question:(2) How many needs were explored to form possible projects? How were the needs analyzed to from criteria, constraints, specifications for separate project proposals? How many models (alternate designs) were considered to formulate solutions to the need? Briefly describe them.

Student’s performance in the above question is given below in Table C4.7:

Table C4.7: Student's performance in question targeting 'C1'; course: UME801

S. No.	Roll No.	C1	Weight (Scale 1 to 5)
		(Q. No. 2 in Final report and evaluation) (5 Marks)	
1	101108003	4	4
2	101108124	4	4
3	101288002	4	4
4	101108128	4	4
5	101008020	4	4
6	101108001	3.7	4
7	101108122	3.7	4
8	101108123	3.7	4
9	101158003	3.7	4
10	101108129	3.7	4
11	101108002	4.2	4
12	101108004	4.2	4
13	101108007	4.2	4
14	101108008	4.2	4
15	101108012	4.2	4
16	101108005	3.9	4
17	101108013	3.9	4
18	101288001	3.9	4
19	101288013	3.9	4
20	101288020	3.9	4
21	101108009	4.6	5
22	101108010	4.6	5
23	101108125	4.6	5
24	101108126	4.6	5
25	101108020	4.6	5
26	101108021	4.1	4
27	101108022	4.1	4
28	101108023	4.1	4
29	101108029	4.1	4
30	101108014	4.2	4
31	101108015	4.2	4
32	101108016	4.2	4
33	101108017	4.2	4
34	101108018	4.2	4
35	101108027	4.1	4
36	101108030	4.1	4
37	101108031	4.1	4
38	101108034	4.1	4
39	101288025	4.1	4

40	101108019	3.75	4
41	101108024	3.75	4
42	101108026	3.75	4
43	101288003	3.75	4
44	101288011	3.75	4
45	101108028	4	4
46	101108032	4	4
47	101108033	4	4
48	101288008	4	4
49	101108131	4	4
50	101108035	4.25	4
51	101108038	4.25	4
52	101108046	4.25	4
53	101108054	4.25	4
54	101288017	4.25	4
55	101108036	3.7	4
56	101108037	3.7	4
57	101108041	3.7	4
58	101108045	3.7	4
59	101108056	3.7	4
60	101108039	3.3	3
61	101108040	3.3	3
62	101108042	3.3	3
63	101108043	3.3	3
64	101108051	3.3	3
65	101108044	4.9	5
66	101108049	4.9	5
67	101108050	4.9	5
68	101108055	4.9	5
69	101288016	4.9	5

The overall performance of students in the above question is then summarized as given below in Table C4.8:

Table C4.8: Average score of student performance in the course UME801 for criteria C1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME801	14.5	78.3	7.2	0	0	4.1

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria C1 as given below in Table C4.9:

Table C4.9: Weighted Average Student class performance (course portfolio) for criteria C1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	32.35	27.94	23.52	14.7	1.49	3.75	5
UME701	15.79	35.09	28.07	12.28	8.77	3.37	4
UME704	26	39	21	7	7	3.70	4
UME801	14.5	78.3	7.2	0	0	4.07	5
Weighted average score	22.30	45.98	19.44	8.37	3.92	3.74	18

b) Indirect measures for Performance criteria C1 (Surveys)**i.) Assessment Tool: Student Course Survey****Table C4.10: Average score of student course survey for criteria C1**

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	8.80	27.04	37.10	15.09	11.94	3.06	5
UME701	22.92	26.05	18.75	21.87	7.17	3.26	4
UME704	20.105	32.06	33.14	12.49	2.1725	3.55	4
UME801	16.27	30.05	38.28	12.19	3.22	3.44	5
Weighted average score	16.53	28.77	32.47	15.22	6.29	3.32	18

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey**Table C4.11: Assessment for criteria C1 using Graduating student survey, alumni survey and employer survey tool**

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	33.33	46.67	18.33	1.67	0	4.12
Alumni survey	48.72	34.15	14.65	2.56	0	4.29
Employer Survey	31.82	50.33	13.64	4.55	0	4.10

c) Overall weighted average score of performance criterion ‘C1’

Finally overall weighted average score of performance criterion ‘C1’ is evaluated as given below in Table C4.12:

Table C4.12: Overall weighted average score of performance criterion 'C1'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	22.30	45.98	19.44	8.37	3.92	3.74	5
Weighted average student course survey	16.53	28.77	32.47	15.22	6.29	3.32	4
Graduating student survey	33.33	46.67	18.33	1.67	0	4.11	3
Alumni survey	48.72	34.15	14.65	2.56	0	4.29	3
Employer survey	31.82	68.18	0	0	0	4.32	3
Overall weighted score	30.65	43.55	18.21	4.71	2.89	3.94	18

Assessment of Outcome 'C' using performance criterion C2

Performance criteria 'C2': Carries out design process to satisfy project requirement for thermal and mechanical systems.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Four courses namely Summer Training (UME591), Advance Machine Design (UME701), Heat and Mass transfer (UME704), Mechanical System Design (UME801) were used to assess performance criteria C2 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Summer Training (UME591)

The above performance criteria are used to measure the attainment of outcome 'C2' through CAD drawing, machining and pattern preparing (weightage 22 marks) to the students.

Expectation: Student needs to be provided CAD drawings of the entire component used in the project along with the details of all the operation used in manufacturing those components. Perform machining on required components and also prepare patterns for casting as part of summer training.

Student's performance in the above question is given below in Table C4.13:

Table C4.13: Student's performance in question targeting 'C2'; course: UME 591

Sr. No.	Roll No.	Marks (MM:22)	Scale (1 to 5)
1	101308001	17	4
2	101308002	11.5	1
3	101308003	18	5
4	101308004	17	4
5	101308005	18	5
6	101308006	18	5
7	101308007	17.5	5
8	101308008	16.5	4
9	101308009	17	4
10	101308010	17	4
11	101308011	16	3
12	101308012	16.5	4

13	101308013	16.5	4
14	101308014	16.5	3
15	101308015	13.5	2
16	101308016	13.5	2
17	101308017	16.5	3
18	101308018	16	3
19	101308019	17	4
20	101308020	16	3
21	101308021	17.5	5
22	101308023	17	4
23	101308024	17.5	5
24	101308025	17	4
25	101308026	15.5	2
26	101308027	16	3
27	101308028	17	4
28	101308029	18	5
29	101308031	17	4
30	101308032	16.5	3
31	101308033	12	1
32	101308034	17.5	5
33	101308035	16.5	3
34	101308036	17	4
35	101308037	16	3
36	101308038	16	3
37	101308039	16	3
38	101308040	16.5	3
39	101308042	17	4
40	101308043	18	5
41	101308044	15	2
42	101308045	18	5
43	101308046	18	5
44	101308047	17	4
45	101308048	18	5
46	101308050	16.5	3
47	101308051	15.5	2
48	101308052	16	2
49	101308053	17	4
50	101308054	18	5
51	101308055	17.5	5
52	101308057	17.5	5
53	101308058	12.5	1
54	101308059	19	5
55	101308060	18	5
56	101308061	17	4
57	101308063	17.5	4
58	101308064	17	4
59	101308065	18.5	5
60	101308066	16	2
61	101308067	13	2
62	101308068	18	5
63	101308069	16.5	3
64	101308071	18.5	5
65	101308072	17.5	4

66	101308073	16	2
67	101308074	14.5	2
68	101308076	14.5	2

The overall performance of student in the above question is then summarised as given below in Table C4.14:

Table C 4.14: Average score of student performance in the course UME591 for criteria C2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME591	29.41	29.41	20.58	16.17	4.41	3.63

(ii) Course: Advance Machine Design (UME701)

The above performance criteria is used to measure the attainment of outcome ‘C2’ by giving the following question (Question No.:3 during MST in September 2015, weightage 7.5 marks) to the students.

Student’s performance in the above question is given below in Table C4.15:

Table C4.15: Student’s performance in question targeting ‘C2’; course: UME701

Sr. No	Roll No	Marks (M.M. 7.5)	Score (1 to 5)
1	101208065	1	2
2	101208066	3.5	4
3	101208068	0.5	1
4	101208069	1	2
5	101208070	6	5
6	101208072	5.5	5
7	101208073	1	2
8	101208075	1	2
9	101208077	1	2
10	101208078	6	5
11	101208079	1	2
12	101208080	5.5	5
13	101208082	6	5
14	101208083	6	5
15	101208084	5.5	5
16	101208086	6	5
17	101208088	1	2
18	101208142	1	2
19	101388012	1	2
20	101208090	0	1
21	101208091	3.5	4
22	101208092	6	5
23	101208093	6.5	5
24	101208095	6.5	5
25	101208096	4.5	4
26	101208097	2.5	3
27	101208101	2.5	3

28	101208102	1.5	2
29	101208104	3	3
30	101208106	1.5	2
31	101208107	5	5
32	101208108	6	5
33	101208110	0	1
34	101208111	1	2
35	101208112	2	3
36	101208113	6.5	5
37	101388009	1	2
38	101388010	5	5
39	101208058	0	1
40	101208114	0.5	1
41	101208115	6	5
42	101208116	6.5	5
43	101208117	6	5
44	101208120	1	2
45	101208121	1	2
46	101208125	0	1
47	101208126	4.5	4
48	101208129	0.5	1
49	101208131	1.5	2
50	101208132	4.5	4
51	101208133	1.5	2
52	101208134	7	5
53	101208136	1	2
54	101208138	0.5	1
55	101208139	1	2
56	101388006	1	2
57	101388008	0	1

The overall performance of students in the above question is then summarized as given below in Table C4.16:

Table C4.16: Average score of student performance in the course UME701 for criteria C2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME701	33.33	12.28	10.53	28.07	15.79	3.19

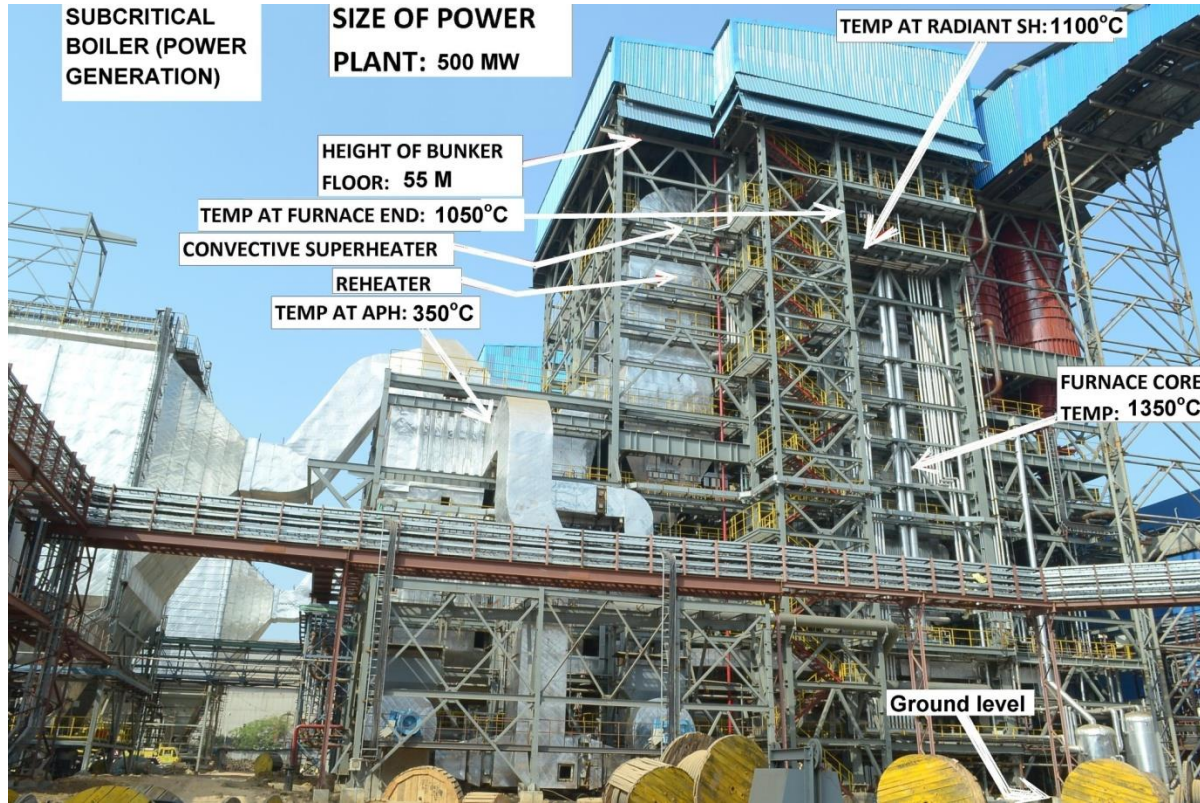
(iii) Course: Heat and Mass transfer (UME704)

The above performance criteria is used to measure the attainment of outcome ‘C2’ by giving the following problem (Question No. 1 in MST, 11 marks) to the students.

Question: A company (involved in the design and supply of power plant systems and components) needs to urgently estimate certain important parameters of a 500 MW subcritical boiler to quote for a power project. Temperature conditions at various places of a similar subcritical power generation 500 MW boiler are provided overleaf (see Figure). Height of the top of boiler bunker is 55 m. The steam condition in the reheater is 160 bar and 540°C. The steam velocity through the reheater tube is 2.5 m/s and the flue gas velocity in the boiler duct is 12 m/s. Practically, some layers (of thickness 1 mm) of

fly ash always remain deposited on the reheater tubes. The thermal conductivity of fly ash is: 1 W/mK. The Internal Diameter of the reheater tube is 1 inch. The available formula (approximate) for forced convection is: $hL/K = 0.023(\rho VL/\mu)^{0.8}(\mu C_p/K)^{0.4}$, where 'L' is the characteristics length.

- Determine the thickness of the reheater tubes as per power piping standards.
- Determine the heat transfer rate at reheater per unit length of the tube.
- Comment if the deposited layer of ash would always reduce the heat transfer.



Student's performance in the above question is given below in Table C4.17:

Table C4.17: Student's performance in question targeting 'C2'; course: UME704

S. No.	Roll No.	Marks (MM: 4)	Score (Scale 1 to 5)
1	101208001	7	4
2	101208002	6.5	4
3	101208003	6	4
4	101208004	4.5	3
5	101208005	5.5	4
6	101208006	9.5	5
7	101208007	7	4
8	101208008	7.5	4
9	101208009	7	4
10	101208010	5	3
11	101208011	8	5

12	101208012	3.5	2
13	101208013	7.5	4
14	101208016	7	4
15	101208017	7	4
16	101208019	9.5	5
17	101208020	4.5	3
18	101208022	7.5	4
19	101208023	7.5	5
20	101208024	5.5	3
21	101208025	9	5
22	101208026	8	5
23	101208027	9.5	5
24	101208028	8	5
25	101208030	7	4
26	101208031	4.5	3
27	101208032	6	4
28	101208034	6	4
29	101208035	4	3
30	101208036	6	4
31	101208037	5	3
32	101208038	8.5	5
33	101208039	6.5	4
34	101208040	7.5	4
35	101208042	7.5	4
36	101208044	6.5	4
37	101208045	3.5	4
38	101208046	9	5
39	101208048	9.5	5
40	101208049	8.5	5
41	101208051	9	5
42	101208052	5	3
43	101208053	5.5	3
44	101208054	8.5	5
45	101208055	7.5	4
46	101208056	6	4

47	101208057	6	4
48	101208060	4.5	3
49	101208061	4.5	3
50	101208062	7.5	4
51	101208063	5.5	3
52	101208064	8.5	5
53	101208076	6.5	4
54	101208081	4	3
55	101208140	10	5
56	101388001	6.5	4
57	101388002	9	5
58	101388003	5.5	3
59	101388004	8.5	5
60	101388005	6.5	4
61	101388007	6	4

The overall performance of students in the above question is then summarized as given below in Table C4.6:

Table C4.18: Average score of student performance in the course UME704 for criteria C2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME704	29	43	23	1	0	3.88

(iv) Course: Mechanical System Design (UME801)

The above performance criteria is used to measure the attainment of outcome ‘C’ by giving the following question (From the final report and evaluation) to the students.

Question: From the final report and evaluation

Student’s performance in the above question is given below in Table C4.19:

Table C4.19: Student’s performance in question targeting ‘C2’; course: UME801

S. No.	Roll No.	C2	Weight (Scale 1 to 5)
		(From Final report and evaluation) (5 Marks)	
1	101108003	3.83	4
2	101108124	3.83	4

3	101288002	3.83	4
4	101108128	3.83	4
5	101008020	3.83	4
6	101108001	4.1	4
7	101108122	4.1	4
8	101108123	4.1	4
9	101158003	4.1	4
10	101108129	4.1	4
11	101108002	4.4	4
12	101108004	4.4	4
13	101108007	4.4	4
14	101108008	4.4	4
15	101108012	4.4	4
16	101108005	4	4
17	101108013	4	4
18	101288001	4	4
19	101288013	4	4
20	101288020	4	4
21	101108009	4.3	4
22	101108010	4.3	4
23	101108125	4.3	4
24	101108126	4.3	4
25	101108020	4.2	4
26	101108021	4.2	4
27	101108022	4.2	4
28	101108023	4.2	4
29	101108029	4.2	4
30	101108014	4.2	4
31	101108015	4.2	4
32	101108016	4.2	4
33	101108017	4.2	4
34	101108018	4.2	4
35	101108027	3.9	4
36	101108030	3.9	4
37	101108031	3.9	4
38	101108034	3.9	4
39	101288025	3.9	4
40	101108019	3.4	3
41	101108024	3.4	3
42	101108026	3.4	3
43	101288003	3.4	3
44	101288011	3.4	3
45	101108028	3.8	4
46	101108032	3.8	4
47	101108033	3.8	4

48	101288008	3.8	4
49	101108131	3.8	4
50	101108035	4.5	5
51	101108038	4.5	5
52	101108046	4.5	5
53	101108054	4.5	5
54	101288017	4.5	5
55	101108036	3.7	4
56	101108037	3.7	4
57	101108041	3.7	4
58	101108045	3.7	4
59	101108056	3.7	4
60	101108039	3.4	3
61	101108040	3.4	3
62	101108042	3.4	3
63	101108043	3.4	3
64	101108051	3.4	3
65	101108044	4.9	5
66	101108049	4.9	5
67	101108050	4.9	5
68	101108055	4.9	5
69	101288016	4.9	5

The overall performance of students in the above question is then summarized as given below in Table C4.20:

Table C4.20: Average score of student performance in the course UME801 for criteria C2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME801	14.5	71	14.5	0	0	4

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria C2 as given below in Table C4.21:

Table C4.21: Weighted Average Student class performance (course portfolio) for criteria C2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	29.41	29.41	20.58	16.17	4.41	3.63	5
UME701	33.33	12.28	10.53	28.07	15.79	3.19	4
UME704	29	43	23	1	0	3.88	4
UME801	14.5	71	14.5	0	0	4.00	5

Weighted average score	26.05	40.18	17.20	10.95	4.73	3.69	18
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b) Indirect measures for Performance criteria C2 (Surveys)

i.) Assessment Tool: Student Course Survey

Table C4.22: Average score of student course survey for criteria C2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	8.80	27.04	37.10	15.09	11.94	3.06	5
UME701	22.92	26.05	18.75	21.87	7.17	3.26	4
UME704	20.10	32.06	33.14	12.49	2.17	3.55	4
UME801	16.27	30.05	38.28	12.19	3.22	3.44	5
Weighted average score	16.53	28.77	32.47	15.22	6.29	3.32	18

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table C4.23: Assessment for criteria C2 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	33.33	46.67	18.33	1.67	0	4.12
Alumni survey	48.72	34.15	14.65	2.56	0	4.29
Employer Survey	31.82	50.33	13.64	4.55	0	4.10

c) Overall weighted average score of performance criterion 'C2'

Finally overall weighted average score of performance criterion 'C2' is evaluated as given below in

Table C4.24:

Table C4.24: Overall weighted average score of performance criterion 'C2'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	26.05	40.18	17.20	10.95	4.73	3.69	5
Weighted average student course survey	16.53	28.77	32.47	15.22	6.29	3.32	4
Graduating student survey	33.33	46.67	18.33	1.67	0	4.11	3
Alumni survey	48.72	34.15	14.65	2.56	0	4.29	3
Employer survey	31.82	50.33	13.64	4.55	0	4.10	3
Overall weighted score	29.89	39.41	19.76	7.89	2.71	3.85	18

Assessment of Outcome 'C' using performance criterion C3

Performance criteria 'C3': Can work within realistic constraints in realizing systems.

Step 1: Three courses namely Summer Training (UME591), Advance Machine Design (UME701), Mechanical System Design (UME801) were used to assess performance criteria C3 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Summer Training (UME591)

The above performance criteria are used to measure the attainment of outcome 'C3' by building up the catapult prototype (weightage 10 marks) to the students.

Expectation: Student needs to be built up a catapult prototype as per the specification constrains specified.

Student's performance in the above question is given below in Table C4.25:

Table C4.25: Student's performance in question targeting 'C3'; course: UME 591

Sr. No.	Roll No.	Marks (MM:10)	Score Scale (1 to 5)
1	101308001	8.5	5
2	101308002	6.5	3
3	101308003	9.5	5
4	101308004	3.5	2
5	101308005	8.5	5
6	101308006	7.5	4
7	101308007	8.5	5
8	101308008	4.5	2
9	101308009	9.5	5
10	101308010	8.5	5
11	101308011	7.1	3
12	101308012	4.5	2
13	101308013	8.5	5
14	101308014	8.5	5
15	101308015	7.5	4
16	101308016	3.5	2
17	101308017	7.1	3
18	101308018	6.5	3
19	101308019	3.5	2
20	101308020	3.5	2
21	101308021	7.5	4
22	101308023	8.5	5
23	101308024	6.25	3
24	101308025	9.5	5
25	101308026	9.5	5
26	101308027	3.5	2
27	101308028	8.5	5
28	101308029	7.5	4

29	101308031	6.25	3
30	101308032	3.5	1
31	101308033	4.5	2
32	101308034	5.5	3
33	101308035	8.5	5
34	101308036	8.5	5
35	101308037	7.1	3
36	101308038	9.75	5
37	101308039	8.5	4
38	101308040	7.1	3
39	101308042	10	5
40	101308043	8.15	4
41	101308044	8.5	4
42	101308045	10	5
43	101308046	5.5	2
44	101308047	7.5	4
45	101308048	8.5	4
46	101308050	8.5	4
47	101308051	8.5	4
48	101308052	6.5	3
49	101308053	8.5	4
50	101308054	8.5	4
51	101308055	8.5	4
52	101308057	8.5	4
53	101308058	10	5
54	101308059	8.5	4
55	101308060	4.5	2
56	101308061	7.1	3
57	101308063	3.5	1
58	101308064	7.5	4
59	101308065	6.25	3
60	101308066	8.5	4
61	101308067	7.5	4
62	101308068	10	5
63	101308069	8.5	4
64	101308071	6.5	3
65	101308072	3.5	1
66	101308073	9.75	5
67	101308074	8.5	4
68	101308076	7.5	3

The overall performance of student in the above question is then summarised as given below in Table C4.26:

Table C 4.26: Average score of student performance in the course UME591 for criteria C3

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME591	29.41	30.88	20.58	14.70	4.41	3.66

(ii) Course: Advance Machine Design (UME701)

The above performance criteria is used to measure the attainment of outcome ‘C3’ by giving the following questions (Questions No. 1: during MST in September 2015, weightage 7.5 marks) to the students.

Student’s performance in the above question is given below in Table C4.27:

Table C4.27: Student’s performance in question targeting ‘C3’; course: UME701

Sr. No	Roll No	Marks (M. M. 7.5)	Score (1 to 5)
1	101208065	4	4
2	101208066	0	1
3	101208068	4.5	4
4	101208069	4.5	4
5	101208070	3.5	4
6	101208072	5.5	5
7	101208073	5	4
8	101208075	0	1
9	101208077	3.5	4
10	101208078	0	1
11	101208079	2	2
12	101208080	3.5	4
13	101208082	4.5	4
14	101208083	1.5	1
15	101208084	3	3
16	101208086	5	4
17	101208088	4.5	4
18	101208142	4.5	4
19	101388012	0.5	1
20	101208090	1.5	1
21	101208091	4.5	4
22	101208092	3	3
23	101208093	0	1
24	101208095	0	1
25	101208096	3.5	4
26	101208097	4	4
27	101208101	0	1
28	101208102	3	3
29	101208104	3.5	4
30	101208106	2.5	3
31	101208107	5	4
32	101208108	3.5	4
33	101208110	2	2
34	101208111	1	1

35	101208112	2.5	3
36	101208113	2	2
37	101388009	4	4
38	101388010	4	4
39	101208058	2	3
40	101208114	3	3
41	101208115	5.5	5
42	101208116	2	3
43	101208117	4	4
44	101208120	1	1
45	101208121	1.5	2
46	101208125	2	2
47	101208126	3.5	4
48	101208129	2	2
49	101208131	6.5	5
50	101208132	1.5	2
51	101208133	4	4
52	101208134	3.5	4
53	101208136	2.5	3
54	101208138	2	2
55	101208139	2	2
56	101388006	1.5	2
57	101388008	1.5	2

The overall performance of students in the above question is then summarized as given below in Table C4.28:

Table C4.28: Average score of student performance in the course UME701 for criteria C2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME701	8.77	38.6	15.79	19.3	17.55	3.02

(iii) Course: Mechanical System Design (UME801)

The above performance criterion is used to measure the attainment of outcome ‘C’ by giving the following question (From marks of fabrication) to the students.

Question: From marks of fabrication

Student’s performance in the above question is given below in Table C4.29:

Table C4.29: Student’s performance in question targeting ‘C3’; course: UME801

S. No.	Roll No.	C3	Weight (Scale 1 to 5)
		(From marks of fabrication) (5 Marks)	
1	101108003	3.4	3
2	101108124	3.4	3

3	101288002	3.4	3
4	101108128	3.4	3
5	101008020	3.4	3
6	101108001	3.4	3
7	101108122	3.4	3
8	101108123	3.4	3
9	101158003	3.4	3
10	101108129	3.4	3
11	101108002	3.8	4
12	101108004	3.8	4
13	101108007	3.8	4
14	101108008	3.8	4
15	101108012	3.8	4
16	101108005	3.6	4
17	101108013	3.6	4
18	101288001	3.6	4
19	101288013	3.6	4
20	101288020	3.6	4
21	101108009	3.8	4
22	101108010	3.8	4
23	101108125	3.8	4
24	101108126	3.8	4
25	101108020	3.6	4
26	101108021	3.6	4
27	101108022	3.6	4
28	101108023	3.6	4
29	101108029	3.6	4
30	101108014	3.7	4
31	101108015	3.7	4
32	101108016	3.7	4
33	101108017	3.7	4
34	101108018	3.7	4
35	101108027	3.6	4
36	101108030	3.6	4
37	101108031	3.6	4
38	101108034	3.6	4
39	101288025	3.6	4
40	101108019	3.5	4
41	101108024	3.5	4
42	101108026	3.5	4
43	101288003	3.5	4
44	101288011	3.5	4
45	101108028	3.5	4
46	101108032	3.5	4
47	101108033	3.5	4

48	101288008	3.5	4
49	101108131	3.5	4
50	101108035	4.2	4
51	101108038	4.2	4
52	101108046	4.2	4
53	101108054	4.2	4
54	101288017	4.2	4
55	101108036	3.6	4
56	101108037	3.6	4
57	101108041	3.6	4
58	101108045	3.6	4
59	101108056	3.6	4
60	101108039	3.9	4
61	101108040	3.9	4
62	101108042	3.9	4
63	101108043	3.9	4
64	101108051	3.9	4
65	101108044	4.5	5
66	101108049	4.5	5
67	101108050	4.5	5
68	101108055	4.5	5
69	101288016	4.5	5

The overall performance of students in the above question is then summarized as given below in Table C4.30:

Table C4.30: Average score of student performance in the course UME801 for criteria C3

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME801	7.2	78.3	14.5	0	0	3.9

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria C3 as given below in Table C4.31:

Table C4.31: Weighted Average Student class performance (course portfolio) for criteria C3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	29.41	30.88	20.58	14.7	4.41	3.66	5
UME701	8.77	38.6	15.79	19.3	17.55	3.02	4
UME801	7.2	78.3	14.5	0	0	3.93	5
Weighted average score	15.58	50.02	17.04	10.76	6.59	3.57	14

b) Indirect measures for Performance criteria C3 (Surveys)

i.) Assessment Tool: Student Course Survey

Table C4.32: Average score of student course survey for criteria C3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	8.80	27.04	37.10	15.09	11.94	3.06	5
UME701	22.92	26.05	18.75	21.87	7.17	3.26	4
UME801	16.27	30.05	38.28	12.19	3.22	3.44	5
Weighted average score	15.50	27.83	32.28	15.99	7.47	3.25	14

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table C4.33: Assessment for criteria C3 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	33.33	46.67	18.33	1.67	0	4.12
Alumni survey	48.72	34.15	14.65	2.56	0	4.29
Employer Survey	31.82	50.33	13.64	4.55	0	4.10

c) Overall weighted average score of performance criterion ‘C3’

Finally overall weighted average score of performance criterion ‘C3’ is evaluated as given below in Table C4.34:

Table C4.34: Overall weighted average score of performance criterion ‘C3’

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	15.58	50.02	17.04	10.76	6.59	3.57	5
Weighted average student course survey	15.50	27.83	32.28	15.99	7.47	3.25	4
Graduating student survey	33.33	46.67	18.33	1.67	0	4.11	3
Alumni survey	48.72	34.15	14.65	2.56	0	4.29	3
Employer survey	31.82	50.33	13.64	4.55	0	4.10	3
Overall weighted score	26.75	41.94	19.68	8.01	3.49	3.80	18

Assessment of Outcome 'C' using performance criterion C4

Performance criteria 'C4' : Can build prototypes that meet design specifications.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Summer Training (UME591), Mechanical System Design (UME801) were used to assess performance criteria C4 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Summer Training (UME591)

The above performance criteria are used to measure the attainment of outcome 'C4' by participating catapult competition (weightage 10 marks) to the students.

Expectation: Student needs to be demonstrated the working of their prototype by participating in a competition.

Student's performance in the above question is given below in Table C4.35:

Table C4.35: Student's performance in question targeting 'C4'; course: UME 591

Sr. No.	Roll No.	Marks (MM: 10)	Score Scale (1 to 5)
1	101308001	8.5	5
2	101308002	6.5	3
3	101308003	9.5	5
4	101308004	3.5	2
5	101308005	8.5	5
6	101308006	7.5	4
7	101308007	8.5	5
8	101308008	4.5	2
9	101308009	9.5	5
10	101308010	8.5	5
11	101308011	7.1	3
12	101308012	4.5	2
13	101308013	8.5	5
14	101308014	8.5	5
15	101308015	7.5	4
16	101308016	3.5	2
17	101308017	7.1	3
18	101308018	6.5	3
19	101308019	3.5	2
20	101308020	3.5	2
21	101308021	7.5	4
22	101308023	8.5	5
23	101308024	6.25	3
24	101308025	9.5	5
25	101308026	9.5	5
26	101308027	3.5	2

27	101308028	8.5	5
28	101308029	7.5	4
29	101308031	6.25	3
30	101308032	3.5	1
31	101308033	4.5	2
32	101308034	5.5	3
33	101308035	8.5	5
34	101308036	8.5	5
35	101308037	7.1	3
36	101308038	9.75	5
37	101308039	8.5	4
38	101308040	7.1	3
39	101308042	10	5
40	101308043	8.15	4
41	101308044	8.5	4
42	101308045	10	5
43	101308046	5.5	2
44	101308047	7.5	4
45	101308048	8.5	4
46	101308050	8.5	4
47	101308051	8.5	4
48	101308052	6.5	3
49	101308053	8.5	4
50	101308054	8.5	4
51	101308055	8.5	4
52	101308057	8.5	4
53	101308058	10	5
54	101308059	8.5	4
55	101308060	4.5	2
56	101308061	7.1	3
57	101308063	3.5	1
58	101308064	7.5	4
59	101308065	6.25	3
60	101308066	8.5	4
61	101308067	7.5	4
62	101308068	10	5
63	101308069	8.5	4
64	101308071	6.5	3
65	101308072	3.5	1
66	101308073	9.75	5
67	101308074	8.5	4
68	101308076	7.5	3

The overall performance of student in the above question is then summarised as given below in Table C4.36:

Table C 4.36: Average score of student performance in the course UME591 for criteria C4

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME591	29.41	30.88	20.58	14.70	4.41	3.66

(ii) Course: Advance Machine Design (UME801)

The above performance criteria is used to measure the attainment of outcome 'C' by giving the following question (From the final report and evaluation) to the students.

Question: From the final report and evaluation

Student's performance in the above question is given below in Table C4.37:

Table C4.37: Student's performance in question targeting 'C4'; course: UME801

S. No.	Roll No.	C4	Weight (Scale 1 to 5)
		(From Final report and evaluation) (5 Marks)	
1	101108003	3.6	4
2	101108124	3.6	4
3	101288002	3.6	4
4	101108128	3.6	4
5	101008020	3.6	4
6	101108001	4.4	4
7	101108122	4.4	4
8	101108123	4.4	4
9	101158003	4.4	4
10	101108129	4.4	4
11	101108002	3.8	4
12	101108004	3.8	4
13	101108007	3.8	4
14	101108008	3.8	4
15	101108012	3.8	4
16	101108005	4.4	4
17	101108013	4.4	4
18	101288001	4.4	4
19	101288013	4.4	4
20	101288020	4.4	4
21	101108009	3.9	4
22	101108010	3.9	4
23	101108125	3.9	4
24	101108126	3.9	4
25	101108020	4	4

26	101108021	4	4
27	101108022	4	4
28	101108023	4	4
29	101108029	4	4
30	101108014	4.1	4
31	101108015	4.1	4
32	101108016	4.1	4
33	101108017	4.1	4
34	101108018	4.1	4
35	101108027	3.6	4
36	101108030	3.6	4
37	101108031	3.6	4
38	101108034	3.6	4
39	101288025	3.6	4
40	101108019	3.25	3
41	101108024	3.25	3
42	101108026	3.25	3
43	101288003	3.25	3
44	101288011	3.25	3
45	101108028	3.3	3
46	101108032	3.3	3
47	101108033	3.3	3
48	101288008	3.3	3
49	101108131	3.3	3
50	101108035	3.9	4
51	101108038	3.9	4
52	101108046	3.9	4
53	101108054	3.9	4
54	101288017	3.9	4
55	101108036	3.4	3
56	101108037	3.4	3
57	101108041	3.4	3
58	101108045	3.4	3
59	101108056	3.4	3
60	101108039	3.6	4
61	101108040	3.6	4
62	101108042	3.6	4
63	101108043	3.6	4
64	101108051	3.6	4
65	101108044	4.75	5
66	101108049	4.75	5
67	101108050	4.75	5
68	101108055	4.75	5
69	101288016	4.75	5

The overall performance of students in the above question is then summarized as given below in Table C4.38:

Table C4.38: Average score of student performance in the course UME801 for criteria C4

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME801	7.3	71	21.7	0	0	3.86

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria C4 as given below in Table C4.39:

Table C4.39: Weighted Average Student class performance (course portfolio) for criteria C4

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	29.41	30.88	20.58	14.7	4.41	3.66	5
UME801	7.3	71	21.7	0	0	3.86	5
Weighted average score	18.36	50.94	21.14	7.35	2.21	3.76	10

b) Indirect measures for Performance criteria C4 (Surveys)

i.) Assessment Tool: Student Course Survey

Table C4.40: Average score of student course survey for criteria C4

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	8.80	27.04	37.10	15.09	11.94	3.05	5
UME801	16.27	30.05	38.28	12.19	3.22	3.44	5
Weighted average score	12.54	28.55	37.69	13.64	7.58	3.25	10

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table C4.41: Assessment for criteria C4 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	33.33	46.67	18.33	1.67	0	4.12
Alumni survey	48.72	34.15	14.65	2.56	0	4.29
Employer Survey	31.82	50.33	13.64	4.55	0	4.10

c) Overall weighted average score of performance criterion 'C4'

Finally overall weighted average score of performance criterion 'C4' is evaluated as given below in Table C4.42:

Table C4.42: Overall weighted average score of performance criterion 'C4'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	18.36	50.94	21.14	7.35	2.21	3.76	5
Weighted average student course survey	12.54	28.55	37.69	13.64	7.58	3.25	4
Graduating student survey	33.33	46.67	18.33	1.67	0	4.11	3
Alumni survey	48.72	34.15	14.65	2.56	0	4.29	3
Employer survey	31.82	50.33	13.64	4.55	0	4.10	3
Overall weighted score	26.86	42.35	22.02	6.54	2.30	3.85	18

Overall assessment of student outcome C using scores of C1, C2, C3 and C4

In the above sections, each of the individual performance criteria C1, C2, C3 and C4 have been assessed. The performance for attainment of outcome C has been completed using the attainment values for C1, C2, C3 and C4 and is provided below:

Table C4.43 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome C.

Table C4.43: Overall score for outcome C at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
C1	28.85	41.02	20.39	7.17	2.49	3.86	5
C2	29.89	39.41	19.76	7.89	2.71	3.85	5
C3	26.75	41.94	19.68	8.01	3.49	3.80	4
C4	26.86	42.35	22.02	6.54	2.30	3.85	3
Overall score	28.31	41.00	20.32	7.47	2.78	3.84	17

**Assessment of Attainment of Program Outcome
'D'
(Year 2015)**

for the

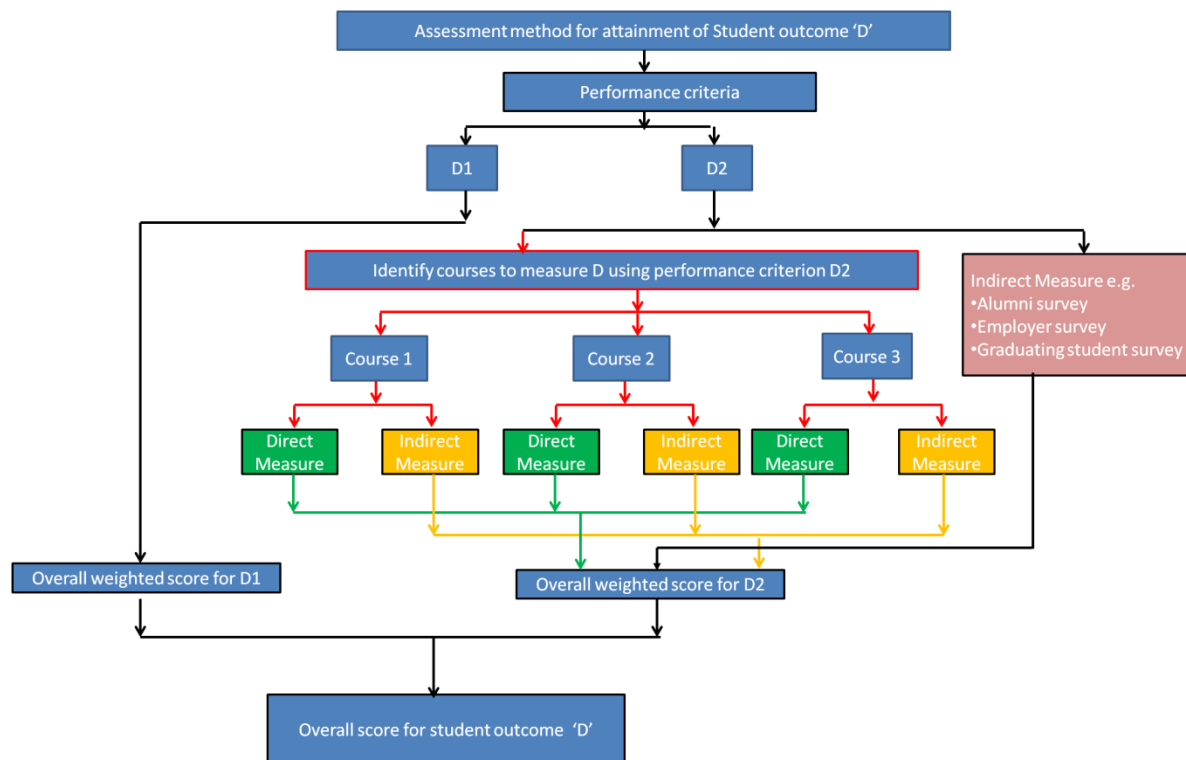
***Bachelor of Engineering
in
Mechanical Engineering***



**Thapar University
Patiala (Punjab) - 147004
INDIA**

Attainment of Outcome D

The attainment of each outcome has been measured using a standard procedure explained in the Self Assessment Report for the program. A flow chart depicting the step by step methodology used to measure each attainment is provided below for ready reference.



The following courses have been considered for the assessment of student outcome 'D'

Courses:

1. Summer Training (UME591)
2. Project Semester (UME691)

Outcome D has been assessed by two performance criteria D1 and D2. The sections below provide data for separate assessments for each of these performance criteria and in the end the results for these two performance criteria has been used to measure the overall measure of outcome D.

1) Assessment of Outcome 'D' using performance criterion D1

Performance criteria 'D1': Shares responsibility and information schedule with others in team.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Summer Training (UME591) and Project semester (UME691) were used to assess performance criteria D1 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Summer Training (UME591)

The above performance criteria are used to measure the attainment of outcome 'D1' by presenting their responsibility to complete the catapult project (weightage 10 marks) to the students.

Expectation: Student needs to be shown their responsibility to complete the catapult project.

Student's performance in the above question is given below in Table D4.1:

Table D4.1: Student's performance in question targeting 'D1'; course: UME 591

Sr. No.	Roll No.	Marks (MM:10)	Scale (1 to 5)
1	101308001	8.00	5
2	101308002	5.67	2
3	101308003	5.92	2
4	101308004	8.00	5
5	101308005	6.75	4
6	101308006	7.42	5
7	101308007	7.00	4
8	101308008	7.42	5
9	101308009	5.83	2
10	101308010	7.50	5
11	101308011	6.20	3
12	101308012	7.25	4
13	101308013	7.17	4
14	101308014	7.50	5
15	101308015	7.17	4
16	101308016	6.42	3
17	101308017	6.00	3
18	101308018	5.67	2
19	101308019	6.33	3
20	101308020	8.58	5
21	101308021	6.42	3
22	101308023	7.42	5
23	101308024	5.90	2
24	101308025	6.00	3
25	101308026	5.83	2

26	101308027	6.42	3
27	101308028	8.00	5
28	101308029	6.08	3
29	101308031	6.00	3
30	101308032	6.42	3
31	101308033	7.25	4
32	101308034	7.25	4
33	101308035	7.08	4
34	101308036	7.00	4
35	101308037	6.00	3
36	101308038	8.17	5
37	101308039	7.42	5
38	101308040	6.58	4
39	101308042	7.00	4
40	101308043	5.42	2
41	101308044	6.58	4
42	101308045	7.00	4
43	101308046	7.17	4
44	101308047	6.50	4
45	101308048	7.67	5
46	101308050	7.42	5
47	101308051	7.42	5
48	101308052	5.75	2
49	101308053	7.50	5
50	101308054	7.42	5
51	101308055	8.17	5
52	101308057	7.42	5
53	101308058	7.08	4
54	101308059	8.00	5
55	101308060	7.25	4
56	101308061	6.00	3
57	101308063	7.92	5
58	101308064	6.00	3
59	101308065	6.00	3
60	101308066	7.17	4
61	101308067	6.17	3
62	101308068	7.08	4
63	101308069	6.92	4
64	101308071	5.75	2
65	101308072	7.92	5
66	101308073	8.17	5
67	101308074	5.10	1
68	101308076	6.25	3

The overall performance of student in the above question is then summarised as given below in Table D4.2:

Table D 4.2: Average score of student performance in the course UME591 for criteria D1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME591	32.36	29.41	23.52	13.24	1.47	3.77

(ii) Course: Project Semester (UME691)

The above performance criteria is used to measure the attainment of outcome 'D' by giving the following question (Question No.: A(iv) in second visit of Project Semester) to the students.

Question:

Planning Skills: Refers to the ability to conceptualise all aspects of the project and to systematically plan the series of activities to achieve the goals.

Student's performance in the above question is given below in Table D4.3:

Table D4.3: Student's performance in question targeting 'D1'; course: UME691

S. No.	Roll No. of Students	D1	Weight (Scale 1 to 5)
		(Q. No. A(iv)) (5 Marks)	
1	101204003	4	4
2	101208012	5	5
3	101208016	5	5
4	101208020	5	5
5	101208027	5	5
6	101208028	5	5
7	101208029	5	5
8	101208032	5	5
9	101208036	5	5
10	101208040	5	5
11	101208045	5	5
12	101208052	5	5
13	101208054	5	5
14	101208055	5	5
15	101208057	4	4
16	101208058	5	5
17	101208059	5	5
18	101208062	5	5
19	101208075	5	5
20	101208079	5	5
21	101208092	5	5
22	101208093	4	4
23	101208096	5	5
24	101208101	4	4

25	101208104	5	5
26	101208107	5	5
27	101208112	5	5
28	101208113	5	5
29	101208114	5	5
30	101208123	5	5
31	101208125	5	5
32	101208131	5	5
33	101208132	5	5
34	101208134	4	4
35	101208136	5	5
36	101209013	5	5
37	101209020	5	5
38	101209022	4	4
39	101209023	5	5
40	101209030	3	3
41	101259002	5	5
42	101388002	4	4
43	101388004	5	5
44	101388006	4	4
45	101388011	5	5
46	101388012	5	5
47	101389002	5	5
48	101389003	5	5
49	401207004	3	3
50	401207007	4	4
51	401207015	5	5
52	401207022	4	4
53	401257003	4	4
54	401257007	5	5
55	401257009	5	5
56	401257010	5	5
57	401257013	5	5
58	401257014	4	4
59	401257017	4	4
60	401387003	5	5

The overall performance of students in the above question is then summarized as given below in Table D4.4:

Table D4.4: Average score of student performance in the course UME691 for criteria D1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME691	75	21.67	3.33	0	0	4.72

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria D1 as given below in Table D4.5:

Table D4.5: Weighted Average Student class performance (course portfolio) for criteria D1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	32.36	29.41	23.52	13.24	1.47	3.78	4
UME691	75	21.67	3.33	0	0	4.72	5
Weighted average score	56.05	25.11	12.31	5.88	0.65	4.30	9

b) Indirect measures for Performance criteria D1 (Surveys)

i.) Assessment Tool: Student Course Survey

Table D4.6: Average score of student course survey for criteria D1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	8.80	27.04	37.10	15.09	11.94	3.06	4
UME601	7.7	23.1	25.6	43.6	0	2.95	5
Weighted average score	8.19	24.85	30.71	30.93	5.31	3.00	9

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table D4.7: Assessment for criteria D1 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	35	45	16.67	3.33	0	4.12
Alumni survey	56.41	29.09	12.09	2.56	0	4.40
Employer Survey	31.82	54.55	18.18	0	0	4.31

c) Overall weighted average score of performance criterion ‘D1’

Finally overall weighted average score of performance criterion ‘D1’ is evaluated as given below in Table D4.8:

Table D4.8: Overall weighted average score of performance criterion 'D1'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	56.05	25.11	12.31	5.88	0.65	4.30	5
Weighted average student course survey	8.19	24.85	30.71	30.93	5.31	3.00	4
Graduating student survey	35	45	16.67	3.33	0	4.11	3
Alumni survey	56.41	29.09	12.09	2.56	0	4.39	3
Employer survey	31.82	54.55	18.18	0	0	4.32	3
Overall weighted score	37.93	33.94	18.07	9.49	1.36	4.00	18

Assessment of Outcome 'D' using performance criterion D2

Performance criteria 'D2': Participates in the development and selection of ideas.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Summer Training (UME591) and Project semester (UME691) were used to assess performance criteria D2 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Summer Training (UME591)

The above performance criteria are used to measure the attainment of outcome 'D2' by discussion on ideas and maintain daily diary (weightage 10 marks) to the students.

Expectation: Student needs to be submitted their daily diary report which were maintained for different discussions on ideas to complete the catapult project.

Student's performance in the above question is given below in Table D4.9:

Table D4.9: Student's performance in question targeting 'D2'; course: UME 591

Sr. No.	Roll No.	Marks (MM:10)	Scale (1 to 5)
1	101308001	7.75	4
2	101308002	6.50	2
3	101308003	7.83	4
4	101308004	7.08	3
5	101308005	8.42	5
6	101308006	6.58	2
7	101308007	8.25	5
8	101308008	6.75	2
9	101308009	8.00	5
10	101308010	7.75	4
11	101308011	8.40	5
12	101308012	7.33	3

13	101308013	7.58	4
14	101308014	6.42	2
15	101308015	7.00	3
16	101308016	8.25	5
17	101308017	8.10	5
18	101308018	7.08	3
19	101308019	8.08	5
20	101308020	8.92	5
21	101308021	8.75	5
22	101308023	7.00	3
23	101308024	8.30	5
24	101308025	8.75	5
25	101308026	7.42	3
26	101308027	6.92	3
27	101308028	7.58	4
28	101308029	8.58	5
29	101308031	9.00	5
30	101308032	7.33	3
31	101308033	6.92	3
32	101308034	8.00	5
33	101308035	7.92	4
34	101308036	8.58	5
35	101308037	7.50	3
36	101308038	7.75	4
37	101308039	6.33	2
38	101308040	7.92	4
39	101308042	7.92	4
40	101308043	7.60	4
41	101308044	8.08	5
42	101308045	8.00	5
43	101308046	7.42	3
44	101308047	8.33	5
45	101308048	6.42	2
46	101308050	6.25	2
47	101308051	7.92	4
48	101308052	6.92	3
49	101308053	7.92	4
50	101308054	6.83	2
51	101308055	6.67	2
52	101308057	7.25	3
53	101308058	7.58	4
54	101308059	6.75	2
55	101308060	7.75	4
56	101308061	8.50	5
57	101308063	8.67	5
58	101308064	7.92	4

59	101308065	8.70	5
60	101308066	7.33	3
61	101308067	7.92	4
62	101308068	7.50	3
63	101308069	7.33	3
64	101308071	7.92	4
65	101308072	7.75	4
66	101308073	7.67	4
67	101308074	6.20	1
68	101308076	8.50	5

The overall performance of student in the above question is then summarised as given below in Table D4.10:

Table D 4.10: Average score of student performance in the course UME591 for criteria D2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME591	32.36	27.95	23.52	14.70	1.47	3.75

(ii) Course: Project Semester (UME691)

The above performance criteria is used to measure the attainment of outcome ‘D’ by giving the following question (Question No.: A(ii) in second visit of Project Semester) to the students.

Question:

Creativity: Refer to the ability to generate new and practical ideas for improvement of systems and operations related to the job.

Student’s performance in the above question is given below in Table D4.11:

Table D4.11: Student’s performance in question targeting ‘D2’; course: UME691

1	101204003	5	5
2	101208012	5	5
3	101208016	5	5
4	101208020	5	5
5	101208027	5	5
6	101208028	5	5
7	101208029	4	4
8	101208032	5	5
9	101208036	5	5
10	101208040	5	5
11	101208045	5	5
12	101208052	5	5
13	101208054	5	5
14	101208055	5	5
15	101208057	5	5

16	101208058	5	5
17	101208059	5	5
18	101208062	5	5
19	101208075	4	4
20	101208079	4	4
21	101208092	4	4
22	101208093	5	5
23	101208096	5	5
24	101208101	5	5
25	101208104	5	5
26	101208107	5	5
27	101208112	4	4
28	101208113	5	5
29	101208114	5	5
30	101208123	4	4
31	101208125	5	5
32	101208131	5	5
33	101208132	5	5
34	101208134	5	5
35	101208136	5	5
36	101209013	4	4
37	101209020	5	5
38	101209022	5	5
39	101209023	5	5
40	101209030	4	4
41	101259002	5	5
42	101388002	5	5
43	101388004	4	4
44	101388006	5	5
45	101388011	5	5
46	101388012	5	5
47	101389002	5	5
48	101389003	4	4
49	401207004	4	4
50	401207007	4	4
51	401207015	5	5
52	401207022	5	5
53	401257003	4	4
54	401257007	5	5
55	401257009	5	5
56	401257010	5	5
57	401257013	3	3
58	401257014	4	4
59	401257017	5	5
60	401387003	5	5

The overall performance of students in the above question is then summarized as given below in Table D4.12:

Table D4.12: Average score of student performance in the course UME691 for criteria D2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME691	75	23.33	1.67	0	0	4.73

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria D2 as given below in Table D4.13:

Table D4.13: Weighted Average Student class performance (course portfolio) for criteria D2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	32.36	27.95	23.52	14.7	1.47	3.75	4
UME691	75	23.33	1.66	0	0	4.73	5
Weighted average score	56.05	25.39	11.38	6.53	0.65	4.30	9

b) Indirect measures for Performance criteria D2 (Surveys)

i.) Assessment Tool: Student Course Survey

Table D4.14: Average score of student course survey for criteria D2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	8.80	27.04	37.10	15.09	11.94	3.06	4
UME601	7.7	23.1	25.6	43.6	0	2.95	5
Weighted average score	8.19	24.85	30.71	30.93	5.31	3.00	9

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table D4.15: Assessment for criteria D2 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	35	45	16.67	3.33	0	4.12
Alumni survey	56.41	29.09	12.09	2.56	0	4.40
Employer Survey	31.82	54.55	18.18	0	0	4.31

c) Overall weighted average score of performance criterion 'D2'

Finally overall weighted average score of performance criterion 'D2' is evaluated as given below in Table D4.16:

Table D4.16: Overall weighted average score of performance criterion 'D2'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	56.05	25.39	11.38	6.53	0.65	4.30	5
Weighted average student course survey	8.19	24.85	30.71	30.93	5.31	3.00	4
Graduating student survey	35	45	16.67	3.33	0	4.11	3
Alumni survey	56.41	29.09	12.09	2.56	0	4.39	3
Employer survey	31.82	54.55	18.18	0	0	4.32	3
Overall weighted score	37.93	34.01	17.81	9.67	1.36	4.00	18

Overall assessment of student outcome D using scores of D1 and D2

In the above sections, each of the individual performance criteria D1 and D2 have been assessed. The performance for attainment of outcome D has been completed using the attainment values for D1 and D2 and is provided below:

Table D4.17 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome D.

Table D4.17: Overall score for outcome D at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
D1	37.93	33.94	18.07	9.49	1.36	4.00	5
D2	37.93	34.01	17.81	9.67	1.36	4.00	5
Overall score	37.93	33.98	17.94	9.58	0.68	4.00	10

**Assessment of Attainment of Program Outcome
'E'
(Year 2015)**

for the

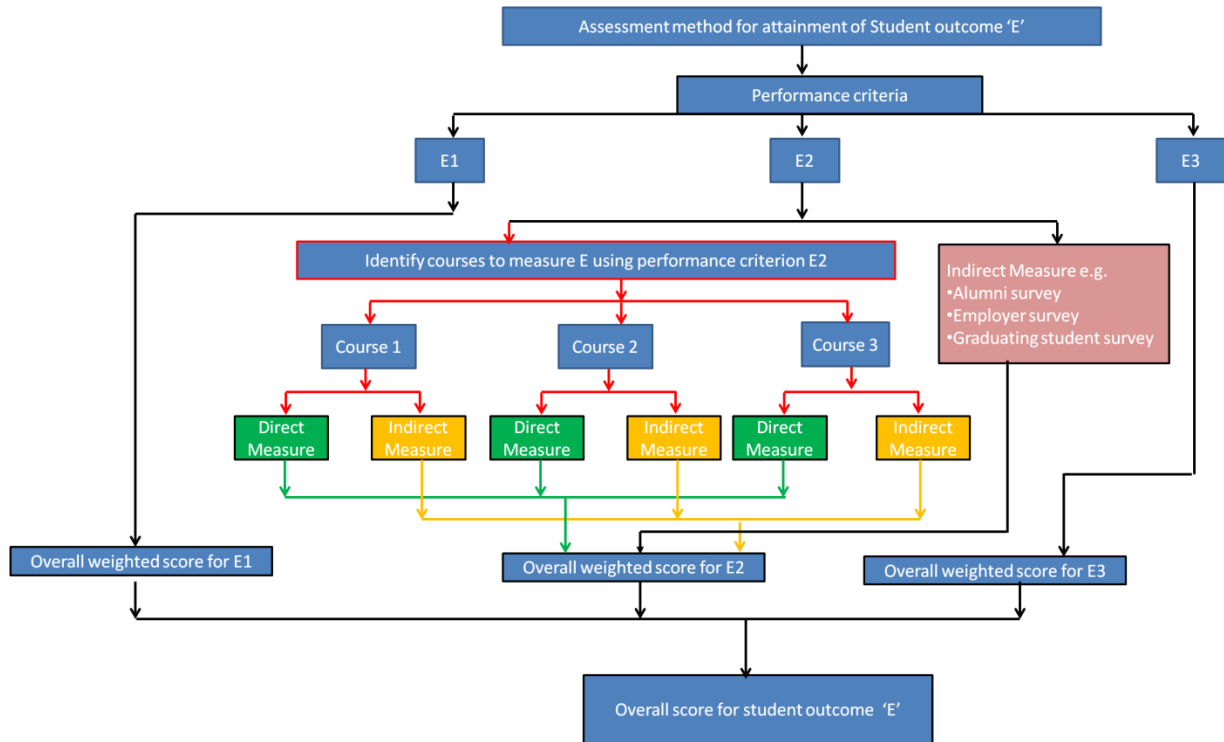
***Bachelor of Engineering
in
Mechanical Engineering***



**Thapar University
Patiala (Punjab) - 147004
INDIA**

Attainment of Outcome E

The attainment of each outcome has been measured using a standard procedure explained in the Self Assessment Report for the program. A flow chart depicting the step by step methodology used to measure each attainment is provided below for ready reference.



The following courses have been considered for the assessment of student outcome 'E'

Courses:

1. Mechanics of Deformable Bodies (UME404)
2. Manufacturing Technology (UME505)
3. Mechanical Vibrations (UME706)

Outcome E has been assessed by four performance criteria E1, E2 and E3. The sections below provide data for separate assessments for each of these performance criteria and in the end the results for these four performance criteria has been used to measure the overall measure of outcome E.

1) Assessment of Outcome 'E' using performance criterion E1

Performance criteria 'E1': Classifies information to identify engineering problems.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Three courses namely Mechanics of Deformable Bodies (UME404), Manufacturing Technology (UME701) and Mechanical Vibration (UME704) were used to assess performance criteria E1 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Mechanics of Deformable Bodies (UME404)

The above performance criteria is used to measure the attainment of outcome 'E' by giving the following question (Question No.: 2 in MST) to the students.

Question:

- Show that the octahedral shearing stress theory and the distortion energy theory are identical.
- If the shearing stress at a point in a steel member is 206.85 kPa, when yielding starts, what is the tensile stress at that point (i) according to the maximum shearing stress theory and (ii) according to the octahedral shearing stress theory? Consider the tensile elastic limit as 413.7 kPa.

Student's performance in the above question is given below in Table E4.1:

Table E4.1: Student's performance in question targeting 'E1'; course: UME 404

S. No.	Roll No.	E1	Weight (Scale 1 to 5)
		(Q. No. 2 in MST) (15 Marks)	
1	101308015	1	2
2	101308033	2	4
3	101308059	1	2
4	101308067	0	1
5	101308069	12	5
6	101308070	0	1
7	101308071	5	5
8	101308074	5	5
9	101308075	6	5
10	101308077	0	1
11	101308078	1	2
12	101308079	12	5
13	101308080	0	1
14	101308081	4	5
15	101308083	10	5
16	101308088	10	5
17	101308089	1	2
18	101308090	1	2

19	101308091	13	5
20	101308096	2	4
21	101308097	5	5
22	101308098	5	5
23	101308099	8	5
24	101308101	12	5
25	101308103	9	5
26	101308104	3	5
27	101308105	3	5
28	101308106	13	5
29	101308108	8	5
30	101308109	3	5
31	101308110	1	2
32	101308111	8	5
33	101308113	8	5
34	101308114	1	2
35	101308115	4	5
36	101308117	1	2
37	101308119	13	5
38	101308120	9	5
39	101308121	1.5	3
40	101308123	12	5
41	101308125	1	2
42	101488008	8.5	5
43	101488012	3	5
44	101488013	1	2
45	101488014	8	5

The overall performance of student in the above question is then summarised as given below in Table E4.2:

Table E 4.2: Average score of student performance in the course UME404 for criteria E1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME404	62	5	2	22	9	3.89

(ii) Course: Manufacturing Technology (UME505)

The above performance criteria is used to measure the attainment of outcome ‘E1’ by giving the following question (Question No. 1(b): during MST in September 2015, weightage 5 marks) to the students.

Question: A cylindrical riser has to be designed for a sand casting mold. The casting is a steel rectangular plate with dimensions 125 mm × 75 mm × 20 mm. The previous observations have indicated that total solidification time (TST) for this casting is 1.6 minutes. The cylindrical riser has a

diameter to height ratio of 1. Determine the dimensions of the riser (using modulus method) so that it's TST = 2 minutes.

Student's performance in the above question is given below in Table E4.3:

Table E4.3: Student's performance in question targeting 'E1'; course: UME505

S. No.	Roll No.	Marks	Score
		(MM: 05)	(Scale 1 to 5)
1	101308001	5	5
2	101308003	0	1
3	101308004	1	2
4	101308006	0	1
5	101308007	0	1
6	101308009	0	1
7	101308010	0	1
8	101308011	0	1
9	101308012	0	1
10	101308013	0	1
11	101308014	1	2
12	101308016	1	2
13	101308017	3	3
14	101308018	0	1
15	101308019	1	2
16	101308020	0	1
17	101308021	1	2
18	101308023	0	1
19	101308024	0	1
20	101308025	4	4
21	101308026	0	1
22	101308027	5	5
23	101308028	0	1
24	101308029	5	5
25	101308032	0	1
26	101308034	5	5
27	101308035	0	1
28	101308036	2	3
29	101308037	5	5
30	101308038	3	3
31	101308039	3	3
32	101308040	0	1
33	101308042	0	1
34	101308043	0	1
35	101308044	2	3
36	101308045	4	4
37	101308046	3	3

38	101308047	1	2
39	101308050	3	3
40	101308051	5	5
41	101308052	0	1
42	101308053	2	3
43	101308054	0	1
44	101308055	0	1
45	101308057	4	4
46	101308060	0	1
47	101308061	0	1
48	101308063	2	3
49	101308064	3	3
50	101308065	1	2
51	101308066	0	1
52	101308068	3	3
53	101308072	4	4
54	101308073	0	1
55	101308076	0	1
56	101308100	3	3
57	101488002	1	2
58	101488003	4	4
59	101488004	0	1
60	101488005	1	2
61	101488006	4	4
62	101488007	1	2
63	101488009	0	1
64	101488010	4	4
65	101488011	3	3

The overall performance of students in the above question is then summarized as given below in Table E4.4:

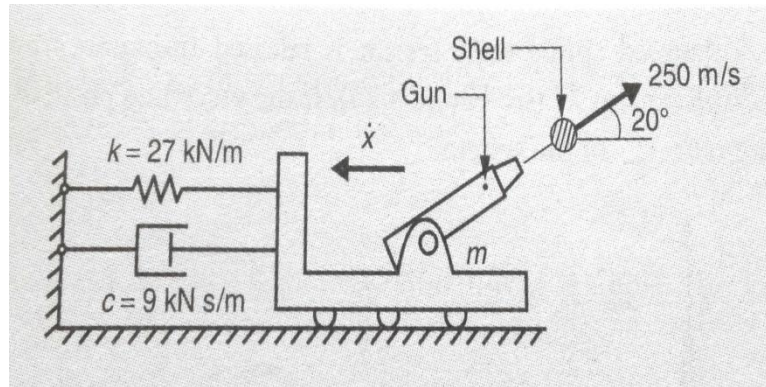
Table E4.4: Average score of student performance in the course UME505 for criteria E1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME701	9.23	10.77	20.00	15.38	44.62	2.25

(iii) Course: Mechanical Vibration (UME706)

The above performance criteria is used to measure the attainment of outcome ‘E1’ by giving the following question (Question No. 5: during MST in Sept 2015, weightage 10 marks) to the students.

Question: A gun-carrying vehicle fires a shell of mass 4.5 kg, as shown in Fig. 3. The combined mass of the gun and the vehicle is 750 kg and recoil mechanism consists of a spring and a dashpot.



- Identify the kind of viscous damping present in the gun-vehicle unit.
- Using the initial conditions, determine the total response of the system. (Hint: The initial velocity can be obtained by applying the principle of conservation of linear momentum to shell mass and gun-vehicle mass).
- Calculate the maximum recoiling (in mm) of the gun-vehicle unit.

Student's performance in the above question is given below in Table E4.5:

Table E4.5: Student's performance in question targeting 'E1'; course: UME706

S. No.	Roll No.	Marks (MM: 10)	Score (Scale 1 to 5)
1	101208001	5	3
2	101208002	10	5
3	101208003	2	2
4	101208004	6	4
5	101208005	6	4
6	101208006	2	2
7	101208007	6.5	4
8	101208008	10	5
9	101208009	4	3
10	101208010	6	4
11	101208011	2	2
12	101208012	3	2
13	101208013	10	5
14	101208016	7	4
15	101208017	2	2
16	101208019	10	5
17	101208020	4	3
18	101208022	6	4
19	101388001	10	5
20	101388002	3	2
21	101208023	4	3
22	101208024	3	2
23	101208025	10	5
24	101208026	6	4
25	101208027	10	5
26	101208028	5	3
27	101208029		
28	101208030	10	5
29	101208031	10	5

30	101208032	0	1
31	101208033		
32	101208034	5	3
33	101208035	8	5
34	101208036	8.5	5
35	101208037	5	3
36	101208038	5	3
37	101208039	0	1
38	101208040	10	5
39	101208042	1	1
40	101208140	6	4
41	101388004	0	1
42	101388005	4	3
43	101208044	6	4
44	101208045	0	1
45	101208046	7	4
46	101208048	6.5	4
47	101208049	10	5
48	101208051	7	4
49	101208052	5	3
50	101208053	2	2
51	101208054	4	3
52	101208055	3	2
53	101208056	10	5
54	101208057	6	4
55	101208058		
56	101208059		
57	101208060	2	2
58	101208061	4	3
59	101208062	0	1
60	101208063	9	5
61	101208064	6	4
62	101208081	4	3
63	101388003	10	5
64	101388007	8	5
65	101208076	6	4

The overall performance of students in the above question is then summarized as given below in Table E4.6:

Table E4.6: Average score of student performance in the course UME706 for criteria E1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME706	27.86	24.59	21.31	16.39	9.83	3.44

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria E1 as given below in Table E4.7:

Table E4.7: Weighted Average Student class performance (course portfolio) for criteria E1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME404	62	5	2	22	9	3.89	5
UME505	9.23	10.77	20	15.38	44.62	2.25	4
UME706	27.86	24.59	21.31	16.39	9.83	3.44	5
Weighted average score	34.73	13.65	14.04	18.11	19.47	3.26	14

b) Indirect measures for Performance criteria E1 (Surveys)**i.) Assessment Tool: Student Course Survey****Table E4.8: Average score of student course survey for criteria E1**

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME404	27	46	18	7	2	3.89	5
UME505	6.21	21.38	40.69	26.21	5.52	2.97	4
UME706	22.78	43.04	27.53	4.114	2.532	3.79	5
Weighted average score	19.55	37.91	27.89	11.46	3.20	3.59	14

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey**Table E4.9: Assessment for criteria E1 using Graduating student survey, alumni survey and employer survey tool**

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	30	53.33	16.67	0	0	4.13
Alumni survey	56.41	23.08	15.38	2.56	2.56	4.28
Employer Survey	18.18	63.64	18.18	0	4.55	4.04

c) Overall weighted average score of performance criterion 'E1'

Finally overall weighted average score of performance criterion 'E1' is evaluated as given below in Table E4.10:

Table E4.10: Overall weighted average score of performance criterion ‘E1’

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	34.73	13.65	14.04	18.11	19.47	3.26	5
Weighted average student course survey	19.55	37.91	27.89	11.46	3.20	3.59	4
Graduating student survey	30	53.33	16.67	0	0	4.13	3
Alumni survey	56.41	23.08	15.38	2.56	2.56	4.28	3
Employer survey	18.18	63.64	18.18	0	4.55	4.05	3
Overall weighted score	31.42	35.56	18.47	8.00	7.30	3.78	18

Assessment of Outcome ‘E’ using performance criterion E2

Performance criteria ‘E2’: Develop appropriate models to formulate solutions.

a.) Assessment Tool: Student’s performance using course portfolio

Step 1: Three courses namely Mechanics of Deformable Bodies (UME404), Manufacturing Technology (UME505) and Mechanical Vibration (UME706) were used to assess performance criteria E2 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Mechanics of Deformable Bodies (UME404)

The above performance criteria is used to measure the attainment of outcome ‘E’ by giving the following question (Question No.:1 during MST in 2015, weightage 15 marks) to the students.

Question:

- Find out the expressions for all stress invariants starting from Cauchy’s stress formula. (5)
- For smaller values of strains, cubical dilatation is the summation of three linear strains. Justify the statement. (5)
- Write down the displacement gradient matrix at point P (5, 3, 2) of a body for the displacement field which is given by $\vec{u} = (x^2 + 2y^2)\hat{i} + (3 + xz)\hat{j} + (x^2 + 2yz)\hat{k}$. (5)

Student’s performance in the above question is given below in Table E4.11:

Table E4.11: Student’s performance in question targeting ‘E2’; course: UME 404

S. No.	Roll No.	E2	Weight (Scale 1 to 5)
		(Q. No. 1 in MST) (15 Marks)	
1	101308015	8	3
2	101308033	13	5
3	101308059	13	5
4	101308067	5	3

5	101308069	10	4
6	101308070	3	2
7	101308071	12	4
8	101308074	13	5
9	101308075	14	5
10	101308077	7	3
11	101308078	10	4
12	101308079	15	5
13	101308080	15	5
14	101308081	14	5
15	101308082	4	2
16	101308083	14	5
17	101308085	1	1
18	101308088	14	5
19	101308089	6	3
20	101308090	1	1
21	101308091	12	4
22	101308093	11	4
23	101308094	13	5
24	101308096	15	5
25	101308097	12.5	4
26	101308098	11	4
27	101308099	15	5
28	101308101	12	4
29	101308102	10	4
30	101308103	14	5
31	101308104	10	4
32	101308105	15	5
33	101308106	14	5
34	101308108	15	5
35	101308109	10	4
36	101308110	13	5
37	101308111	15	5
38	101308112	8	3
39	101308113	15	5
40	101308114	10	4
41	101308115	13	5
42	101308117	11	4
43	101308118	10	4
44	101308119	15	5
45	101308120	9	4
46	101308122	15	5
47	101308123	9	4
48	101308124	9	4
49	101308125	8	3

50	101488008	11	4
51	101488012	1	1
52	101488013	3	2
53	101488014	14	5
54	101488015	13	5
55	101488016	9	4
56	101488017	5	3
57	101488018	12	4

The overall performance of student in the above question is then summarised as given below in Table E4.12:

Table E 4.12: Average score of student performance in the course UME404 for criteria E2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME404	42	36	12	5	5	4.04

(ii) Course: Manufacturing Technology (UME505)

The above performance criteria is used to measure the attainment of outcome ‘E2’ by giving the following question (Question No. 2(b): during MST in September 2015, weightage 5 marks) to the students.

Question: A grey iron foundry produce 7500 kg of good casting in a day. The charge consists of 25% Pig Iron – 1, 25% Pig Iron – 2, and 50% iron scrap. The composition of the charge is as follows:

	% C	% Si	% S
Pig Iron - 1	3.5	3.25	0.03
Pig Iron - 2	3.25	2.75	0.05
Iron scrap	3.0	2.0	0.08

The casting contains 2.25% Si, and 0.0602% S. Estimate the percentage gain or loss of silicon and sulphur during melting.

Student’s performance in the above question is given below in Table E4.13:

Table E4.13: Student’s performance in question targeting ‘E2’; course: UME505

S. No.	Roll No.	Marks	Score
		(MM: 05)	(Scale 1 to 5)
1	101308001	5	5
2	101308003	5	5
3	101308004	1	1
4	101308006	3	3
5	101308007	3	3
6	101308009	1	1

7	101308010	4	4
8	101308011	5	5
9	101308012	3	3
10	101308013	1	1
11	101308014	5	5
12	101308016	4	4
13	101308017	4	4
14	101308018	4	4
15	101308019	4	4
16	101308020	3	3
17	101308021	2	2
18	101308023	3	3
19	101308024	1	1
20	101308025	4	4
21	101308026	3	3
22	101308027	3	3
23	101308028	2	2
24	101308029	4	4
25	101308032	4	4
26	101308034	3	3
27	101308035	2	2
28	101308036	4	4
29	101308037	3	3
30	101308038	3	3
31	101308039	1	1
32	101308040	1	1
33	101308042	2	2
34	101308043	1	1
35	101308044	2	2
36	101308045	3	3
37	101308046	5	5
38	101308047	4	4
39	101308050	5	5
40	101308051	2	2
41	101308052	2	2
42	101308053	4	4
43	101308054	2	2
44	101308055	3	3
45	101308057	4	4
46	101308060	2	2
47	101308061	4	4
48	101308063	3	3
49	101308064	2	2
50	101308065	3	3
51	101308066	2	2

52	101308068	1	1
53	101308072	3	3
54	101308073	4	4
55	101308076	1	1
56	101308100	4	4
57	101488002	3	3
58	101488003	3	3
59	101488004	5	5
60	101488005	3	3
61	101488006	5	5
62	101488007	2	2
63	101488009	1	1
64	101488010	3	3
65	101488011	3	3

The overall performance of students in the above question is then summarized as given below in Table E4.14:

Table E4.14: Average score of student performance in the course UME505 for criteria E2

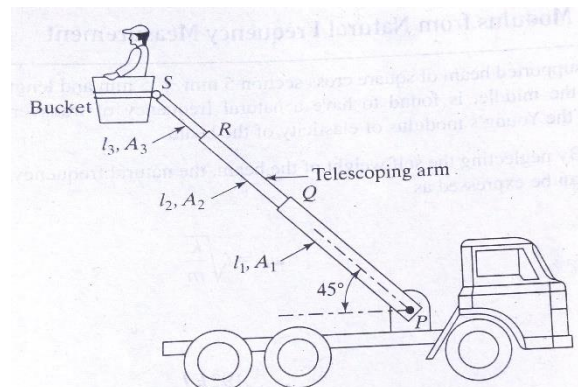
Course	% of students in each score					Average Score
	5	4	3	2	1	
UME701	12.31	23.08	30.77	18.47	15.37	2.98

(iii) Course: Mechanical Vibration (UME706)

The above performance criteria is used to measure the attainment of outcome ‘E2’ by giving the following question (Question No.:4 during MST in Sept 2015, weightage 10 marks) to the students.

Question:

The cockpit (bucket) of a fire truck is located at the end of a telescopic boom (arm), as shown in Fig. 2. The cockpit along with the fireman weights 2 kN. Determine the equivalent axial stiffness of the boom in N/m and the natural frequency of the cockpit’s vibration in vertical direction in rad/s. Assume Young’s modulus of the material $E = 2.1 \times 10^{11}$ N/m², lengths $l_1 = l_2 = l_3 = 3$ m, the cross-sectional areas $A_1 = 20$ cm², $A_2 = 10$ cm², and $A_3 = 5$ cm². Neglect the mass of the telescopic boom and assume its deformation in axial direction with no bending. (Hint: Stiffness of a beam/rod = AE/l).



Student's performance in the above question is given below in Table E4.5:

Table E4.15: Student's performance in question targeting 'E2'; course: UME706

S. No.	Roll No.	Marks (MM: 07)	Score (Scale 1 to 5)
1	101208001	10	5
2	101208002	7	4
3	101208003	7	4
4	101208004	0	1
5	101208005	6	4
6	101208006	7	4
7	101208007	7	4
8	101208008	6	4
9	101208009	4	3
10	101208010	10	5
11	101208011	6	4
12	101208012	0	1
13	101208013	2	2
14	101208016	10	5
15	101208017	7	4
16	101208019	10	5
17	101208020	0	1
18	101208022	10	5
19	101388001	4	3
20	101388002	0	1
21	101208023	6	4
22	101208024	4	3
23	101208025	4	3
24	101208026	10	5
25	101208027	8.5	5
26	101208028	4	3
27	101208029		
28	101208030	10	5
29	101208031	4	3
30	101208032	2	2
31	101208033		
32	101208034	5	3
33	101208035	0	1
34	101208036	5	3
35	101208037	3	2
36	101208038	3	2
37	101208039	7	4
38	101208040	10	5
39	101208042	5	3
40	101208140	5	3
41	101388004	0	1
42	101388005	5	3
43	101208044	5	3
44	101208045	0	1
45	101208046	6	4
46	101208048	8	5

47	101208049	7	4
48	101208051	4	3
49	101208052	6	4
50	101208053	6	4
51	101208054	7	4
52	101208055	5	3
53	101208056	2	2
54	101208057	6	4
55	101208058		
56	101208059		
57	101208060	4	3
58	101208061	4	3
59	101208062	5	3
60	101208063	7	4
61	101208064	4	3
62	101208081	0	1
63	101388003	3	2
64	101388007	7	4
65	101208076	6	4

The overall performance of students in the above question is then summarized as given below in Table E4.16:

Table E4.16: Average score of student performance in the course UME706 for criteria E2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME706	16.39	31.14	29.50	9.83	13.11	3.27

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria E2 as given below in Table E4.17:

Table E4.17: Weighted Average Student class performance (course portfolio) for criteria E2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME404	42	36	12	5	5	4.05	5
UME505	12.31	23.08	30.77	18.47	15.37	2.98	4
UME706	16.39	31.14	29.5	9.83	13.11	3.28	5
Weighted average score	24.37	30.57	23.61	10.57	10.86	3.47	14

b) Indirect measures for Performance criteria E2 (Surveys)

i.) Assessment Tool: Student Course Survey

Table E4.18: Average score of student course survey for criteria E2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME404	27	46	18	7	2	3.89	5
UME505	6.21	21.38	40.69	26.21	5.52	2.97	4
UME706	22.78	43.04	27.53	4.114	2.532	3.79	5
Weighted average score	19.55	37.91	27.89	11.46	3.20	3.59	14

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table E4.19: Assessment for criteria E2 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	30	53.33	16.67	0	0	4.13
Alumni survey	56.41	23.08	15.38	2.56	2.56	4.28
Employer Survey	18.18	63.64	18.18	0	4.55	4.04

c) Overall weighted average score of performance criterion 'E2'

Finally overall weighted average score of performance criterion 'E2' is evaluated as given below in Table E4.20:

Table E4.20: Overall weighted average score of performance criterion 'E2'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	24.37	30.57	23.61	10.57	10.86	3.47	5
Weighted average student course survey	19.55	37.91	27.89	11.46	3.20	3.59	4
Graduating student survey	30	53.33	16.67	0	0	4.13	3
Alumni survey	56.41	23.08	15.38	2.56	2.56	4.28	3
Employer survey	18.18	63.64	18.18	0	4.55	4.05	3
Overall weighted score	28.55	40.26	21.13	5.91	4.91	3.84	18

Assessment of Outcome 'E' using performance criterion E3

Performance criteria 'E3': Uses analytical, computational and/or experimental methods to obtain solutions.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Manufacturing Technology (UME505) and Mechanical Vibration (UME706) were used to assess performance criteria E3 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Manufacturing Technology (UME505)

The above performance criteria is used to measure the attainment of outcome 'E3' by giving the following question (Question No.:4(b) during MST in September 2015, weightage 7 marks) to the students.

Question: During plain slab milling operation, a cutter of diameter 75 mm (and 100 mm wide) with 8 teeth on periphery is used. Cutting parameters are: cutter revolution 250 rpm, depth of cut 4.5 mm, feed 0.15 mm/tooth. Calculate the milling power required. Work piece material block (size 300 mm × 150 mm × 25 mm) is of alloy steel with hardness 210 BHN. If specific cutting energy U_c (in $Wm^{-3}s^{-1}$) is expressed as $U_c = U_0(t_{avg})^{0.235}$. Determine the value of U_0 when t_{avg} is the average thickness of the chip in mm.

Student's performance in the above question is given below in Table E4.21:

Table E4.21: Student's performance in question targeting 'E3'; course: UME505

S. No.	Roll No.	Marks	Score
		(MM: 07)	(Scale 1 to 5)
1	101308001	2	3
2	101308003	0	1
3	101308004	5	5
4	101308006	0	1
5	101308007	0	1
6	101308009	3	3
7	101308010	0	1
8	101308011	0	1
9	101308012	1	2
10	101308013	0	1
11	101308014	0	1
12	101308016	3	3
13	101308017	5	5
14	101308018	1	2
15	101308019	5	5
16	101308020	1	2
17	101308021	4	4
18	101308023	1	2

19	101308024	5	5
20	101308025	2	3
21	101308026	0	1
22	101308027	1	2
23	101308028	0	1
24	101308029	0	1
25	101308032	3	3
26	101308034	5	5
27	101308035	5	5
28	101308036	1	2
29	101308037	4	4
30	101308038	0	1
31	101308039	0	1
32	101308040	0	1
33	101308042	1	2
34	101308043	5	5
35	101308044	1	2
36	101308045	0	1
37	101308046	3	3
38	101308047	5	5
39	101308050	2	3
40	101308051	0	1
41	101308052	0	1
42	101308053	0	1
43	101308054	4	4
44	101308055	0	1
45	101308057	1	2
46	101308060	0	1
47	101308061	2	3
48	101308063	1	2
49	101308064	5	5
50	101308065	0	1
51	101308066	1	2
52	101308068	4	4
53	101308072	4	4
54	101308073	0	1
55	101308076	1	2
56	101308100	4	4
57	101488002	5	5
58	101488003	0	1
59	101488004	1	2
60	101488005	2	3
61	101488006	2	3
62	101488007	1	2
63	101488009	2	3

64	101488010	4	4
65	101488011	4	4

The overall performance of students in the above question is then summarized as given below in Table E4.22:

Table E4.22: Average score of student performance in the course UME505 for criteria E3

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME701	15.38	12.31	16.92	21.54	33.85	2.54

(ii) Course: Mechanical Vibration (UME706)

The above performance criteria is used to measure the attainment of outcome ‘E3’ by giving the following question (Question No.:1 during MST in Sept 2015, weightage 10 marks) to the students.

Question:

A mass weighing 85 N is supported on springs, which deflects 1.8 cm under the weight of the mass. Vibrations of the mass are constrained to be linear and vertical and are damped by a dashpot, which reduced the amplitude to one-quarter of its initial value in two complete cycles. Determine

- the magnitude of the damping force at unit speed,
- the period of damped vibrations and
- what would be the percentage change in damping factor (ratio), if damping is considered to be light?

Student’s performance in the above question is given below in Table E4.23:

Table E4.23: Student’s performance in question targeting ‘E3’; course: UME704

S. No.	Roll No.	Marks (MM: 10)	Score (Scale 1 to 5)
1	101208001	7	4
2	101208002	6	4
3	101208003	3	2
4	101208004	4	3
5	101208005	5	3
6	101208006	3	2
7	101208007	7	4
8	101208008	6	4
9	101208009	4	3
10	101208010	10	5
11	101208011	3	2
12	101208012	4	3
13	101208013	9	5
14	101208016	8	5
15	101208017	7	4
16	101208019	7	4
17	101208020	1	1
18	101208022	7	4

19	101388001	1	1
20	101388002	4	3
21	101208023	7	4
22	101208024	5	3
23	101208025	10	5
24	101208026	7	4
25	101208027	9	5
26	101208028	8	5
27	101208029		
28	101208030	6	4
29	101208031	7	4
30	101208032	0	1
31	101208033		
32	101208034	4	3
33	101208035	7	4
34	101208036	4	3
35	101208037	7	4
36	101208038	2	2
37	101208039	8	5
38	101208040	5	3
39	101208042	7	4
40	101208140	0	1
41	101388004	0	1
42	101388005	5	3
43	101208044	6	4
44	101208045	0	1
45	101208046	9	5
46	101208048	10	5
47	101208049	7	4
48	101208051	7	4
49	101208052	5	3
50	101208053	5	3
51	101208054	7	4
52	101208055	2	2
53	101208056	1	1
54	101208057	4	3
55	101208058		
56	101208059		
57	101208060	3	2
58	101208061	9	5
59	101208062	4	3
60	101208063	9	5
61	101208064	4	3
62	101208081	7	4
63	101388003	0	1
64	101388007	7	4
65	101208076	1	1

The overall performance of students in the above question is then summarized as given below in Table E4.24:

Table E4.24: Average score of student performance in the course UME706 for criteria E3

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME706	18.03	32.78	24.59	9.83	14.75	3.29

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria E3 as given below in Table E4.25:

Table E4.25: Weighted Average Student class performance (course portfolio) for criteria E3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME505	15.38	12.31	16.92	21.54	33.85	2.54	4
UME706	18.03	32.78	24.59	9.83	14.75	3.29	5
Weighted average score	16.85	23.68	21.18	15.03	23.24	2.96	9

b) Indirect measures for Performance criteria E3 (Surveys)

i.) Assessment Tool: Student Course Survey

Table E4.26: Average score of student course survey for criteria E3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME505	6.21	21.38	40.69	26.21	5.52	2.97	4
UME706	22.78	43.04	27.53	4.114	2.532	3.79	5
Weighted average score	15.42	33.41	33.38	13.93	3.86	3.43	9

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table E4.27: Assessment for criteria E3 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	30	53.33	16.67	0	0	4.13
Alumni survey	56.41	23.08	15.38	2.56	2.56	4.28
Employer Survey	18.18	63.64	18.18	0	4.55	4.04

c) Overall weighted average score of performance criterion ‘E3’

Finally overall weighted average score of performance criterion ‘E3’ is evaluated as given below in Table E4.28:

Table E4.28: Overall weighted average score of performance criterion ‘E3’

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	16.85	23.68	21.18	15.03	23.24	2.96	5
Weighted average student course survey	15.42	33.41	33.38	13.93	3.86	3.43	4
Graduating student survey	30	53.33	16.67	0	0	4.13	3
Alumni survey	56.41	23.08	15.38	2.56	2.56	4.28	3
Employer survey	18.18	63.64	18.18	0	4.55	4.05	3
Overall weighted score	25.54	37.35	21.67	7.70	8.50	3.66	18

Overall assessment of student outcome E using scores of E1, E2 and E3

In the above sections, each of the individual performance criteria E1, E2 and E3 have been assessed. The performance for attainment of outcome E has been completed using the attainment values for E1, E2 and E3 and is provided below:

Table E4.29 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome E.

Table E4.29: Overall score for outcome E at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
E1	31.42	35.56	18.47	8.00	7.30	3.78	5
E2	28.55	40.26	21.13	5.91	4.91	3.84	5
E3	25.54	37.35	21.67	7.70	8.50	3.66	4
Overall score	28.71	37.75	20.33	7.17	4.01	3.77	14

**Assessment of Attainment of Program Outcome
'F'
(Year 2015)**

for the

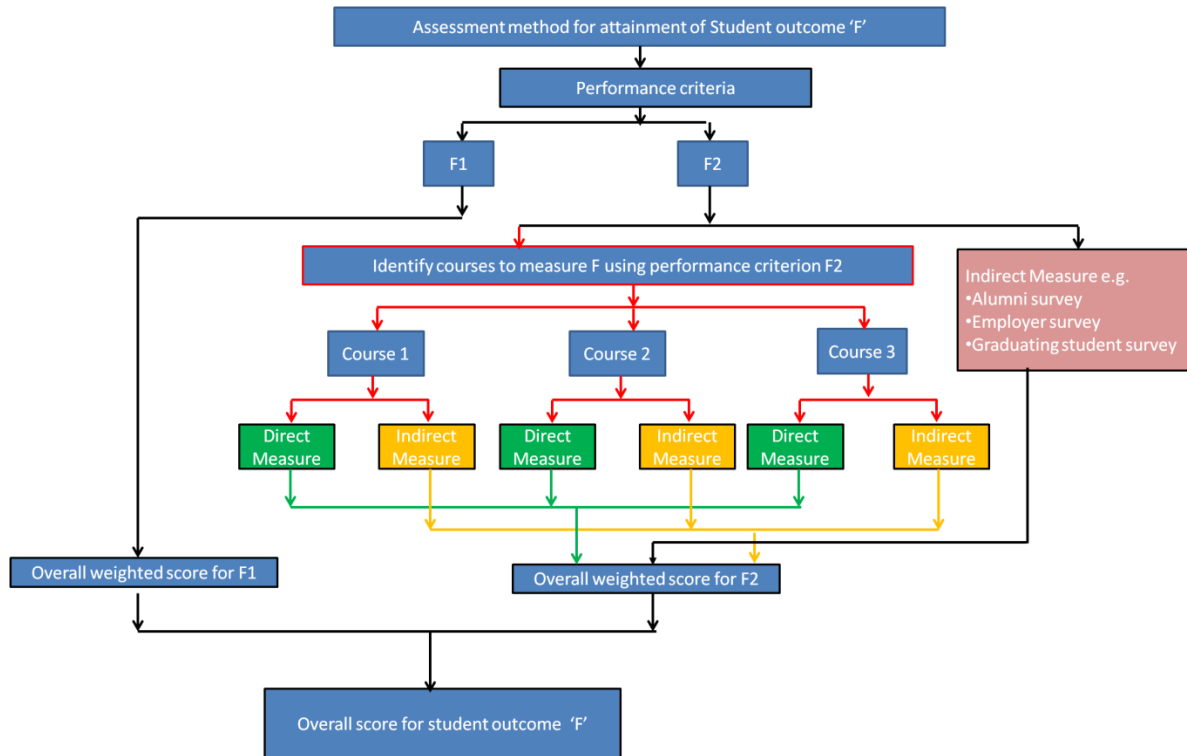
***Bachelor of Engineering
in
Mechanical Engineering***



**Thapar University
Patiala (Punjab) - 147004
INDIA**

Attainment of Outcome F

The attainment of each outcome has been measured using a standard procedure explained in the Self Assessment Report for the program. A flow chart depicting the step by step methodology used to measure each attainment is provided below for ready reference.



The following courses have been considered for the assessment of student outcome 'F'

Courses:

1. Project Semester (UME691),
2. Human Values, Human Rights & IPR (UHU034)
3. Student F1Project

Outcome F has been assessed by four performance criteria F1, and F2. The sections below provide data for separate assessments for each of these performance criteria and in the end the results for these four performance criteria has been used to measure the overall measure of outcome F.

1) Assessment of Outcome 'F' using performance criterion F1

Performance criteria 'F1': Evaluates ethical issues that may occur in professional practice using professional codes of ethics.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Project Semester (UME691) and Human Values, Human Rights & IPR (UHU034) were used to assess performance criteria A1 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Project Semester (UME691)

The above performance criteria is used to measure the attainment of outcome 'F' by giving the following question (Question No.: A(ix) in second visit of Project Semester) to the students.

Question:

Regularity and Punctuality: Refers to (i) sanctioned authorised leave, absence without permission (ii) late coming & leaving work place early.

Student's performance in the above question is given below in Table F4.1:

Table F4.1: Student's performance in question targeting 'F1'; course: UME 691

S. No.	Roll No. of Students	F1	Weight (Scale 1 to 5)
		(Q. No. A(iv)) (5 Marks)	
1	101204003	5	5
2	101208012	5	5
3	101208016	5	5
4	101208020	5	5
5	101208027	5	5
6	101208028	5	5
7	101208029	5	5
8	101208032	5	5
9	101208036	5	5
10	101208040	5	5
11	101208045	5	5
12	101208052	5	5
13	101208054	5	5
14	101208055	5	5
15	101208057	5	5
16	101208058	4	4
17	101208059	5	5
18	101208062	4	4
19	101208075	3	3
20	101208079	5	5

21	101208092	5	5
22	101208093	5	5
23	101208096	5	5
24	101208101	4	4
25	101208104	5	5
26	101208107	5	5
27	101208112	5	5
28	101208113	5	5
29	101208114	5	5
30	101208123	5	5
31	101208125	5	5
32	101208131	5	5
33	101208132	5	5
34	101208134	5	5
35	101208136	5	5
36	101209013	4	4
37	101209020	5	5
38	101209022	5	5
39	101209023	5	5
40	101209030	5	5
41	101259002	4	4
42	101388002	3	3
43	101388004	4	4
44	101388006	4	4
45	101388011	5	5
46	101388012	5	5
47	101389002	5	5
48	101389003	5	5
49	401207004	4	4
50	401207007	4	4
51	401207015	5	5
52	401207022	5	5
53	401257003	3	3
54	401257007	5	5
55	401257009	5	5
56	401257010	5	5
57	401257013	4	4
58	401257014	4	4
59	401257017	5	5
60	401387003	4	4

The overall performance of student in the above question is then summarised as given below in Table F4.2:

Table F4.2: average score of the student performance in the course UME 691 for criteria F1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME 691	75	20	5	0	0	4.70

(ii) Course: Human values, human rights & IPR (UHU034)

The above performance criteria is used to measure the attainment of outcome 'F1' by giving the following question (Question No. 1: during MST in March 2015, weightage 3 marks) to the students.

Ques. 1 Suppose you are selected at administrative or managerial position within a company and you need to give ethical judgement to punish someone who has done something wrong in the company. On what factors would you base your judgment regarding this offender? Answer by considering factors to be considered in making ethical judgement.

Student's performance in the above question is given below in Table F4.3:

Table F4.3: Student's performance in question targeting 'F1'; course: UHU034

S. No.	Roll No.	Marks (MM: 02)	Score (Scale 1 to 5)
1.	101408001	0.5	2
2.	101408002	2	5
3.	101408003	1.5	4
4.	101408007	1	3
5.	101408010	1	3
6.	101408012	2	5
7.	101408013	0	1
8.	101408014	1.5	4
9.	101408017	.5	2
10.	101408019	2	5
11.	101408020	0	1
12.	101408021	1.5	4
13.	101408022	1	3
14.	101408023	2	5
15.	101408025	2	5
16.	101408026	2	5
17.	101408028	2	5
18.	101408029	2	5
19.	101408030	0	1
20.	101408031	1	3
21.	101408033	2	5
22.	101408034	2	5
23.	101408040	2	5
24.	101408042	2	5
25.	101408043	2	5
26.	101408045	2	5
27.	101408046	2	5
28.	101408047	1.5	4
29.	101408048	1.5	4
30.	101408050	2	5
31.	101408055	1	3

32.	101408056	1.5	4
33.	101408059	2	5
34.	101408060	2	5
35.	101408063	1.5	4
36.	101408064	2	5
37.	101408066	2	5
38.	101408068	.5	2
39.	101408069	2	5
40.	101408070	2	5
41.	101408071	2	5
42.	101408073	2	5
43.	101588001	2	5
44.	101588002	0	1
45.	101588004	2	5
46.	101588005	2	5
47.	101588006	2	5
48.	101588012	0	1
49.	101588013	2	5
50.	101588015	2	5

The overall performance of students in the above question is then summarized as given below in Table F4.4:

Table F4.4: Average score of student performance in the course UHU034 for criteria F1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UTA002	32.6	21.74	26.1	13.04	6.52	3.60

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria F1 as given below in Table F4.5:

Table F4.5: Weighted Average Student class performance (course portfolio) for criteria F1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME691	75	20	5	0	0	4.70	5
UHU034	32.6	21.74	26.1	13.04	6.52	3.61	5
Weighted average score	53.80	20.87	15.55	6.52	3.26	4.15	10

b) Indirect measures for Performance criteria F1 (Surveys)

i.) Assessment Tool: Student Course Survey

Table F4.6: Average score of student course survey for criteria F1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME691	7.7	23.1	25.6	43.6	0	2.95	5
UHU034	24	68	7	0	0	4.13	5
Weighted average score	15.85	45.55	16.30	21.80	0.00	3.54	10

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table F4.7: Assessment for criteria F1 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	43.33	38.33	16.67	1.67	0	4.23
Alumni survey	51.28	28.21	20.51	0	0	4.31
Employer Survey	22.73	63.64	13.64	0	0	4.0913

c) Overall weighted average score of performance criterion 'F1'

Finally overall weighted average score of performance criterion 'F1' is evaluated as given below in Table F4.8:

Table F4.8: Overall weighted average score of performance criterion 'F1'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	53.80	20.87	15.55	6.52	3.26	4.15	5
Weighted average student course survey	15.85	45.55	16.30	21.80	0.00	3.54	4
Graduating student survey	43.33	38.33	16.67	1.67	0	4.23	3
Alumni survey	51.28	28.21	20.51	0	0	4.30	3
Employer survey	22.73	63.64	13.64	0	0	4.09	3
Overall weighted score	38.02	37.62	16.41	6.93	0.91	4.05	18

Assessment of Outcome 'F' using performance criterion F2

Performance criteria 'F2': Interacts with industry, project sponsors, professional societies and/or communities in a professional manner.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Project Semester (UME691) and Student F1 Project were used to assess performance criteria F2 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Project Semester (UME691)

The above performance criteria is used to measure the attainment of outcome 'F' by giving the following question (Question No.: A(x) in second visit of Project Semester) to the students.

Question:

Adaptability to new environment: Refer to the ability to acclimatise himself/herself to new work environment/culture

Student's performance in the above question is given below in Table F4.9:

Table F4.9: Student's performance in question targeting 'F2'; course: UME691

S. No.	Roll No. of Students	F2	Weight (Scale 1 to 5)
		(Q. No. A(iv)) (5 Marks)	
1	101204003	5	5
2	101208012	5	5
3	101208016	5	5
4	101208020	5	5
5	101208027	5	5
6	101208028	5	5
7	101208029	5	5
8	101208032	5	5
9	101208036	5	5
10	101208040	5	5
11	101208045	5	5
12	101208052	5	5
13	101208054	5	5
14	101208055	5	5
15	101208057	5	5
16	101208058	5	5
17	101208059	5	5
18	101208062	5	5
19	101208075	4	4
20	101208079	5	5
21	101208092	5	5
22	101208093	5	5

23	101208096	5	5
24	101208101	5	5
25	101208104	5	5
26	101208107	5	5
27	101208112	5	5
28	101208113	5	5
29	101208114	5	5
30	101208123	5	5
31	101208125	5	5
32	101208131	5	5
33	101208132	5	5
34	101208134	4	4
35	101208136	4	4
36	101209013	4	4
37	101209020	5	5
38	101209022	5	5
39	101209023	5	5
40	101209030	5	5
41	101259002	5	5
42	101388002	5	5
43	101388004	5	5
44	101388006	5	5
45	101388011	5	5
46	101388012	5	5
47	101389002	5	5
48	101389003	4	4
49	401207004	4	4
50	401207007	5	5
51	401207015	5	5
52	401207022	5	5
53	401257003	3	3
54	401257007	5	5
55	401257009	5	5
56	401257010	5	5
57	401257013	4	4
58	401257014	4	4
59	401257017	4	4
60	401387003	5	5

The overall performance of student in the above question is then summarised as given below in Table F4.10:

Table F4.10: average score of the student performance in the course UME691 for criteria F2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME691	83.33	15	1.67	0	0	4.82

(ii) Course: Student F1 Project

The above performance criteria is used to measure the attainment of outcome 'F' based on the team's interaction with industry, potential sponsors and professional societies and/or communities in a professional manner.

For the above mentioned performance criteria, the team has been rated in the scale of 0 to 5 by a group of faculties from the department and the faculty advisor of the team, in the following format (attached).

S. No.	Name of Faculty	Score for the Team (Scale 1 to 5)	Signature

Student's performance in the above question is given below in Table F4.11:

Table F4.11: Student's performance in question targeting 'F2'; course: Student F1 Project

S. No.	Name of Faculty	Score for the Team (Scale 1 to 5)	Signature
01	Prof. SK Mohapatra	4	
02	Dr. Sumit Sharma	4	
03	Dr. Dheeraj Gupta	4	
04	Dr. TK Bera	5	
05	Dr. Satish Kumar	4	
06	Dr. HL Bhowmick	5	
07	Mr. Atul Sharma	4	
08	Mr. Devender Kumar	4	

The overall performance of students in the above question is then summarized as given below in Table F4.12:

Table F4.12: Average score of student performance in the Student F1 Project for criteria F2

Course	% in each score					Average Score
	5	4	3	2	1	
Student F1 Project	25.0	75.0	0.0	0.0	0.0	4.25

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria F2 as given below in Table F4.13:

Table F4.13: Weighted Average Student class performance (course portfolio) for criteria F2

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

UME691	83.33333	15	1.666667	0	0	4.82	5
Student F1 Project	25	75	0	0	0	4.25	4
Weighted average score	57.41	41.67	0.93	0.00	0.00	4.56	9

b.) Assessment Tool: Student Course Survey

Table F4.14: Average score of student course survey for criteria F2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME691	7.7	23.1	25.6	43.6	0	2.95	5
Weighted average score	7.70	23.10	25.60	43.60	0.00	2.95	5

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table F4.15: Assessment for criteria F2 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	43.33	38.33	16.67	1.67	0	4.23
Alumni survey	51.28	28.21	20.51	0	0	4.31
Employer Survey	22.73	63.64	13.64	0	0	4.091

Finally overall weighted average score of performance criterion 'F2' is evaluated as given below in Table F4.16:

Table F4.16.: Overall weighted average score of performance criterion 'F2'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	57.41	41.67	0.93	0.00	0.00	4.56	5
Weighted average student course survey	7.70	23.10	25.60	43.60	0.00	2.95	4
Graduating student survey	43.33	38.33	16.67	1.67	0	4.23	3
Alumni survey	51.28	28.21	20.51	0	0	4.30	3
Employer survey	22.73	63.64	13.64	0	0	4.09	3
Overall weighted score	37.21	38.40	14.42	9.97	0.00	4.03	18

Overall assessment of student outcome F using scores of F1 and F2

In the above sections, each of the individual performance criteria F1 and F2 have been assessed. The performance for attainment of outcome F has been completed using the attainment values for F1 and F2 and is provided below:

Table F4.17 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome F.

Table F4.17: Overall score for outcome F at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
F1	38.02	37.62	16.41	6.93	0.91	4.05	5
F2	37.21	38.40	14.42	9.97	0.00	4.03	5
Overall score	37.62	38.01	15.41	8.45	0.45	4.04	10

**Assessment of Attainment of Program Outcome
'G'
(Year 2015)**

for the

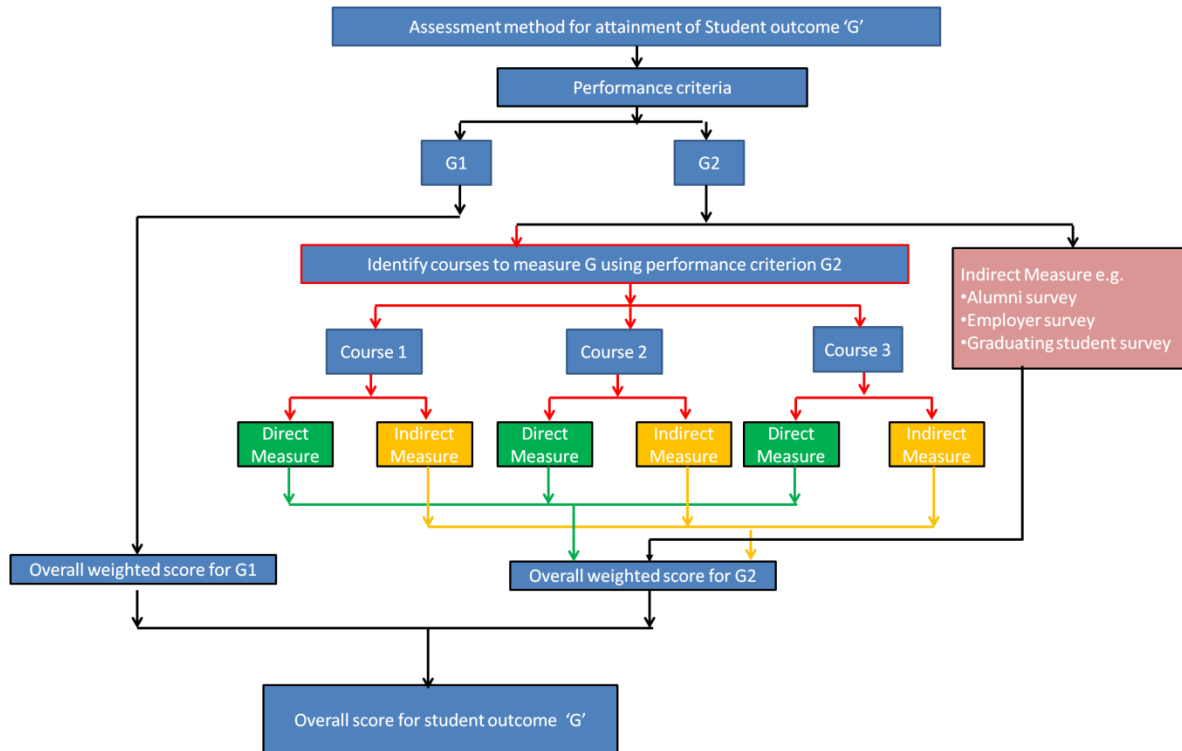
***Bachelor of Engineering
in
Mechanical Engineering***



**Thapar University
Patiala (Punjab) - 147004
INDIA**

Attainment of Outcome G

The attainment of each outcome has been measured using a standard procedure explained in the Self Assessment Report for the program. A flow chart depicting the step by step methodology used to measure each attainment is provided below for ready reference.



The following courses have been considered for the assessment of student outcome 'G'

Courses:

1. Summer Training (UME591)
2. Project Semester (UME691)
3. Mechanical System Design (UME801)

Outcome G has been assessed by four performance criteria G1, and G2. The sections below provide data for separate assessments for each of these performance criteria and in the end the results for these four performance criteria has been used to measure the overall measure of outcome G.

1) Assessment of Outcome 'G' using performance criterion G1

Performance criteria 'G1': Produce a variety of documents such as laboratory or project reports using appropriate formats and grammar with discipline specific conventions including citations.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Three courses namely Summer Training (UME591), Project Semester (UME691) and Mechanical System Design (UME801) were used to assess performance criteria G1 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Summer Training (UME591)

The above performance criteria are used to measure the attainment of outcome 'G1' by submitting the detailed project report (weightage 5 marks) to the students.

Expectation: Student needs to be submitted their detailed catapult project report.

Student's performance in the above question is given below in Table G4.1:

Table G4.1: Student's performance in question targeting 'G1'; course: UME 591

Sr. No.	Roll No.	Marks (MM:5)	Scale (1 to 5)
1	101308001	2.83	2
2	101308002	2.92	2
3	101308003	3.92	5
4	101308004	4.33	5
5	101308005	3.08	3
6	101308006	3.42	4
7	101308007	3.50	4
8	101308008	3.33	4
9	101308009	3.92	5
10	101308010	3.58	4
11	101308011	3.10	3
12	101308012	3.25	4
13	101308013	3.50	4
14	101308014	2.83	2
15	101308015	3.50	4
16	101308016	3.25	4
17	101308017	3.10	3
18	101308018	2.92	2
19	101308019	3.08	3
20	101308020	4.08	5
21	101308021	4.33	5
22	101308023	3.00	3
23	101308024	4.20	5

24	101308025	4.17	5
25	101308026	3.92	5
26	101308027	3.00	3
27	101308028	2.92	2
28	101308029	3.00	3
29	101308031	4.30	4
30	101308032	3.17	4
31	101308033	3.33	4
32	101308034	3.08	3
33	101308035	3.58	4
34	101308036	3.58	4
35	101308037	3.00	1
36	101308038	4.25	5
37	101308039	2.92	2
38	101308040	4.83	5
39	101308042	4.25	5
40	101308043	3.80	4
41	101308044	3.92	5
42	101308045	4.25	5
43	101308046	3.00	3
44	101308047	4.25	5
45	101308048	2.75	2
46	101308050	2.92	2
47	101308051	3.92	5
48	101308052	3.00	3
49	101308053	3.58	4
50	101308054	3.00	3
51	101308055	2.92	2
52	101308057	3.53	4
53	101308058	4.17	5
54	101308059	2.83	2
55	101308060	3.42	4
56	101308061	3.10	1
57	101308063	4.50	5
58	101308064	2.83	2
59	101308065	4.30	4
60	101308066	3.83	4
61	101308067	4.17	5
62	101308068	4.17	5
63	101308069	3.42	4
64	101308071	2.92	2
65	101308072	4.50	5
66	101308073	4.33	5
67	101308074	2.90	1
68	101308076	4.25	5

The overall performance of student in the above question is then summarised as given below in Table G4.2:

Table G4.2: average score of the student performance in the course UME 591 for criteria G1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME591	32.36	29.41	16.18	17.64	4.41	3.67

(ii) Course: Project Semester (UME691)

The above performance criteria is used to measure the attainment of outcome ‘G’ by giving the following question (Evaluation No.: Report Writing during final evaluation of Project Semester in department) to the students.

Question:

Each student has to submit one printed report on the projects completed during training. Students are evaluated on the basis of report writing skills, formatting, grammar mistakes and overall structure of the report.

Student’s performance in the above question is given below in Table G4.3:

Table G4.3: Student’s performance in question targeting ‘G1’; course: UME691

S. No.	Roll No. of Students	G1	Weight (Scale 1 to 5)
		Report (20)	
1	101208001	14.8	4
2	101208003	15.2	4
3	101208004	15.0	4
4	101208005	13.5	4
5	101208007	16.0	4
6	101208010	16.0	4
7	101208012	16.8	5
8	101208017	14.8	4
9	101208019	15.2	4
10	101208020	15.2	4
11	101208022	14.6	4
12	101208025	15.0	4
13	101208028	16.5	5
14	101208030	15.8	4
15	101208031	16.6	5
16	101208032	15.6	4
17	101208034	13.6	4
18	101208036	14.2	4
19	101208038	14.7	4

20	101208039	14.2	4
21	101208040	14.3	4
22	101208042	15.8	4
23	101208044	13.2	4
24	101208045	14.4	4
25	101208049	13.2	4
26	101208051	15.0	4
27	101208053	17.2	5
28	101208057	15.6	4
29	101208058	16.0	4
30	101208064	16.5	5
31	101208065	13.8	4
32	101208068	14.8	4
33	101208072	16.0	4
34	101208075	15.4	4
35	101208078	15.4	4
36	101208082	13.3	4
37	101208084	13.4	4
38	101208086	15.5	4
39	101208089	14.3	4
40	101208091	15.6	4
41	101208095	16.0	4
42	101208097	15.4	4
43	101208102	12.8	4
44	101208112	14.4	4
45	101208116	17.0	5
46	101208118	16.3	5
47	101208125	15.9	4
48	101208129	15.2	4
49	101208131	13.2	4
50	101208134	15.7	4
51	101208139	11.3	3
52	101208140	11.4	3
53	101209001	12.0	3
54	101209002	14.4	4
55	101209005	15.0	4
56	101209006	15.4	4
57	101209007	15.6	4
58	101209008	9.4	3
59	101209009	16.8	5
60	101209010	14.8	4
61	101209013	14.4	4
62	101209014	13.8	4
63	101209017	13.5	4
64	101209019	13.5	4
65	101209027	16.8	5
66	101209030	14.8	4
67	101259002	16.8	5

68	101388002	17.8	5
69	101388003	11.6	3
70	101388006	14.4	4
71	101388007	13.8	4
72	101388008	14.5	4
73	101388010	15.3	4
74	101388011	14.3	4
75	101388012	14.8	4
76	101389001	13.8	4
77	101389003	14.8	4
78	401207004	14.4	4
79	401207007	14.8	4
80	401207013	15.5	4
81	401207015	14.0	4
82	401207027	13.6	4
83	401207028	14.0	4
84	401257004	14.0	4
85	401257005	14.2	4
86	401257007	14.0	4
87	401257009	14.4	4
88	401257010	17.6	5
89	401257016	15.8	4

The overall performance of students in the above question is then summarized as given below in Table G4.4:

Table G4.4: Average score of student performance in the course UME691 for criteria G1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME691	13.48	80.89	5.61	0	0	4.08

(iii) Course: Mechanical System Design (UME801)

The above performance criteria is used to measure the attainment of outcome ‘G’ by giving the following question (From the final report) to the students.

Question:

(a) From the final report and evaluation. (5)

Student’s performance in the above question is given below in Table G4.5:

Table G4.5: Student’s performance in question targeting ‘G1’; course: UME801

S. No.	Roll No.	G1	Weight (Scale 1 to 5)
		(Final report and evaluation) (15 Marks)	
1	101108003	12	4

2	101108124	14.5	5
3	101288002	14.5	5
4	101108128	14.5	5
5	101008020	14.5	5
6	101108001	9	3
7	101108122	9	3
8	101108123	11	4
9	101158003	9	3
10	101108129	10	3
11	101108002	13.5	5
12	101108004	13.5	5
13	101108007	13.5	5
14	101108008	13.5	5
15	101108012	13.5	5
16	101108005	10	3
17	101108013	10	3
18	101288001	11	4
19	101288013	12	4
20	101288020	12	4
21	101108009	14	5
22	101108010	14	5
23	101108125	10	3
24	101108126	9	3
25	101108020	13	4
26	101108021	13	4
27	101108022	13	4
28	101108023	13	4
29	101108029	13	4
30	101108014	11	4
31	101108015	11	4
32	101108016	12	4
33	101108017	10	3
34	101108018	12	4
35	101108027	9	3
36	101108030	9	3
37	101108031	9	3
38	101108034	9	3
39	101288025	9	3
40	101108019	13	4
41	101108024	12	4
42	101108026	12	4
43	101288003	13	4
44	101288011	13	4
45	101108028	11	4
46	101108032	11	4

47	101108033	11	4
48	101288008	11	4
49	101108131	11	4
50	101108035	10	3
51	101108038	12	4
52	101108046	10	3
53	101108054	10	3
54	101288017	10	3
55	101108036	11	4
56	101108037	11	4
57	101108041	11	4
58	101108045	11	4
59	101108056	11	4
60	101108039	12	4
61	101108040	12	4
62	101108042	12	4
63	101108043	12	4
64	101108051	12	4
65	101108044	12.5	4
66	101108049	13	4
67	101108050	13	4
68	101108055	13	4
69	101288016	13	4

The overall performance of students in the above question is then summarized as given below in Table G4.6

Table G4.6: Average score of student performance in the course UME801 for criteria G1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME801	16	57.9	26.1	0	0	3.9

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria G1 as given below in Table G4.7:

Table G4.7: Weighted Average Student class performance (course portfolio) for criteria G1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	32.36	29.41	16.18	17.64	4.41	3.68	4
UME691	13.48	80.89	5.61	0	0	4.08	5
UME801	16	57.9	26.1	0	0	3.90	5
Weighted average score	19.78	57.97	15.95	5.04	1.26	3.90	14

b) Indirect measures for Performance criteria G1 (Surveys)

i.) Assessment Tool: Student Course Survey

Table G4.8: Average score of student course survey for criteria G1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	8.80	27.04	37.10	15.09	11.94	3.06	4
UME691	7.7	23.1	25.6	43.6	0	2.95	5
UME801	16.27	30.05	38.28	12.19	3.22	3.44	5
Weighted average score	11.08	26.71	33.42	24.24	4.56	3.16	14

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table G4.9: Assessment for criteria G1 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	43.33	40	15	1.67	0	4.25
Alumni survey	61.54	30.77	5.13	2.56	0	4.51
Employer Survey	22.73	54.55	27.27	0	0	4.13

c) Overall weighted average score of performance criterion ‘G1’

Finally overall weighted average score of performance criterion ‘G1’ is evaluated as given below in Table G4.10:

Table G4.10: Overall weighted average score of performance criterion ‘G1’

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	19.78	57.97	15.95	5.04	1.26	3.90	5
Weighted average student course survey	11.08	26.71	33.42	24.24	4.56	3.16	4
Graduating student survey	43.33	40	15	1.67	0	4.24	3
Alumni survey	61.54	30.77	5.13	2.56	0	4.51	3
Employer survey	22.73	54.55	27.27	0	0	4.14	3
Overall weighted score	29.22	42.93	19.76	7.49	1.36	3.93	18

Assessment of Outcome 'G' using performance criterion G2

Performance criteria 'G2': Deliver well organized, logical oral presentation, including good explanations when questioned.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Three courses namely Summer Training (UME591), Project Semester (UME691) and Mechanical System Design (UME801) were used to assess performance criteria G1 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Summer Training (UME591)

The above performance criteria are used to measure the attainment of outcome 'G2' by oral presentation on the catapult project work (weightage 10 marks) to the students.

Expectation: Student needs to be presented their detailed catapult project work through PPT.

Student's performance in the above criteria is given below in Table G4.11:

Table G4.11: Student's performance in question targeting 'G2'; course: UME591

Sr. No.	Roll No.	Marks (MM:10)	Scale (1 to 5)
1	101308001	8.00	5
2	101308002	5.67	2
3	101308003	5.92	2
4	101308004	8.00	5
5	101308005	6.75	4
6	101308006	7.42	5
7	101308007	7.00	4
8	101308008	7.42	5
9	101308009	5.83	2
10	101308010	7.50	5
11	101308011	6.20	3
12	101308012	7.25	4
13	101308013	7.17	4
14	101308014	7.50	5
15	101308015	7.17	4
16	101308016	6.42	3
17	101308017	6.00	3
18	101308018	5.67	2
19	101308019	6.33	3
20	101308020	8.58	5
21	101308021	6.42	3
22	101308023	7.42	5
23	101308024	5.90	2
24	101308025	6.00	3
25	101308026	5.83	2

26	101308027	6.42	3
27	101308028	8.00	5
28	101308029	6.08	3
29	101308031	6.00	3
30	101308032	6.42	3
31	101308033	7.25	4
32	101308034	7.25	4
33	101308035	7.08	4
34	101308036	7.00	4
35	101308037	6.00	3
36	101308038	8.17	5
37	101308039	7.42	5
38	101308040	6.58	4
39	101308042	7.00	4
40	101308043	5.42	2
41	101308044	6.58	4
42	101308045	7.00	4
43	101308046	7.17	4
44	101308047	6.50	4
45	101308048	7.67	5
46	101308050	7.42	5
47	101308051	7.42	5
48	101308052	5.75	2
49	101308053	7.50	5
50	101308054	7.42	5
51	101308055	8.17	5
52	101308057	7.42	5
53	101308058	7.08	4
54	101308059	8.00	5
55	101308060	7.25	4
56	101308061	6.00	3
57	101308063	7.92	5
58	101308064	6.00	3
59	101308065	6.00	3
60	101308066	7.17	4
61	101308067	6.17	3
62	101308068	7.08	4
63	101308069	6.92	4
64	101308071	5.75	2
65	101308072	7.92	5
66	101308073	8.17	5
67	101308074	5.10	1
68	101308076	6.25	3

The overall performance of students in the above criteria is then summarized as given below in Table G4.12

Table G4.12: Average score of student performance in the course UME591 for criteria G2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME591	32.36	29.41	23.52	13.24	1.47	3.77

(ii) Course: Project Semester (UME691)

The above performance criteria is used to measure the attainment of outcome 'G' by giving the following question (Evaluation No.: Communication skills and Question answer during final evaluation of Project Semester in department) to the students.

Question:

Students are evaluated by a group of members for the evaluation of communication skills during presentation of the project report and his/her ability of answer the questions raised by the panel.

Student's performance in the above question is given below in Table G4.13:

Table G4.13: Student's performance in question targeting 'G2'; course: UME691

S. No.	Roll No. of Students	G2	Weight (Scale 1 to 5)
		Communication Skill (10)	
1	101208001	7.8	4
2	101208003	7.4	4
3	101208004	6.8	4
4	101208005	7.0	4
5	101208007	8.0	4
6	101208010	7.3	4
7	101208012	8.0	4
8	101208017	8.3	5
9	101208019	7.6	4
10	101208020	6.7	4
11	101208022	7.8	4
12	101208025	7.5	4
13	101208028	8.0	4
14	101208030	8.4	5
15	101208031	7.0	4
16	101208032	6.0	4
17	101208034	8.2	5
18	101208036	8.6	5
19	101208038	8.7	5
20	101208039	6.8	4
21	101208040	8.3	5
22	101208042	8.8	5

23	101208044	7.4	4
24	101208045	8.0	4
25	101208049	8.0	4
26	101208051	8.8	5
27	101208053	8.6	5
28	101208057	8.0	4
29	101208058	7.2	4
30	101208064	7.5	4
31	101208065	8.3	5
32	101208068	8.0	4
33	101208072	8.5	5
34	101208075	8.0	4
35	101208078	7.9	4
36	101208082	7.6	4
37	101208084	8.4	5
38	101208086	8.2	5
39	101208089	7.8	4
40	101208091	8.5	5
41	101208095	6.8	4
42	101208097	7.5	4
43	101208102	7.3	4
44	101208112	7.8	4
45	101208116	7.4	4
46	101208118	7.6	4
47	101208125	8.8	5
48	101208129	8.3	5
49	101208131	7.4	4
50	101208134	8.3	5
51	101208139	7.8	4
52	101208140	8.4	5
53	101209001	8.0	4
54	101209002	8.0	4
55	101209005	8.2	5
56	101209006	8.3	5
57	101209007	7.3	4
58	101209008	6.8	4
59	101209009	7.0	4
60	101209010	6.6	4
61	101209013	6.8	4
62	101209014	7.8	4
63	101209017	8.4	5
64	101209019	9.0	5
65	101209027	8.5	5
66	101209030	8.5	5
67	101259002	7.5	4
68	101388002	8.7	5
69	101388003	7.4	4
70	101388006	6.0	4

71	101388007	6.6	4
72	101388008	8.0	4
73	101388010	8.0	4
74	101388011	6.7	4
75	101388012	7.0	4
76	101389001	8.3	5
77	101389003	7.0	4
78	401207004	6.4	4
79	401207007	7.2	4
80	401207013	8.5	5
81	401207015	8.2	5
82	401207027	7.6	4
83	401207028	7.4	4
84	401257004	7.4	4
85	401257005	7.4	4
86	401257007	8.6	5
87	401257009	7.6	4
88	401257010	7.2	4
89	401257016	9.0	5

The overall performance of student in the above question is then summarised as given below in Table G4.14:

Table G4.14: average score of the student performance in the course UME691 for criteria G2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME691	33.70	66.29	0	0	0	4.34

(iii) Course: Mechanical System Design (UME801)

The above performance criteria is used to measure the attainment of outcome ‘G’ by giving the following question (From the final report and evaluation) to the students.

Question:

From the final presentation

Student’s performance in the above question is given below in Table G4.15:

Table G4.15: Student’s performance in question targeting ‘G2’; course: UME801

S. No.	Roll No.	G2	Weight (Scale 1 to 5)
		(From Final presentation) (40 Marks)	
1	101108003	27.47	3
2	101108124	27.47	3
3	101288002	27.47	3
4	101108128	27.47	3

5	101008020	27.47	3
6	101108001	26.11	3
7	101108122	26.11	3
8	101108123	26.11	3
9	101158003	26.11	3
10	101108129	26.11	3
11	101108002	28.07	4
12	101108004	28.07	4
13	101108007	28.07	4
14	101108008	28.07	4
15	101108012	28.07	4
16	101108005	27.03	3
17	101108013	27.03	3
18	101288001	27.03	3
19	101288013	27.03	3
20	101288020	27.03	3
21	101108009	27.92	4
22	101108010	27.92	4
23	101108125	27.92	4
24	101108126	27.92	4
25	101108020	27.04	3
26	101108021	27.04	3
27	101108022	27.04	3
28	101108023	27.04	3
29	101108029	27.04	3
30	101108014	27.16	3
31	101108015	27.16	3
32	101108016	27.16	3
33	101108017	27.16	3
34	101108018	27.16	3
35	101108027	26.36	3
36	101108030	26.36	3
37	101108031	26.36	3
38	101108034	26.36	3
39	101288025	26.36	3
40	101108019	25.97	3
41	101108024	25.97	3
42	101108026	25.97	3
43	101288003	25.97	3
44	101288011	25.97	3
45	101108028	25.94	3
46	101108032	25.94	3
47	101108033	25.94	3
48	101288008	25.94	3
49	101108131	25.94	3

50	101108035	30.11	4
51	101108038	30.11	4
52	101108046	30.11	4
53	101108054	30.11	4
54	101288017	30.11	4
55	101108036	27.25	4
56	101108037	27.25	4
57	101108041	27.25	4
58	101108045	27.25	4
59	101108056	27.25	4
60	101108039	27.46	4
61	101108040	27.46	4
62	101108042	27.46	4
63	101108043	27.46	4
64	101108051	27.46	4
65	101108044	31.51	4
66	101108049	31.51	4
67	101108050	31.51	4
68	101108055	31.51	4
69	101288016	31.51	4

The overall performance of students in the above question is then summarized as given below in Table G4.16:

Table G4.16: Average score of student performance in the Course UME801 for criteria G2

Course	% in each score					Average Score
	5	4	3	2	1	
UME801	0	42.1	57.9	0	0	3.4

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria G2 as given below in Table G4.17

Table G4.17: Weighted Average Student class performance (course portfolio) for criteria G2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	32.36	29.41	23.52	13.24	1.47	3.78	4
UME691	33.70	66.29	0	0	0	4.34	5
UME801	0	42.1	57.9	0	0	3.42	5
Weighted average score	21.28	47.11	27.40	3.78	0.42	3.85	14

b.) Assessment Tool: Student Course Survey

Table G4.18: Average score of student course survey for criteria G2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME591	8.80	27.04	37.10	15.09	11.94	3.06	4
UME691	7.7	23.1	25.6	43.6	0	2.95	5
UME801	16.27	30.05	38.28	12.19	3.22	3.44	5
Weighted average score	11.08	26.71	33.42	24.24	4.56	3.16	14

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table G4.19: Assessment for criteria G2 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	43.33	40	15	1.67	0	4.25
Alumni survey	61.54	30.77	5.13	2.56	0	4.51
Employer Survey	22.73	54.55	27.27	0	0	4.13

Finally overall weighted average score of performance criterion 'G2' is evaluated as given below in Table G4.20:

Table G4.20.: Overall weighted average score of performance criterion 'G2'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	21.28	47.11	27.40	3.78	0.42	3.85	5
Weighted average student course survey	11.08	26.71	33.42	24.24	4.56	3.16	4
Graduating student survey	43.33	40	15	1.67	0	4.24	3
Alumni survey	61.54	30.77	5.13	2.56	0	4.51	3
Employer survey	22.73	54.55	27.27	0	0	4.14	3
Overall weighted score	29.64	39.91	22.94	7.14	1.13	3.92	18

Overall assessment of student outcome G using scores of G1 and G2

In the above sections, each of the individual performance criteria G1 and G2 have been assessed. The performance for attainment of outcome G has been completed using the attainment values for G1 and G2 and is provided below:

Table G4.21 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome G.

Table G4.21: Overall score for outcome G at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
G1	29.22	42.93	19.76	7.49	1.36	3.93	4
G2	29.64	39.91	22.94	7.14	1.13	3.92	5
Overall score	29.45	41.25	21.52	7.30	0.61	3.93	9

**Assessment of Attainment of Program Outcome
'H'
(Year 2015)**

for the

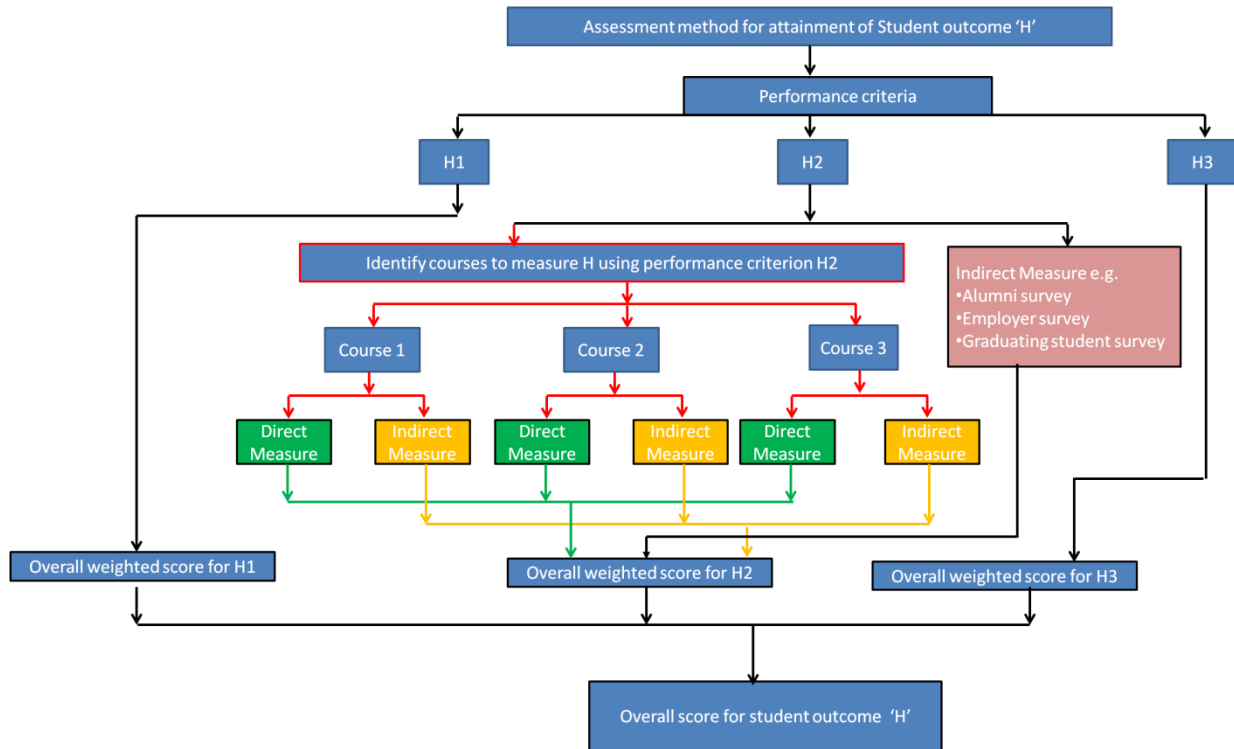
***Bachelor of Engineering
in
Mechanical Engineering***



**Thapar University
Patiala (Punjab) - 147004
INDIA**

Attainment of Outcome H

The attainment of each outcome has been measured using a standard procedure explained in the Self Assessment Report for the program. A flow chart depicting the step by step methodology used to measure each attainment is provided below for ready reference.



The following courses have been considered for the assessment of student outcome 'H'

Courses:

1. Engineering Economics (UHU081)
2. Environmental Studies (UEN001)
3. Mechanical System Design (UME801)

Outcome A has been assessed by Three performance criteria H1, H2 and H3. The sections below provide data for separate assessments for each of these performance criteria and in the end the results for these four performance criteria has been used to measure the overall measure of outcome H.

1) Assessment of Outcome 'H' using performance criterion H1

Performance criteria 'H1': Aware of societal and global changes that engineering innovations may cause.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Environment Studies (UEN001) and Mechanical System Design (UME801) were used to assess performance criteria H1 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Environment Studies (UEN001)

The above performance criteria is used to measure the attainment of outcome 'H1' by giving the following questions (Question No.3 (a) and 3(b): during MST in October 2015, weightage is 6 marks and 3 marks respectively) to the students.

Question: Q3. **a)** Discuss management of Forest and Water Resources for optimal utilization.

b) Explain the concept of 'Energy Flow in Ecosystems' with the help of suitable diagram. Support your argument with appropriate examples.

Student's performance in the above question is given below in Table H 4.1:

**Table H 4.1: Student's performance in question targeting 'H1' in
Course: UEN001/UEN003**

S.No.	Roll No.	Marks (MM:06)	Score (Scale 1 to 5)
1	101408001	2.5	3
2	101408002	3.5	4
3	101408003	3	4
4	101408004	2.8	3
5	101408005	0	1
6	101408006	0.4	1
7	101408007	1.6	2
8	101408008	3.5	4
9	101408009	2.5	3
10	101408010	2.8	3
11	101408011	2.2	2
12	101408012	1.2	2
13	101408013	1.2	2
14	101408014	2.8	3
15	101408015	2.7	3
16	101408017	3.2	4
17	101408019	2.8	3
18	101408020	0.3	1
19	101408021	1.2	1
20	101408022	0.6	1
21	101408023	3	4

22	101408024	2.7	4
23	101408025	0	1
24	101408026	2.8	3
25	101408028	2	2
26	101408029	0.6	1
27	101408030	2.1	2
28	101408033	1.2	1
29	101408034	3	4
30	101408035	2.8	3
31	101408036	0.6	1
32	101408037	1.5	1
33	101408038	2.8	3
34	101408039	0.6	1
35	101408040	2	2
36	101408041	0.8	1
37	101408042	2.8	3
38	101408043	3.5	4
39	101408044	0	1
40	101408045	3.7	4
41	101408046	2.4	2
42	101408047	NA	1
43	101408048	3.8	4
44	101408049	2.8	3
45	101408050	2.2	2
46	101408051	2.8	3
47	101408055	0.5	1
48	101408056	2.2	2
49	101408057	0.6	1
50	101408058	2.6	3
51	101408059	1.2	1
52	101408060	2.8	3
53	101408061	1.8	1
54	101408062	2.7	3
55	101408063	3.4	4
56	101408064	1.5	1
57	101408066	0.2	1
58	101408067	2.4	1
59	101408069	0	1
60	101408070	3.5	4
61	101408071	2.2	2
62	101408073	1.9	1
63	101408074	1.6	1
64	101408075	0.3	1
65	101408076	0.8	1
66	101408079	0.4	1

67	101408081	1.8	1
68	101408082	NA	1
69	101408083	1.8	1
70	101408084	0.6	1
71	101408085	NA	1
72	101408086	3.6	4
73	101408087	1.8	1
74	101408088	0.6	1
75	101408089	0.8	1
76	101408090	3.3	4
77	101408091	2.4	2
78	101408092	2.9	3
79	101408093	2	2
80	101408094	3.4	4
81	101408095	3.5	4
82	101408096	2.2	2
83	101408097	3	3
84	101408098	2.4	2
85	101408099	3.3	4
86	101408100	2.7	3
87	101408101	1.5	1
88	101408102	2	2
89	101408103	1.8	1
90	101408104	3	3
91	101408105	1.8	1
92	101408106	3.7	4
93	101408107	3.4	4
94	101408108	3.6	4
95	101408110	3.5	4
96	101408111	3	3
97	101408112	2.2	2
98	101408113	3.6	4
99	101408114	2.6	3
100	101408115	3.4	4
101	101408116	NA	1
102	101408118	NA	1
103	101408119	NA	1
104	101408120	2.2	2
105	101408121	3.6	4
106	101408122	2	2
107	101408123	3.4	4
108	101408124	3.7	4
109	101408125	NA	1
110	101408126	0.8	
111	101408127	4.2	5

112	101408128	2.8	3
113	101408129	3	3
114	101408130	2	2
115	101408131	3.9	4
116	101408132	0.8	1
117	101408133	4	5
118	101408136	1.8	2
119	101408137	3.2	3
120	101414001	3.6	4
121	101414002	2.7	3
122	101414003	2.8	3
123	101414004	1.8	1
124	101414005	1.2	1
125	101414006	2.2	2
126	101414009	3.7	4
127	101414010	3.3	4
128	101414013	3.6	4
129	101414014	3.2	4
130	101414015	3.8	4
131	101414017	3.4	4
132	101414018	3.2	4
133	101414019	3	3
134	101414020	3.4	4
135	101414021	2.8	3
136	101414023	0	1
137	101414026	3	3
138	101414027	2.8	3
139	101414028	3.2	4
140	101414030	3.4	4
141	101414031	2.8	3
142	101414032	2.4	3
143	101414034	3.4	4
144	101414035	2.4	3
145	101458001	3	3
146	101458002	3	3
147	101458003	3.8	4
148	101458004	3.7	4
149	101464002	2.5	3
150	101464003	2.4	3
151	101464004	2.6	3
152	101464005	3.8	4
153	101464006	2.4	3
154	101464007	3	3
155	101464008	NA	1
156	101464011	3	3

157	101588001	3.4	4
158	101588002	2.6	3
159	101588003	2.7	3
160	101588004	4.4	5
161	101588005	2.3	3
162	101588006	1	1
163	101588007	2.3	3
164	101588008	0.8	1
165	101588009	0.3	1
166	101588010	2.8	3
167	101588011	2	2
168	101588012	3.5	4
169	101588013	1.8	1
170	101588014	4	5
171	101588015	3.6	4
172	101594001	2.5	3
173	101594003	3.5	4

The overall performance of the students in the above question is then summarized as given below in table H4.2

Table H 4.2: Average score of the student performance in the course UEN001/UEN003 for criteria H1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEN003	$4/173 \times 100$ =2.31	$46/173 \times 100$ =26.58	$48/173 \times 100$ =27.74	$23/173 \times 100$ =13.89	$51/173 \times 100$ =29.48	2.583

(ii) Course: Mechanical System Design (UME801)

The above performance criteria is used to measure the attainment of outcome ‘H1’ by giving the following question (Question No.: 10 in the Final report) to the students.

Question:

- (a) List the societal and global changes that this project may cause. (5)

Student’s performance in the above question is given below in Table H4.3:

Table H4.3: Student’s performance in question targeting ‘H1’; course: UME801

S. No.	Roll No.	H1	Weight (Scale 1 to 5)
		(Q. No. 10 in Final report) (5 Marks)	
1	101108003	4.5	5
2	101108124	4.5	5

3	101288002	4.5	5
4	101108128	4.5	5
5	101008020	4.5	5
6	101108001	3	3
7	101108122	3	3
8	101108123	3	3
9	101158003	3	3
10	101108129	3	3
11	101108002	4	4
12	101108004	4	4
13	101108007	4	4
14	101108008	4	4
15	101108012	4	4
16	101108005	4	4
17	101108013	4	4
18	101288001	4	4
19	101288013	4	4
20	101288020	4	4
21	101108009	4	4
22	101108010	4	4
23	101108125	4	4
24	101108126	4	4
25	101108020	4	4
26	101108021	4	4
27	101108022	4	4
28	101108023	4	4
29	101108029	4	4
30	101108014	4.5	5
31	101108015	4.5	5
32	101108016	4.5	5
33	101108017	4.5	5
34	101108018	4.5	5
35	101108027	3.5	4
36	101108030	3.5	4
37	101108031	3.5	4
38	101108034	3.5	4
39	101288025	3.5	4
40	101108019	4.5	5
41	101108024	4.5	5
42	101108026	4.5	5
43	101288003	4.5	5
44	101288011	4.5	5
45	101108028	2.5	3
46	101108032	2.5	3
47	101108033	2.5	3

48	101288008	2.5	3
49	101108131	2.5	3
50	101108035	4.5	5
51	101108038	4.5	5
52	101108046	4.5	5
53	101108054	4.5	5
54	101288017	4.5	5
55	101108036	4	4
56	101108037	4	4
57	101108041	4	4
58	101108045	4	4
59	101108056	4	4
60	101108039	4	4
61	101108040	4	4
62	101108042	4	4
63	101108043	4	4
64	101108051	4	4
65	101108044	4.5	5
66	101108049	4.5	5
67	101108050	4.5	5
68	101108055	4.5	5
69	101288016	4.5	5

The overall performance of students in the above question is then summarized as given below in Table H4.4:

Table H4.4: Average score of student performance in the course UME801 for criteria H1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME801	36	49	15	0	0	4.21

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria H1 as given below in Table H4.5:

Table H4.5: Weighted Average Student class performance (course portfolio) for criteria H1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME801	36	49	15	0	0	4.21	4
UEN001	2.31	26.58	27.74	13.89	29.48	2.58	5
Weighted average score	17.28	36.54	22.08	7.72	16.38	3.31	9

b) Indirect measures for Performance criteria H1 (Surveys)

i.) Assessment Tool: Student Course Survey

Table H4.6: Average score of student course survey for criteria H1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME801	16.27	30.05	38.28	12.19	3.22	3.44	4
UEN001	22.92	26.05	18.75	21.87	7.17	3.26	5
Weighted average score	19.96	27.83	27.43	17.57	5.41	3.34	9

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table H4.7: Assessment for criteria H1 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	36.67	33.33	26.67	3.33	0	4.03
Alumni survey	51.28	15.38	28.21	5.13	0	4.13
Employer Survey	40.91	45.45	9.09	4.55	0	4.22

c) Overall weighted average score of performance criterion ‘H1’

Finally overall weighted average score of performance criterion ‘H1’ is evaluated as given below in Table H4.8:

Table H4.8: Overall weighted average score of performance criterion ‘H1’

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	17.28	36.54	22.08	7.72	16.38	3.31	5
Weighted average student course survey	19.96	27.83	27.43	17.57	5.41	3.34	4
Graduating student survey	36.67	33.33	26.67	3.33	0	4.03	3
Alumni survey	51.28	15.38	28.21	5.13	0	4.12	3
Employer survey	40.91	45.45	9.09	4.55	0	4.23	3
Overall weighted score	30.71	32.03	22.89	8.22	5.75	3.73	18

Assessment of Outcome 'A' using performance criterion H2

Performance criteria 'H2': Examines economics tradeoffs in engineering systems.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Engineering Economics (UHU081) and Mechanical System Design (UME801) were used to assess performance criteria H2 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Engineering Economics (UHU081)

The above performance criteria is used to measure the attainment of outcome 'H2' by giving the following question (Question No. 1: during EST in May 2015, weightage 5 marks) to the students.

Question: Matching Products Limited is considering two mutually exclusive investments, Project X and Project Y. The Expected cash flows of these projects are as follow :

Year	Project X (Rs.)	Project Y (Rs.)
0	-1000	-1600
1	300	200
2	600	400
3	250	600
4	300	800
5	200	200

- Calculate choice of project using payback period method.
- Calculate NPV of Project X & Y and rank them as per priority of acceptance if discounting rate is 12%.

Student's performance in the above question is given below in Table H4.9:

Table H4.9: Student's performance in question targeting 'H2; course: UHU081

S.No.	Roll No.	Marks (MM:07)	Score (Scale 1-5)
1.	101108109	3	3
2.	101288006	4	4
3.	101108076	3.5	4
4.	101158001	5.0	5
5.	101108098	2.0	2
6.	101158001	4.0	4
7.	101288014	4.0	4
8.	101108114	1.0	1
9.	101288018	4	4
10.	101108058	3.5	4
11.	101108059	3.5	4
12.	101108060	3.0	3
13.	101108061	5.0	5
14.	101108062	2.0	2

15.	101108064	3.0	3
16.	101108065	3.5	4
17.	101108066	5.0	5
18.	101108067	2.0	2
19.	101108068	2.0	2
20.	101108069	3.5	4
21.	101108070	5.0	5
22.	101108071	5.0	5
23.	101108072	5.0	5
24.	101108074	5.0	5
25.	101108077	4.0	4
26.	101108079	5.0	5
27.	101108082	5.0	5
28.	101108083	3.0	3
29.	101108085	3.0	3
30.	101108086	5.0	5
31.	101108087	4.0	4
32.	101108091	3.0	3
33.	101108092	3.0	3
34.	101108093	5.0	5
35.	101108094	3.0	3
36.	101108095	4.5	5
37.	101108096	5.0	5
38.	101108099	2.0	2
39.	101108101	5.0	5
40.	101108112	5.0	5
41.	101108111	5.0	5
42.	101108106	3.5	4
43.	101108105	5.0	5
44.	101108104	5.0	5
45.	101108103	2.0	2
46.	101108102	5.0	5
47.	101108092	0.0	0
48.	101108093	3.0	3
49.	101288007	3.0	3
50.	101108088	3.0	3
51.	101288021	5.0	5
52.	101108063	5.0	5
53.	101108080	5.0	5
54.	101288019	2.0	2
55.	101108108	5.0	5
56.	101108110	1.0	1
57.	101108097	5.0	5
58.	101288015	1.0	1
59.	101108100	5.0	5
60.	101108113	5.0	5
61.	101108113	3.5	4
62.	101108117	5.0	5
63.	101108116	5.0	5
64.	101108118	4.0	4
65.	101108113	5.0	5
66.	101108126	1.0	1
67.	101288010	1.5	2

68.	101288024	4.0	4
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The overall performance of student in the above question is then summarised as given below in Table H4.10:

Table H4.10: average score of the student performance in the course UME302 for criteria H2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UHU-081	39.7	22.05	16.18	11.76	7.35	3.66

(ii) Course: Mechanical system Design (UME801)

The above performance criteria is used to measure the attainment of outcome ‘H’ by giving the following question (Question No.: 11 in the Final report) to the students.

Question:

- (a) What are the economics tradeoffs in your engineering design? What would be the cost if they were not made? **(5)**

Student’s performance in the above question is given below in Table H4.11:

Table H4.11: Student’s performance in question targeting ‘H2’; course: UME801

S. No.	Roll No.	H2	Weight (Scale 1 to 5)
		(Q. No. 11 in Final report) (5 Marks)	
1	101108003	4	4
2	101108124	4	4
3	101288002	4	4
4	101108128	4	4
5	101008020	4	4
6	101108001	3.5	4
7	101108122	3.5	4
8	101108123	3.5	4
9	101158003	3.5	4
10	101108129	3.5	4
11	101108002	4.5	5
12	101108004	4.5	5
13	101108007	4.5	5
14	101108008	4.5	5
15	101108012	4.5	5
16	101108005	4.5	5
17	101108013	4.5	5
18	101288001	4.5	5
19	101288013	4.5	5

20	101288020	4.5	5
21	101108009	4.5	5
22	101108010	4.5	5
23	101108125	4.5	5
24	101108126	4.5	5
25	101108020	3.5	4
26	101108021	3.5	4
27	101108022	3.5	4
28	101108023	3.5	4
29	101108029	3.5	4
30	101108014	4.5	5
31	101108015	4.5	5
32	101108016	4.5	5
33	101108017	4.5	5
34	101108018	4.5	5
35	101108027	3	3
36	101108030	3	3
37	101108031	3	3
38	101108034	3	3
39	101288025	3	3
40	101108019	5	5
41	101108024	5	5
42	101108026	5	5
43	101288003	5	5
44	101288011	5	5
45	101108028	3	3
46	101108032	3	3
47	101108033	3	3
48	101288008	3	3
49	101108131	3	3
50	101108035	5	5
51	101108038	5	5
52	101108046	5	5
53	101108054	5	5
54	101288017	5	5
55	101108036	3.5	4
56	101108037	3.5	4
57	101108041	3.5	4
58	101108045	3.5	4
59	101108056	3.5	4
60	101108039	4	4
61	101108040	4	4
62	101108042	4	4
63	101108043	4	4

64	101108051	4	4
65	101108044	4.5	5
66	101108049	4.5	5
67	101108050	4.5	5
68	101108055	4.5	5
69	101288016	4.5	5

The overall performance of students in the above question is then summarized as given below in Table H4.12:

Table H4.12: Average score of student performance in the course UME801 for criteria H2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME801	49	36	15	0	0	4.34

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria H2 as given below in Table H4.13:

Table H4.13: Weighted Average Student class performance (course portfolio) for criteria H2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME801	49	36	15	0	0	4.34	4
UHU081	39.7	22.05	16.18	11.76	7.35	3.66	4
Weighted average score	44.35	29.03	15.59	5.88	3.68	4.00	8

b.) Assessment Tool: Student Course Survey

Table H4.14: Average score of student course survey for criteria H2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME801	16.27	30.05	38.28	12.19	3.22	3.44	4
UHU081	6.21	21.38	40.69	26.21	5.52	2.97	4
Weighted average score	11.24	25.72	39.49	19.20	4.37	3.20	8

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table H4.15: Assessment for criteria H2 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	36.67	33.33	26.67	3.33	0	4.03
Alumni survey	51.28	15.38	28.21	5.13	0	4.13
Employer Survey	40.91	45.45	9.09	4.55	0	4.2272

Finally overall weighted average score of performance criterion 'H2' is evaluated as given below in Table H4.16:

Table H4.16.: Overall weighted average score of performance criterion 'H2'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	44.35	29.03	15.59	5.88	3.68	4.00	5
Weighted average student course survey	11.24	25.72	39.49	19.20	4.37	3.20	4
Graduating student survey	36.67	33.33	26.67	3.33	0	4.03	3
Alumni survey	51.28	15.38	28.21	5.13	0	4.12	3
Employer survey	40.91	45.45	9.09	4.55	0	4.23	3
Overall weighted score	36.29	29.47	23.77	8.07	1.99	3.89	18

Assessment of Outcome 'H' using performance criterion H3

Performance criteria 'H3': Evaluates engineering solutions that consider environmental factors.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Environmental Studies (UEN001) and Mechanical System Design (UME801) were used to assess performance criteria H3 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Environmental Studies (UEN001)

The above performance criteria is used to measure the attainment of outcome 'H3' by giving the following questions (Question No. 1(a) and 1(b): during MST in October 2015, weightage is 3 marks and 5 marks respectively) to the students.

Question: Q1. **a)** Describe the effects of deforestation on environment and its major threat to human beings. Illustrate this concept in context of India.

b) Narrate the problems arising related to environmental issues faced by people of Punjab region in day to day life and suggest possible solutions to associated problems.

Student's performance in the above question is given below in Table H4.17:

Table H4.17: Student's performance in question targeting 'H3'; course: UEN001/UEN003

S.No.	Roll No.	Marks (MM:03)	Score (Scale 1 to 5)
1	101408001	1.4	3
2	101408002	2.4	5
3	101408003	1.9	4
4	101408004	2.1	4
5	101408005	0.6	1
6	101408006	2.4	5
7	101408007	1.7	3
8	101408008	1.9	4
9	101408009	1.7	3
10	101408010	2.4	5
11	101408011	1.7	3
12	101408012	1.2	2
13	101408013	1.9	4
14	101408014	2.1	4
15	101408015	2.2	5
16	101408017	2.1	4
17	101408019	2.3	5
18	101408020	0.2	1
19	101408021	1.5	3
20	101408022	1	1
21	101408023	2.4	5
22	101408024	2	4
23	101408025	2.2	5
24	101408026	2.2	5
25	101408028	1.8	4
26	101408029	1.9	4
27	101408030	1.4	3
28	101408033	1.7	3
29	101408034	1.8	4
30	101408035	2	4
31	101408036	1.3	2
32	101408037	1.4	3
33	101408038	1.8	4
34	101408039	1.2	2
35	101408040	1.8	4
36	101408041	1.4	3
37	101408042	1.9	4
38	101408043	2.3	5
39	101408044	1.7	3
40	101408045	1.8	4
41	101408046	2.1	4
42	101408047	1.8	4

43	101408048	1.9	4
44	101408049	1.2	2
45	101408050	2.2	5
46	101408051	1.9	4
47	101408055	1	1
48	101408056	1.6	3
49	101408057	1.6	3
50	101408058	1.2	2
51	101408059	1.8	4
52	101408060	1.8	4
53	101408061	0.8	1
54	101408062	1.8	4
55	101408063	2	4
56	101408064	0.6	1
57	101408066	1.5	3
58	101408067	1.7	3
59	101408069	1.5	3
60	101408070	1.3	2
61	101408071	1.9	4
62	101408073	1.5	3
63	101408074	1.8	4
64	101408075	1.9	4
65	101408076	1	1
66	101408079	0.5	1
67	101408081	1	1
68	101408082	1.4	3
69	101408083	1.6	3
70	101408084	1.7	3
71	101408085	1.7	3
72	101408086	2.5	5
73	101408087	2.1	4
74	101408088	1.9	4
75	101408089	1.9	4
76	101408090	1.9	4
77	101408091	2	4
78	101408092	0.5	1
79	101408093	1	1
80	101408094	0.3	1
81	101408095	1.8	4
82	101408096	1.3	2
83	101408097	2	4
84	101408098	1	1
85	101408099	1.8	4
86	101408100	1.5	3
87	101408101	1.7	3

88	101408102	1.8	4
89	101408103	1.2	2
90	101408104	2	4
91	101408105	1.2	2
92	101408106	2.2	5
93	101408107	2	4
94	101408108	1.9	4
95	101408110	2.2	5
96	101408111	1.2	2
97	101408112	1.7	3
98	101408113	1.9	4
99	101408114	1.2	2
100	101408115	2.1	4
101	101408116	2	4
102	101408118	1.4	3
103	101408119	2.1	4
104	101408120	1.9	4
105	101408121	2.3	5
106	101408122	2	4
107	101408123	2.3	5
108	101408124	1.6	3
109	101408125	2.1	4
110	101408126	1.8	4
111	101408127	2	4
112	101408128	0.8	1
113	101408129	1.9	4
114	101408130	1.6	3
115	101408131	1.7	3
116	101408132	2.2	5
117	101408133	2.1	4
118	101408136	2.1	4
119	101408137	1.2	2
120	101414001	1.7	3
121	101414002	1.4	3
122	101414003	1.2	2
123	101414004	1.4	3
124	101414005	1.6	3
125	101414006	1.4	3
126	101414009	2	4
127	101414010	2.1	4
128	101414013	2.2	5
129	101414014	1.7	3
130	101414015	2	4
131	101414017	2	4
132	101414018	1.8	4

133	101414019	1.6	3
134	101414020	1.8	4
135	101414021	2	4
136	101414023	0	1
137	101414026	1.6	3
138	101414027	1	1
139	101414028	1.6	3
140	101414030	2.1	4
141	101414031	1.2	2
142	101414032	2.2	5
143	101414034	2	4
144	101414035	1.9	4
145	101458001	1.1	1
146	101458002	2.1	4
147	101458003	2.2	5
148	101458004	2.1	4
149	101464002	1.7	3
150	101464003	2.5	5
151	101464004	1.3	2
152	101464005	1.2	2
153	101464006	2.2	5
154	101464007	2	4
155	101464008	1.6	3
156	101464011	2.1	4
157	101588001	2	4
158	101588002	2.3	5
159	101588003	1.8	4
160	101588004	2	4
161	101588005	2.4	5
162	101588006	1.9	4
163	101588007	0.3	1
164	101588008	2.4	5
165	101588009	1.2	2
166	101588010	2.5	5
167	101588011	2.2	5
168	101588012	2.1	4
169	101588013	1.8	4
170	101588014	2.3	5
171	101588015	2.1	4
172	101594001	1.5	3
173	101594003	2.2	5

The overall performance of student in the above question is then summarised as given below in Table H4.18:

Table H4.18: average score of the student performance in the course UEN001/UEN003 for criteria H3

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEN003	16.18	41.04	22.54	9.82	10.40	3.42

(II) Course: Mechanical System Design (UME801)

The above performance criteria is used to measure the attainment of outcome ‘H’ by giving the following question (Question No.: 12 in the final report) to the students.

Question:

- (a) Evaluate the environmental factors in the engineering design of this project. (5)

Student’s performance in the above question is given below in Table H4.19:

Table H4.19: Student’s performance in question targeting ‘H3’; course: UME801

S. No.	Roll No.	H3	Weight (Scale 1 to 5)
		(Q. No. 12 in Final report) (5 Marks)	
1	101108003	3.5	4
2	101108124	3.5	4
3	101288002	3.5	4
4	101108128	3.5	4
5	101008020	3.5	4
6	101108001	4	4
7	101108122	4	4
8	101108123	4	4
9	101158003	4	4
10	101108129	4	4
11	101108002	3	3
12	101108004	3	3
13	101108007	3	3
14	101108008	3	3
15	101108012	3	3
16	101108005	3.5	4
17	101108013	3.5	4
18	101288001	3.5	4
19	101288013	3.5	4
20	101288020	3.5	4
21	101108009	3.5	4

22	101108010	3.5	4
23	101108125	3.5	4
24	101108126	3.5	4
25	101108020	3	3
26	101108021	3	3
27	101108022	3	3
28	101108023	3	3
29	101108029	3	3
30	101108014	3.5	4
31	101108015	3.5	4
32	101108016	3.5	4
33	101108017	3.5	4
34	101108018	3.5	4
35	101108027	2.5	3
36	101108030	2.5	3
37	101108031	2.5	3
38	101108034	2.5	3
39	101288025	2.5	3
40	101108019	3.5	4
41	101108024	3.5	4
42	101108026	3.5	4
43	101288003	3.5	4
44	101288011	3.5	4
45	101108028	2.5	3
46	101108032	2.5	3
47	101108033	2.5	3
48	101288008	2.5	3
49	101108131	2.5	3
50	101108035	4	4
51	101108038	4	4
52	101108046	4	4
53	101108054	4	4
54	101288017	4	4
55	101108036	4	4
56	101108037	4	4
57	101108041	4	4
58	101108045	4	4
59	101108056	4	4
60	101108039	4	4
61	101108040	4	4
62	101108042	4	4
63	101108043	4	4
64	101108051	4	4
65	101108044	4	4

66	101108049	4	4
67	101108050	4	4
68	101108055	4	4
69	101288016	4	4

The overall performance of students in the above question is then summarized as given below in Table H4.20:

Table H4.20: Average score of student performance in the course UME801 for criteria H3

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME801	0	71	29	0	0	3.71

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria H3 as given below in Table H4.21:

Table H4.21: Weighted Average Student class performance (course portfolio) for criteria H3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME801	0	71	29	0	0	3.71	4
UEN001	16.18	41.04	22.54	9.82	10.4	3.43	5
Weighted average score	8.99	54.36	25.41	5.46	5.78	3.55	9

b.) Assessment Tool: Student Course Survey

Table H4.22: Average score of student course survey for criteria H3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME801	16.27	30.05	38.28	12.19	3.22	3.44	4
UEN001	22.92	26.05	18.75	21.87	7.17	3.26	5
Weighted average score	19.96	27.83	27.43	17.57	5.41	3.34	9

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table H4.23: Assessment for criteria A3 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	36.67	33.33	26.67	3.33	0	4.03

Alumni survey	51.28	15.38	28.21	5.13	0	4.13
Employer Survey	40.91	45.45	9.09	4.55	0	4.2272

Finally overall weighted average score of performance criterion 'H3' is evaluated as given below in Table H4.24:

Table H4.24: Overall weighted average score of performance criterion 'H3'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	8.99	54.36	25.41	5.46	5.78	3.55	5
Weighted average student course survey	19.96	27.83	27.43	17.57	5.41	3.34	4
Graduating student survey	36.67	33.33	26.67	3.33	0	4.03	3
Alumni survey	51.28	15.38	28.21	5.13	0	4.12	3
Employer survey	40.91	45.45	9.09	4.55	0	4.23	3
Overall weighted score	28.41	36.98	23.82	7.59	2.81	3.79	18

Overall assessment of student outcome H using scores of H1, H2 and H3

In the above sections, each of the individual performance criteria H1, H2 and H3 have been assessed. The performance for attainment of outcome A has been completed using the attainment values for H1 , H2 and H3 and is provided below:

Table H4.25 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome H.

Table H4.25: Overall score for outcome H at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
H1	30.71	32.03	22.89	8.22	5.75	3.73	5
H2	36.29	29.47	23.77	8.07	1.99	3.89	5
H3	28.41	36.98	23.82	7.59	2.81	3.79	4
Overall score	32.05	32.53	23.47	7.98	2.62	3.80	14

**Assessment of Attainment of Program Outcome
'I'
(Year 2015)**

for the

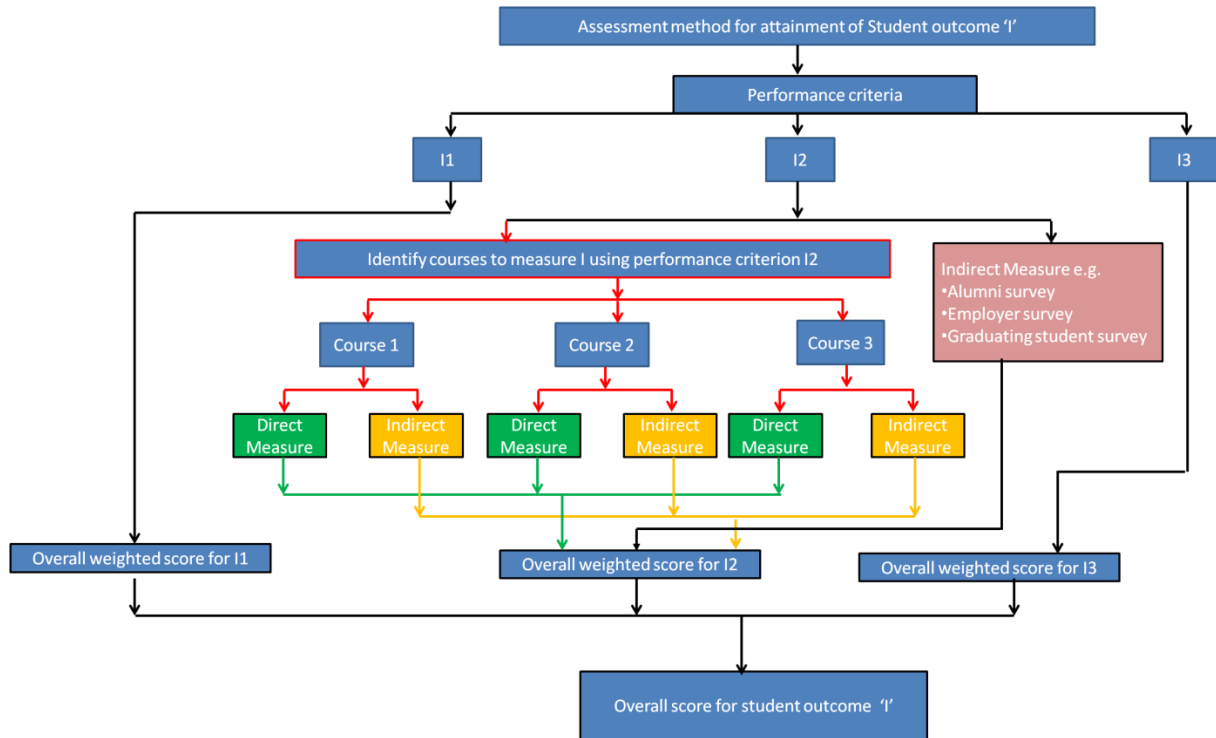
***Bachelor of Engineering
in
Mechanical Engineering***



**Thapar University
Patiala (Punjab) - 147004
INDIA**

Attainment of Outcome A

The attainment of each outcome has been measured using a standard procedure explained in the Self Assessment Report for the program. A flow chart depicting the step by step methodology used to measure each attainment is provided below for ready reference.



The following courses have been considered for the assessment of student outcome 'I'

Courses:

1. Project Semester (UME691)
2. Mechanical System Design (UME801)

Outcome I has been assessed by four performance criteria I1, I2 and I3. The sections below provide data for separate assessments for each of these performance criteria and in the end the results for these four performance criteria has been used to measure the overall measure of outcome I.

1) Assessment of Outcome 'I' using performance criterion I1

Performance criteria 'I1': Able to use resources to learn new materials not taught in class.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Project Semester (UME691) and Mechanical System Design (UME801) were used to assess performance criteria I1 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Project Semester (UME691)

The above performance criteria is used to measure the attainment of outcome 'I' by giving the following question (Question No.: B(vi) in second visit of Project Semester) to the students.

Question:

Status and feasibility of implementation^[1]

Student's performance in the above question is given below in Table I4.1:

Table I4.1: Student's performance in question targeting 'I 1'; course: UME 691

S. No.	Roll No. of Students	I 1	Weight (Scale 1 to 5)
		(Q. No. B(vi)) (5 Marks)	
1	101204003	5	5
2	101208012	4	4
3	101208016	5	5
4	101208020	5	5
5	101208027	5	5
6	101208028	5	5
7	101208029	4	4
8	101208032	5	5
9	101208036	5	5
10	101208040	5	5
11	101208045	5	5
12	101208052	5	5
13	101208054	4	4
14	101208055	5	5
15	101208057	5	5
16	101208058	5	5
17	101208059	5	5
18	101208062	5	5
19	101208075	4	4
20	101208079	4	4
21	101208092	5	5
22	101208093	5	5
23	101208096	5	5

24	101208101	5	5
25	101208104	5	5
26	101208107	5	5
27	101208112	4	4
28	101208113	5	5
29	101208114	5	5
30	101208123	4	4
31	101208125	5	5
32	101208131	5	5
33	101208132	5	5
34	101208134	4	4
35	101208136	5	5
36	101209013	4	4
37	101209020	5	5
38	101209022	4	4
39	101209023	5	5
40	101209030	3	3
41	101259002	5	5
42	101388002	4	4
43	101388004	5	5
44	101388006	5	5
45	101388011	5	5
46	101388012	5	5
47	101389002	5	5
48	101389003	4	4
49	401207004	3	3
50	401207007	5	5
51	401207015	5	5
52	401207022	5	5
53	401257003	4	4
54	401257007	5	5
55	401257009	5	5
56	401257010	5	5
57	401257013	4	4
58	401257014	4	4
59	401257017	4	4
60	401387003	5	5

The overall performance of student in the above question is then summarised as given below in Table I4.2:

Table I4.2: average score of the student performance in the course UME691 for criteria I 1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME691	70	26.67	3.34	0	0	4.67

(ii) Course: Mechanical system design (UME801)

The above performance criteria is used to measure the attainment of outcome 'I' by giving the following question (Question No.: 13 in the Final report) to the students.

Question:

- (a) What resources did you use to learn new materials not taught in class for the course of the project? Which of these resources, references and new learning would you keep for future use / anticipate would be useful in future? **(5)**

Student's performance in the above question is given below in Table I 4.3:

Table I4.3: Student's performance in question targeting 'I 1'; course: UME801

S. No.	Roll No.	I1	Weight (Scale 1 to 5)
		(Q. No. 13 in Final report) (5 Marks)	
1	101108003	3.5	4
2	101108124	3.5	4
3	101288002	3.5	4
4	101108128	3.5	4
5	101008020	3.5	4
6	101108001	3.5	4
7	101108122	3.5	4
8	101108123	3.5	4
9	101158003	3.5	4
10	101108129	3.5	4
11	101108002	3.5	4
12	101108004	3.5	4
13	101108007	3.5	4
14	101108008	3.5	4
15	101108012	3.5	4
16	101108005	4	4
17	101108013	4	4
18	101288001	4	4
19	101288013	4	4
20	101288020	4	4
21	101108009	4.5	5
22	101108010	4.5	5
23	101108125	4.5	5
24	101108126	4.5	5
25	101108020	4.5	5
26	101108021	4.5	5
27	101108022	4.5	5
28	101108023	4.5	5

29	101108029	4.5	5
30	101108014	3.5	4
31	101108015	3.5	4
32	101108016	3.5	4
33	101108017	3.5	4
34	101108018	3.5	4
35	101108027	3	3
36	101108030	3	3
37	101108031	3	3
38	101108034	3	3
39	101288025	3	3
40	101108019	4.5	5
41	101108024	4.5	5
42	101108026	4.5	5
43	101288003	4.5	5
44	101288011	4.5	5
45	101108028	3	3
46	101108032	3	3
47	101108033	3	3
48	101288008	3	3
49	101108131	3	3
50	101108035	4	4
51	101108038	4	4
52	101108046	4	4
53	101108054	4	4
54	101288017	4	4
55	101108036	4.5	5
56	101108037	4.5	5
57	101108041	4.5	5
58	101108045	4.5	5
59	101108056	4.5	5
60	101108039	4.5	5
61	101108040	4.5	5
62	101108042	4.5	5
63	101108043	4.5	5
64	101108051	4.5	5
65	101108044	4	4
66	101108049	4	4
67	101108050	4	4
68	101108055	4	4
69	101288016	4	4

The overall performance of students in the above question is then summarized as given below in Table I4.4:

Table I4.4: Average score of student performance in the course UME801 for criteria I1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME801	35	51	14	0	0	4.21

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria I1 as given below in Table I4.5:

Table I4.5: Weighted Average Student class performance (course portfolio) for criteria I1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME801	35	51	14	0	0	4.21	5
UME691	70	26.67	3.33	0	0	4.67	5
Weighted average score	52.50	38.83	8.67	0.00	0.00	4.44	10

b) Indirect measures for Performance criteria I1 (Surveys)

i.) Assessment Tool: Student Course Survey

Table I4.6: Average score of student course survey for criteria I1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME801	16.27	30.05	38.28	12.19	3.22	3.44	5
UME691	7.7	23.1	25.6	43.6	0	2.95	5
Weighted average score	11.99	26.58	31.94	27.90	1.61	3.19	10

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table I4.7: Assessment for criteria I1 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	35	45	18.33	1.67	0	4.13
Alumni survey	56.41	25.64	15.38	2.56	0	4.36
Employer Survey	36.36	50	13.64	0	0	4.22

c) Overall weighted average score of performance criterion 'I1'

Finally overall weighted average score of performance criterion 'I1' is evaluated as given below in Table I4.8:

Table I4.8: Overall weighted average score of performance criterion 'I1'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	52.50	38.83	8.67	0.00	0.00	4.44	5
Weighted average student course survey	11.99	26.58	31.94	27.90	1.61	3.19	4
Graduating student survey	35	45	18.33	1.67	0	4.13	3
Alumni survey	56.41	25.64	15.38	2.56	0	4.35	3
Employer survey	36.36	50	13.64	0	0	4.23	3
Overall weighted score	38.54	36.80	17.40	6.90	0.36	4.06	18

Assessment of Outcome 'I' using performance criterion I2

Performance criteria 'I2': Ability to list sources for continuing education opportunities.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Project Semester (UME691) and Mechanical System design (UME801) were used to assess performance criteria I2 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Project Semester (UME801)

The above performance criteria is used to measure the attainment of outcome 'I' by giving the following question (Question No.: B(iv)) in second visit of Project Semester) to the students.

Question:

Information collection update (refers to: (a) Literature survey (b) Guidance from others in Industry & the Institute).

Student's performance in the above question is given below in Table I4.9:

Table I4.9: Student's performance in question targeting 'I2'; course: UME691

S. No.	Roll No. of Students	I 2	Weight (Scale 1 to 5)
		(Q. No. B(iv)) (5 Marks)	
1	101204003	5	5
2	101208012	4	4

3	101208016	5	5
4	101208020	5	5
5	101208027	5	5
6	101208028	5	5
7	101208029	5	5
8	101208032	5	5
9	101208036	5	5
10	101208040	5	5
11	101208045	5	5
12	101208052	5	5
13	101208054	5	5
14	101208055	5	5
15	101208057	5	5
16	101208058	5	5
17	101208059	5	5
18	101208062	5	5
19	101208075	5	5
20	101208079	5	5
21	101208092	5	5
22	101208093	5	5
23	101208096	5	5
24	101208101	5	5
25	101208104	5	5
26	101208107	5	5
27	101208112	5	5
28	101208113	5	5
29	101208114	5	5
30	101208123	5	5
31	101208125	5	5
32	101208131	5	5
33	101208132	4	4
34	101208134	4	4
35	101208136	5	5
36	101209013	4	4
37	101209020	4	4
38	101209022	5	5
39	101209023	4	4
40	101209030	4	4
41	101259002	5	5
42	101388002	5	5
43	101388004	5	5
44	101388006	5	5
45	101388011	5	5
46	101388012	5	5
47	101389002	5	5
48	101389003	4	4
49	401207004	4	4
50	401207007	5	5

51	401207015	5	5
52	401207022	5	5
53	401257003	4	4
54	401257007	5	5
55	401257009	5	5
56	401257010	5	5
57	401257013	4	4
58	401257014	3	3
59	401257017	4	4
60	401387003	5	5

The overall performance of student in the above question is then summarised as given below in Table I4.10:

Table I4.10: average score of the student performance in the course UME691 for criteria I2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME691	78.33	20	1.66	0	0	4.77

(ii) Course: Mechanical System Design (UME801)

The above performance criteria is used to measure the attainment of outcome 'I2' by giving the following question (Question No.: 14 in the Final report) to the students.

Question:

- (a) What has this project taught you about the use of self-learning? Does it prepare you for the future to undertake new and unexplored engineering problems using self-learning? (5)

Student's performance in the above question is given below in Table I4.11:

Table I4.11: Student's performance in question targeting 'I2'; course: UME801

S. No.	Roll No.	I2	Weight (Scale 1 to 5)
		(Q. No. 14 in Final report) (5 Marks)	
1	101108003	4	4
2	101108124	4	4
3	101288002	4	4
4	101108128	4	4
5	101008020	4	4
6	101108001	3	3
7	101108122	3	3
8	101108123	3	3
9	101158003	3	3
10	101108129	3	3

11	101108002	4	4
12	101108004	4	4
13	101108007	4	4
14	101108008	4	4
15	101108012	4	4
16	101108005	4.5	5
17	101108013	4.5	5
18	101288001	4.5	5
19	101288013	4.5	5
20	101288020	4.5	5
21	101108009	4	4
22	101108010	4	4
23	101108125	4	4
24	101108126	4	4
25	101108020	3.5	4
26	101108021	3.5	4
27	101108022	3.5	4
28	101108023	3.5	4
29	101108029	3.5	4
30	101108014	5	5
31	101108015	5	5
32	101108016	5	5
33	101108017	5	5
34	101108018	5	5
35	101108027	3	3
36	101108030	3	3
37	101108031	3	3
38	101108034	3	3
39	101288025	3	3
40	101108019	4	4
41	101108024	4	4
42	101108026	4	4
43	101288003	4	4
44	101288011	4	4
45	101108028	3	3
46	101108032	3	3
47	101108033	3	3
48	101288008	3	3
49	101108131	3	3
50	101108035	4	4
51	101108038	4	4
52	101108046	4	4
53	101108054	4	4
54	101288017	4	4

55	101108036	4	4
56	101108037	4	4
57	101108041	4	4
58	101108045	4	4
59	101108056	4	4
60	101108039	4	4
61	101108040	4	4
62	101108042	4	4
63	101108043	4	4
64	101108051	4	4
65	101108044	3.5	4
66	101108049	3.5	4
67	101108050	3.5	4
68	101108055	3.5	4
69	101288016	3.5	4

The overall performance of students in the above question is then summarized as given below in Table I4.12:

Table I4.12: Average score of student performance in the course UME801 for criteria I2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME801	14	64	22	0	0	3.92

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria I2 as given below in Table I4.13:

Table I4.13: Weighted Average Student class performance (course portfolio) for criteria I2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME801	14	64	22	0	0	3.92	5
UME691	78.33	20	1.67	0	0	4.77	5
Weighted average score	46.17	42.00	11.83	0.00	0.00	4.34	10

b.) Assessment Tool: Student Course Survey

Table I4.14: Average score of student course survey for criteria I2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME801	16.27	30.05	38.28	12.19	3.22	3.44	5
UME691	7.7	23.1	25.6	43.6	0	2.95	5
Weighted average score	11.99	26.58	31.94	27.90	1.61	3.19	10

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table I4.15: Assessment for criteria I2 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	35	45	18.33	1.67	0	4.13
Alumni survey	56.41	25.64	15.38	2.56	0	4.36
Employer Survey	36.36	50	13.64	0	0	4.22

Finally overall weighted average score of performance criterion 'I2' is evaluated as given below in Table I4.16:

Table I4.16: Overall weighted average score of performance criterion 'I2'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	46.17	42.00	11.83	0.00	0.00	4.34	5
Weighted average student course survey	11.99	26.58	31.94	27.90	1.61	3.19	4
Graduating student survey	35	45	18.33	1.67	0	4.13	3
Alumni survey	56.41	25.64	15.38	2.56	0	4.35	3
Employer survey	36.36	50	13.64	0	0	4.23	3
Overall weighted score	36.78	37.68	18.28	6.90	0.36	4.04	18

Assessment of Outcome 'I' using performance criterion I3

Performance criteria 'I3': Applying scientific and/or engineering principles towards solving engineering problems.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Project Semester (UME691) and Mechanical System Design (UME801) were used to assess performance criteria I3 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Project Semester (UME691)

The above performance criteria is used to measure the attainment of outcome 'I' by giving the following question (Question No.: A(vi) in second visit of Project Semester) to the students.

Question:

Application skills (refers to the ability to apply knowledge to real life situations).

Student's performance in the above question is given below in Table I4.17:

Table I4.17: Student's performance in question targeting 'I3'; course: UME691

S. No.	Roll No. of Students	I 3	Weight (Scale 1 to 5)
		(Q. No. A(vi)) (5 Marks)	
1	101204003	5	5
2	101208012	5	5
3	101208016	5	5
4	101208020	5	5
5	101208027	5	5
6	101208028	5	5
7	101208029	5	5
8	101208032	5	5
9	101208036	5	5
10	101208040	5	5
11	101208045	5	5
12	101208052	5	5
13	101208054	5	5
14	101208055	5	5
15	101208057	4	4
16	101208058	5	5
17	101208059	5	5
18	101208062	5	5
19	101208075	5	5
20	101208079	5	5
21	101208092	4	4
22	101208093	5	5

23	101208096	5	5
24	101208101	5	5
25	101208104	4	4
26	101208107	5	5
27	101208112	5	5
28	101208113	4	4
29	101208114	4	4
30	101208123	5	5
31	101208125	5	5
32	101208131	5	5
33	101208132	5	5
34	101208134	5	5
35	101208136	5	5
36	101209013	4	4
37	101209020	5	5
38	101209022	5	5
39	101209023	5	5
40	101209030	3	3
41	101259002	5	5
42	101388002	5	5
43	101388004	4	4
44	101388006	5	5
45	101388011	5	5
46	101388012	5	5
47	101389002	5	5
48	101389003	4	4
49	401207004	3	3
50	401207007	4	4
51	401207015	5	5
52	401207022	5	5
53	401257003	3	3
54	401257007	5	5
55	401257009	5	5
56	401257010	5	5
57	401257013	5	5
58	401257014	4	4
59	401257017	5	5
60	401387003	5	5

The overall performance of student in the above question is then summarised as given below in Table I4.18:

Table I4.18: average score of the student performance in the course UME691 for criteria I3

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME691	78.33	16.67	5	0	0	4.73

(II) Course: Mechanical System Design (UME801)

The above performance criteria is used to measure the attainment of outcome 'I' by giving the following question (Question No.: 15 in the Final report) to the students.

Question:

- (a) Does the project make you appreciate the need to solve problems in real life using engineering? **(5)**

Student's performance in the above question is given below in Table I4.19:

Table I4.19: Student's performance in question targeting 'I3'; course: UME801

S. No.	Roll No.	I3	Weight (Scale 1 to 5)
		(Q. No. 15 in Final report) (5 Marks)	
1	101108003	3.5	4
2	101108124	3.5	4
3	101288002	3.5	4
4	101108128	3.5	4
5	101008020	3.5	4
6	101108001	4.5	5
7	101108122	4.5	5
8	101108123	4.5	5
9	101158003	4.5	5
10	101108129	4.5	5
11	101108002	4.5	5
12	101108004	4.5	5
13	101108007	4.5	5
14	101108008	4.5	5
15	101108012	4.5	5
16	101108005	5	5
17	101108013	5	5
18	101288001	5	5
19	101288013	5	5
20	101288020	5	5
21	101108009	4	4
22	101108010	4	4
23	101108125	4	4
24	101108126	4	4
25	101108020	4	4
26	101108021	4	4
27	101108022	4	4
28	101108023	4	4
29	101108029	4	4
30	101108014	4.5	5

31	101108015	4.5	5
32	101108016	4.5	5
33	101108017	4.5	5
34	101108018	4.5	5
35	101108027	3	3
36	101108030	3	3
37	101108031	3	3
38	101108034	3	3
39	101288025	3	3
40	101108019	4	4
41	101108024	4	4
42	101108026	4	4
43	101288003	4	4
44	101288011	4	4
45	101108028	3	3
46	101108032	3	3
47	101108033	3	3
48	101288008	3	3
49	101108131	3	3
50	101108035	4	4
51	101108038	4	4
52	101108046	4	4
53	101108054	4	4
54	101288017	4	4
55	101108036	3.5	4
56	101108037	3.5	4
57	101108041	3.5	4
58	101108045	3.5	4
59	101108056	3.5	4
60	101108039	4	4
61	101108040	4	4
62	101108042	4	4
63	101108043	4	4
64	101108051	4	4
65	101108044	4	4
66	101108049	4	4
67	101108050	4	4
68	101108055	4	4
69	101288016	4	4

The overall performance of students in the above question is then summarized as given below in Table I4.20:

Table I4.20: Average score of student performance in the course UME801 for criteria I3

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME801	29	57	14	0	0	4.15

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria I3 as given below in Table I4.21:

Table I4.21: Weighted Average Student class performance (course portfolio) for criteria I3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME801	29	57	14	0	0	4.15	5
UME691	78.33	16.67	5	0	0	4.73	5
Weighted average score	53.67	36.83	9.50	0.00	0.00	4.44	10

b.) Assessment Tool: Student Course Survey

Table I4.22: Average score of student course survey for criteria I3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME801	16.27	30.05	38.28	12.19	3.22	3.44	5
UME691	7.7	23.1	25.6	43.6	0	2.95	5
Weighted average score	11.99	26.58	31.94	27.90	1.61	3.19	10

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table I4.23: Assessment for criteria I3 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	35	45	18.33	1.67	0	4.13
Alumni survey	56.41	25.64	15.38	2.56	0	4.36
Employer Survey	36.36	50	13.64	0	0	4.22

Finally overall weighted average score of performance criterion 'A3' is evaluated as given below in Table I4.24:

Table I4.24: Overall weighted average score of performance criterion 'I3'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	53.67	36.83	9.50	0.00	0.00	4.44	5
Weighted average student course survey	11.99	26.58	31.94	27.90	1.61	3.19	4
Graduating student survey	35	45	18.33	1.67	0	4.13	3
Alumni survey	56.41	25.64	15.38	2.56	0	4.35	3
Employer survey	36.36	50	13.64	0	0	4.23	3
Overall weighted score	38.87	36.24	17.63	6.90	0.36	4.06	18

Overall assessment of student outcome I using scores of I1, I2 and I3

In the above sections, each of the individual performance criteria I1, I2 and I3 have been assessed. The performance for attainment of outcome A has been completed using the attainment values for I1, I2 and I3 and is provided below:

Table A4.33 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome A.

Table I4.25: Overall score for outcome I at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
I1	38.54	36.80	17.40	6.90	0.36	4.06	5
I2	36.78	37.68	18.28	6.90	0.36	4.04	5
I3	38.87	36.24	17.63	6.90	0.36	4.06	4
Overall score	38.01	36.95	17.78	6.90	0.23	4.05	14

**Assessment of Attainment of Program Outcome
'J'
(Year 2015)**

for the

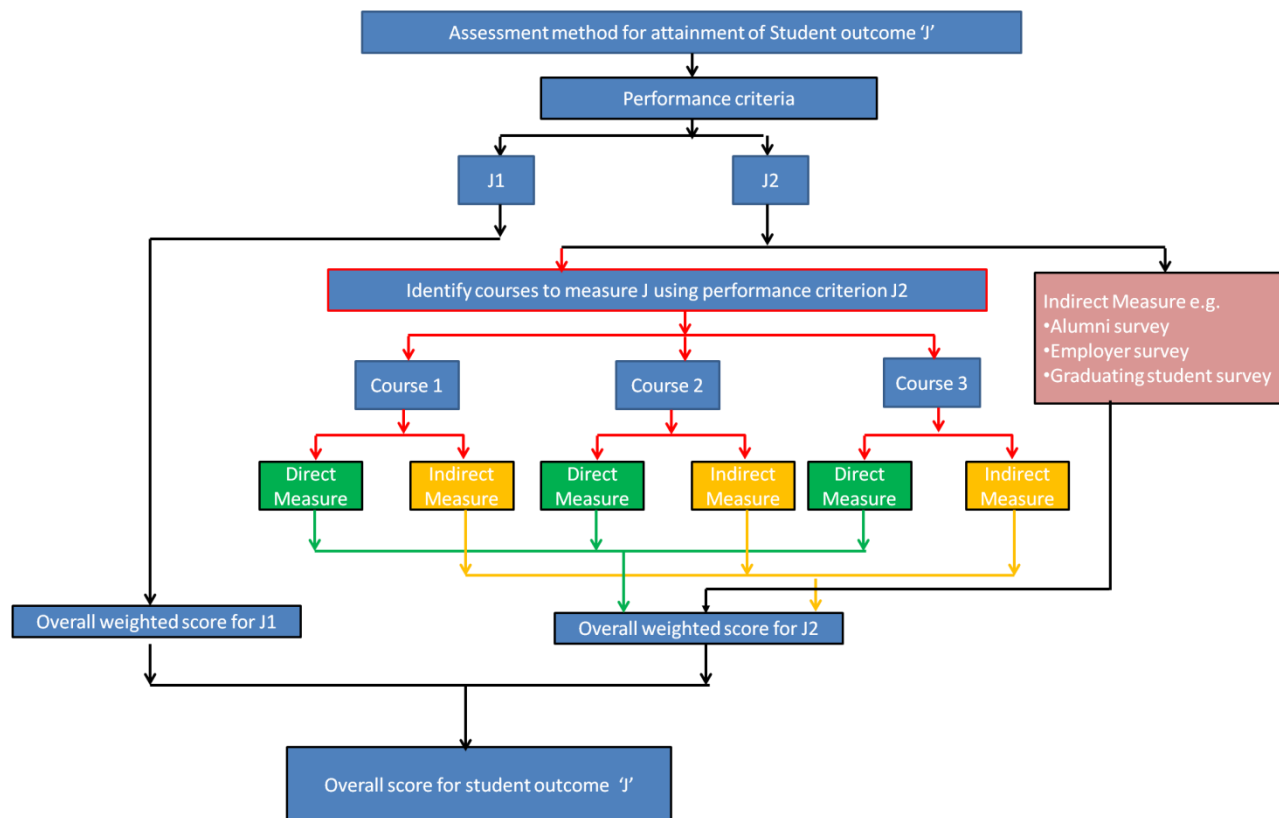
***Bachelor of Engineering
in
Mechanical Engineering***



**Thapar University
Patiala (Punjab) - 147004
INDIA**

Attainment of Outcome A

The attainment of each outcome has been measured using a standard procedure explained in the Self Assessment Report for the program. A flow chart depicting the step by step methodology used to measure each attainment is provided below for ready reference.



The following courses have been considered for the assessment of student outcome 'J'

Courses:

1. Environmental Studies(UEN001)
2. Automobile Engineering (UME502),
3. Mechatronics(UME802),

Outcome J has been assessed by two performance criteria J1 and J2. The sections below provide data for separate assessments for each of these performance criteria and in the end the results for these four performance criteria has been used to measure the overall measure of outcome J.

1) Assessment of Outcome 'J' using performance criterion J1

Performance criteria 'J1': Describes the importance of contemporary issues.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Three courses namely Environmental studies(UEN001), Automobile Engineering(UME502) and Mechatronics(UME802) were used to assess performance criteria J1 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Environmental studies(UEN001)

The above performance criteria has been used to measure the attainment of outcome 'A1' by giving the following question (Question No. 1: during MST in September in 2015, weightage 20 marks) to the students.

Question:

The above performance criteria is used to measure the attainment of outcome 'J1' by giving the following questions (Question No. 5 during MST in October 2015, weightage is 6 marks) to the students.

Question: Q5. How can we contribute to environment conservation by applying the concept of reduce, reuse and recycle. Discuss it with suitable example.

Student's performance in the above question is given below in Table J4.1:

Table J4.1: Student's performance in question targeting 'J1'; course: UEN001/UEN003

S.No.	Roll No.	Marks (MM:06)	Score (Scale 1 to 5)
1	101408001	3.5	4
2	101408002	4	5
3	101408003	3.5	4
4	101408004	3	4
5	101408005	1	1
6	101408006	3.5	4
7	101408007	3	4
8	101408008	2.5	3
9	101408009	5	5
10	101408010	4.5	5
11	101408011	4	5
12	101408012	4	5
13	101408013	2	2
14	101408014	4	5
15	101408015	3	4
16	101408017	3	4
17	101408019	3	4
18	101408020	2	2
19	101408021	2.5	3
20	101408022	2	2

21	101408023	3.5	4
22	101408024	3	4
23	101408025	3	4
24	101408026	3	4
25	101408028	3	4
26	101408029	2	2
27	101408030	2	2
28	101408033	3.5	4
29	101408034	3	4
30	101408035	3	4
31	101408036	2.5	3
32	101408037	2	2
33	101408038	2	2
34	101408039	2	2
35	101408040	3	4
36	101408041	1	1
37	101408042	3	4
38	101408043	3	4
39	101408044	2	2
40	101408045	3	4
41	101408046	3	4
42	101408047	3.5	4
43	101408048	3.5	4
44	101408049	3	4
45	101408050	3	4
46	101408051	2	2
47	101408055	2.5	3
48	101408056	3	4
49	101408057	3	4
50	101408058	3	4
51	101408059	2	2
52	101408060	3	4
53	101408061	2	2
54	101408062	2	2
55	101408063	2	2
56	101408064	2	2
57	101408066	3	4
58	101408067	2	2
59	101408069	3.5	4
60	101408070	3.5	4
61	101408071	3.5	4
62	101408073	2	2
63	101408074	3	4
64	101408075	3	4
65	101408076	2.5	3

66	101408079	2	2
67	101408081	3	4
68	101408082	3	4
69	101408083	3	4
70	101408084	2.5	3
71	101408085	2	2
72	101408086	3	4
73	101408087	2.5	3
74	101408088	3	4
75	101408089	3	4
76	101408090	2.5	3
77	101408091	3	4
78	101408092	1.5	1
79	101408093	3	4
80	101408094	3	4
81	101408095	2.5	3
82	101408096	3.5	4
83	101408097	3.5	4
84	101408098	3	4
85	101408099	3.5	4
86	101408100	3.5	4
87	101408101	3.5	4
88	101408102	3	4
89	101408103	3.5	4
90	101408104	2.5	3
91	101408105	2	2
92	101408106	2.5	3
93	101408107	3	4
94	101408108	2	2
95	101408110	3.5	4
96	101408111	3	4
97	101408112	3.5	4
98	101408113	3.5	4
99	101408114	3	4
100	101408115	3	4
101	101408116	3	4
102	101408118	3	4
103	101408119	NA	1
104	101408120	3	4
105	101408121	3.5	4
106	101408122	2	2
107	101408123	2.5	3
108	101408124	3	4
109	101408125	3.5	4
110	101408126	2.5	3

111	101408127	3.5	4
112	101408128	3.5	4
113	101408129	3	4
114	101408130	2.5	3
115	101408131	3	4
116	101408132	2	2
117	101408133	3	4
118	101408136	3.5	4
119	101408137	3.5	4
120	101414001	3	4
121	101414002	3	4
122	101414003	2.5	3
123	101414004	2.5	3
124	101414005	2.5	3
125	101414006	3	4
126	101414009	2.5	3
127	101414010	2.5	3
128	101414013	3	4
129	101414014	2.5	3
130	101414015	3.5	4
131	101414017	3.5	4
132	101414018	2	2
133	101414019	2.5	3
134	101414020	3	4
135	101414021	2.5	3
136	101414023	1.5	1
137	101414026	2.5	3
138	101414027	2	2
139	101414028	2.5	3
140	101414030	3	4
141	101414031	2	2
142	101414032	3	4
143	101414034	3	4
144	101414035	1.5	1
145	101458001	3.5	4
146	101458002	2.5	3
147	101458003	3	4
148	101458004	3	4
149	101464002	3	4
150	101464003	3.5	4
151	101464004	2	2
152	101464005	2.5	3
153	101464006	2.5	3
154	101464007	2.5	3
155	101464008	1	1

156	101464011	3	4
157	101588001	3	4
158	101588002	3	4
159	101588003	3.5	4
160	101588004	3.5	4
161	101588005	3.5	4
162	101588006	3	4
163	101588007	3.5	4
164	101588008	3	4
165	101588009	NA	1
166	101588010	3	4
167	101588011	2.5	3
168	101588012	2.5	3
169	101588013	2	2
170	101588014	3.5	4
171	101588015	4	5
172	101594001	3	4
173	101594003	4	5

The overall performance of student in the above question is then summarised as given below in Table J4.2:

Table J4.2: average score of the student performance in the course UEN001/UEN003 for criteria J1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEN003/UEN001	4.62	57.225	17.34	16.18	4.62	3.41

(ii) Course: Automobile Engineering (UME502)

The above performance criteria is used to measure the attainment of outcome 'J1' by giving the following question (Question No. 6(a): during MST in September 2015, weightage 6 marks) to the students.

Question: Explain with the help of a neat sketch the power flow in "First gear" of an automatic transmission system working on the Simpson gear train.

Student's performance in the above question is given below in Table J4.3:

Table J4.3: Student's performance in question targeting 'J1'; course: UME502

S. No.	Roll No.	Marks (MM: 06)	Score (Scale 1 to 5)
1	101308015	6	5
2	101308033	6	5

3	101308059	6	5
4	101308067	1	2
5	101308069	0	1
6	101308070	6	5
7	101308071	6	5
8	101308074	3	3
9	101308075	Absent	N/A
10	101308077	1.5	2
11	101308078	5	4
12	101308079	3	3
13	101308080	1	2
14	101308082	2	2
15	101308083	6	5
16	101308084	Absent	N/A
17	101488012	4	4
18	101488013	0.5	1
19	101488014	6	5
20	101308085	5	4
21	101308088	3	3
22	101308089	6	5
23	101308090	5	4
24	101308091	6	5
25	101308093	1.5	2
26	101308094	4	4
27	101308096	6	5
28	101308097	Absent	N/A
29	101308098	5	4
30	101308099	6	5
31	101308101	3.5	3
32	101308103	6	5
33	101488008	3.5	3
34	101488015	1.5	2
35	101488016	0	1
36	101308102	3.5	3
37	101308104	0	1

38	101308105	6	5
39	101308106	6	5
40	101308108	6	5
41	101308109	6	5
42	101308110	6	5
43	101308111	6	5
44	101308112	2	2
45	101308113	6	5
46	101308114	5	4
47	101308115	Absent	N/A
48	101308116	6	5
49	101308117	6	5
50	101308118	5	4
51	101308119	1	2
52	101308120	4.5	4
53	101308121	Absent	N/A
54	101308122	5	4
55	101308123	6	5
56	101308124	5.5	5
57	101308125	Absent	N/A
58	101488017	6	5
59	101488018	6	5
60	101309001	4	4
61	101309002	3	3
62	101309003	1	2
63	101309004	3	3
64	101309005	6	5
65	101309006	4	4
66	101309007	2	2
67	101309009	2.5	3
68	101309010	6	5
69	101309011	4	4
70	101309012	Absent	N/A
71	101309013	3	3
72	101309015	2	2

73	101309016	3	3
74	101309017	0	1
75	101309018	1.5	2
76	101309019	2.5	3
77	101309021	3	3
78	101309022	0	1
79	101309024	Absent	N/A
80	101309025	3	3
81	101309026	2.5	3
82	101309027	5	4
83	101309028	5	4
84	101309030	Absent	N/A
85	101309031	5	4
86	101309032	2	2
87	101489001	5	4
88	101489002	0	1
89	101489003	2	2
90	101489004	4	4
91	101489005	6	5
92	101489006	5	4
93	101489007	5	4

The overall performance of students in the above question is then summarized as given below in Table J4.4:

Table J4.4: Average score of student performance in the course UME502 for criteria J1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME502	33.33	23.81	17.86	16.66	8.33	3.57

(ii) Course: Mechatronics (UME802)

The above performance criteria is used to measure the attainment of outcome ‘E1’ by giving the following question (Question No. 4-(a): during ESE in May 2015, weightage 10 marks) to the students.

Question:What are sequential controllers? Consider the case study of a latest Digital camera. Identify all the system, controller, important inputs, outputs, sensors and correction elements. Use these elements to represent the block diagram of the camera.

Student's performance in the above question is given below in Table J4.5:

Table J4.5: Student's performance in question targeting 'J1'; course: UME802

S. No.	Roll No.	Marks (MM: 10)	Score (Scale 1 to 5)
1	101008020	7	5
2	101108001	-	1
3	101108002	2	3
4	101108003	1	2
5	101108004	-	1
6	101108005	4	4
7	101108007	2	3
8	101108008	2	3
9	101108009	4	4
10	101108010	-	1
11	101108012	2	3
12	101108013	-	1
13	101108014	1	2
14	101108015	6	4
15	101108016	1	2
16	101108017	0	1
17	101108018	5	4
18	101108019	7	5
19	101108020	7.5	5
20	101108021	5	4
21	101108022	3	3
22	101108023	4	4
23	101108024	1	2
24	101108026	2	3
25	101108027	-	1
26	101108028	7	5
27	101108029	5	4
28	101108030	4	4
29	101108031	1	2
30	101108032	1	2
31	101108033	1	2
32	101108034	7	5
33	101108035	1	2
34	101108036	-	1
35	101108037	5	4
36	101108038	0	1
37	101108039	6	4
38	101108040	-	1
39	101108041	1	2
40	101108042	4	4
41	101108043	2.5	3
42	101108044	4	4

43	101108045	6.5	4
44	101108046	-	1
45	101108047	7	5
46	101108049	2	3
47	101108050	5	4
48	101108051	1	2
49	101108052	7	5
50	101108054	5	4
51	101108055	3	3
52	101108056	2	3
53	101108122	2	3
54	101108123	-	1
55	101108124	2	3
56	101108125	2	3
57	101108126	8	5
58	101108128	3	3
59	101108129	2	3
60	101108131	1	2
61	101158003	3	3
62	101288001	4	4
63	101288002	2.5	3
64	101288003	2	3
65	101288004	7	5
66	101288008	6	4
67	101288009	4.5	4
68	101288011	5	4
69	101288013	5	4
70	101288016	8	5
71	101288017	2	3
72	101288020	7	5
73	101288025	9	5

The overall performance of students in the above question is then summarized as given below in Table J4.6:

Table J4.6: Average score of student performance in the course UME802 for criteria J1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME802	16.44	27.40	26.03	15.07	15.07	3.15

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria A1 as given below in Table J4.7:

Table J4.7: Weighted Average Student class performance (course portfolio) for criteria J1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UEN001	4.62	57.23	17.34	16.18	4.62	3.41	5
UME502	33.33	23.81	17.86	16.66	8.33	3.57	4
UME802	16.44	27.4	26.03	15.07	15.07	3.15	4
Weighted average score	17.09	37.77	20.17	15.99	8.98	3.38	13

b) Indirect measures for Performance criteria J1 (Surveys)**i.) Assessment Tool: Student Course Survey****Table J4.8: Average score of student course survey for criteria J1**

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UEN001	22.92	26.05	18.75	21.87	7.17	3.26	5
UME502	29.95	37.68	26.57	2.89	2.89	3.89	4
UME802	18	70	12	0	0	4.06	4
Weighted average score	23.57	43.15	19.08	9.30	3.65	3.70	13

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey**Table J4.9: Assessment for criteria J1 using Graduating student survey, alumni survey and employer survey tool**

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	30	48.33	21.67	0	0	4.08
Alumni survey	53.85	28.21	17.95	0	0	4.36
Employer Survey	22.73	63.64	13.64	0	0	4.0913

c) Overall weighted average score of performance criterion ‘J1’

Finally overall weighted average score of performance criterion ‘J1’ is evaluated as given below in Table J4.10:

Table J4.10: Overall weighted average score of performance criterion ‘J1’

Assessment tools	% of students in each score					Average	Assessme nt tool
	5	4	3	2	1		

						weighte d score	weight
Weighted average student class performance	17.09	37.77	20.17	15.99	8.98	3.38	5
Weighted average student course survey	23.57	43.15	19.08	9.30	3.65	3.70	4
Graduating student survey	30	48.33	21.67	0	0	4.08	3
Alumni survey	53.85	28.21	17.95	0	0	4.35	3
Employer survey	22.73	63.64	13.64	0	0	4.09	3
Overall weighted score	27.75	43.44	18.72	6.51	3.30	3.85	18

Assessment of Outcome 'J' using performance criterion J2

Performance criteria 'J2': Describes the impact of engineering decisions on energy resources/environment.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Environmental studies (UEN001/UEN003) and Automobile Engineering(UME502) were used to assess performance criteria J2 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Environmental studies (UEN001/UEN003)

The above performance criteria is used to measure the attainment of outcome 'J1' by giving the following questions (Question No. 2 during MST in October 2015, weightage is 6 marks) to the students.

Question: Q2. How can renewable energy resources replace the requirement of fossil fuels in future?
Comment on anticipated challenges in this pursuits.

Student's performance in the above question is given below in Table J4.11:

Table A4.11: Student's performance in question targeting 'J2'; course: UEN001/UEN003

S.No.	Roll No.	Marks (MM:06)	Score (Scale 1 to 5)
1	101408001	3.2	4
2	101408002	3.7	5
3	101408003	2.2	3
4	101408004	2.8	3
5	101408005	1.2	1
6	101408006	2.8	3
7	101408007	1.5	2
8	101408008	3.8	5
9	101408009	3.3	4
10	101408010	3.5	4
11	101408011	1.2	1
12	101408012	3.3	4

13	101408013	1.5	2
14	101408014	3.6	5
15	101408015	2.4	3
16	101408017	2.7	3
17	101408019	2.5	3
18	101408020	0.3	1
19	101408021	2.6	3
20	101408022	0.3	1
21	101408023	3.5	4
22	101408024	2.5	3
23	101408025	0.6	1
24	101408026	3.5	4
25	101408028	3.3	4
26	101408029	4.2	5
27	101408030	3.4	4
28	101408033	0.5	1
29	101408034	2.8	3
30	101408035	3	3
31	101408036	1.6	2
32	101408037	1.2	1
33	101408038	2.9	3
34	101408039	0.5	1
35	101408040	2.6	3
36	101408041	2.8	3
37	101408042	2.5	3
38	101408043	3.6	5
39	101408044	3.2	4
40	101408045	3.4	4
41	101408046	3.9	5
42	101408047	3.4	4
43	101408048	3.5	4
44	101408049	3.5	4
45	101408050	3.9	5
46	101408051	3	3
47	101408055	1	1
48	101408056	3.6	5
49	101408057	2.6	3
50	101408058	0.6	1
51	101408059	3.3	4
52	101408060	3.2	4
53	101408061	3.2	4
54	101408062	3	3
55	101408063	3.3	4
56	101408064	1.3	1
57	101408066	3.2	4

58	101408067	2.7	3
59	101408069	3.3	4
60	101408070	1	1
61	101408071	3.8	5
62	101408073	1.5	2
63	101408074	2.8	3
64	101408075	2.8	3
65	101408076	0.8	1
66	101408079	0.6	1
67	101408081	3.4	4
68	101408082	3.2	4
69	101408083	3.5	4
70	101408084	2.4	3
71	101408085	2.7	3
72	101408086	3.2	4
73	101408087	3.5	4
74	101408088	3	3
75	101408089	2.6	3
76	101408090	3.7	5
77	101408091	1.2	1
78	101408092	0.6	1
79	101408093	3	3
80	101408094	3.5	4
81	101408095	3.6	5
82	101408096	2.8	3
83	101408097	3.3	4
84	101408098	2.8	3
85	101408099	3.8	5
86	101408100	2.8	3
87	101408101	4	5
88	101408102	3.2	4
89	101408103	0.5	1
90	101408104	3.6	5
91	101408105	0.6	1
92	101408106	3.5	4
93	101408107	3.2	4
94	101408108	3.5	4
95	101408110	4	5
96	101408111	0.2	1
97	101408112	4.4	5
98	101408113	2.8	3
99	101408114	2.4	3
100	101408115	4.1	5
101	101408116	4	5
102	101408118	2	2

103	101408119	NA	1
104	101408120	2.4	3
105	101408121	4.7	5
106	101408122	3.5	4
107	101408123	0.3	1
108	101408124	2.2	3
109	101408125	3.6	5
110	101408126	2.8	3
111	101408127	4.4	5
112	101408128	2.8	3
113	101408129	2.8	3
114	101408130	3	3
115	101408131	4.2	5
116	101408132	1.8	2
117	101408133	4.2	5
118	101408136	3	3
119	101408137	3.4	4
120	101414001	3.5	4
121	101414002	3.6	5
122	101414003	0.6	1
123	101414004	3.3	4
124	101414005	2.8	3
125	101414006	3.3	4
126	101414009	3.8	5
127	101414010	2.6	3
128	101414013	2.6	3
129	101414014	3.5	4
130	101414015	3	3
131	101414017	1.2	1
132	101414018	3.4	4
133	101414019	3.6	5
134	101414020	3.5	4
135	101414021	3.2	4
136	101414023	NA	1
137	101414026	3.4	4
138	101414027	3	3
139	101414028	3.3	4
140	101414030	3.8	5
141	101414031	3.2	4
142	101414032	3	3
143	101414034	3.6	5
144	101414035	3	3
145	101458001	3.4	4
146	101458002	3.5	4
147	101458003	4.4	5

148	101458004	3.6	5
149	101464002	3	3
150	101464003	3.8	5
151	101464004	4.2	5
152	101464005	0.6	1
153	101464006	3.8	5
154	101464007	4.2	5
155	101464008	2.5	3
156	101464011	3.6	5
157	101588001	4.4	5
158	101588002	3.5	4
159	101588003	1.8	2
160	101588004	3.8	5
161	101588005	1.8	2
162	101588006	4	5
163	101588007	0.2	1
164	101588008	3.7	5
165	101588009	0	1
166	101588010	3	3
167	101588011	3.6	5
168	101588012	2.6	3
169	101588013	3.8	5
170	101588014	3.8	5
171	101588015	3.5	4
172	101594001	2.9	3
173	101594003	4.4	5

The overall performance of student in the above question is then summarised as given below in Table J4.12:

Table J4.12: average score of the student performance in the course UEN001/UEN003 for criteria J2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UEN001/UEN003	24.855	26.589	28.32	4.62	15.60	3.40

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria J2 as given below in Table J4.13:

Table J4.13: Weighted Average Student class performance (course portfolio) for criteria J2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UEN001	24.855	26.589	28.32	4.62	15.6	3.40	5

Weighted average score	24.86	26.59	28.32	4.62	15.60	3.40	5

b.) Assessment Tool: Student Course Survey

Table J4.14: Average score of student course survey for criteria J2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UEN001	22.92	26.05	18.75	21.87	7.17	3.26	5
Weighted average score	22.92	26.05	18.75	21.87	7.17	3.26	5

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table J4.15: Assessment for criteria J2 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	30	48.33	21.67	0	0	4.08
Alumni survey	53.85	28.21	17.95	0	0	4.36
Employer Survey	22.73	63.64	13.64	0	0	4.091

Finally overall weighted average score of performance criterion 'J2' is evaluated as given below in Table J4.16:

Table J4.16.: Overall weighted average score of performance criterion 'J2'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	24.86	26.59	28.32	4.62	15.60	3.40	5
Weighted average student course survey	22.92	26.05	18.75	21.87	7.17	3.26	4
Graduating student survey	30	48.33	21.67	0	0	4.08	3
Alumni survey	53.85	28.21	17.95	0	0	4.3594	3
Employer survey	22.73	63.64	13.64	0	0	4.09	3

Overall weighted score	29.76	36.54	20.91	6.14	5.93	3.76	18
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Overall assessment of student outcome J using scores of J1, and J2

In the above sections, each of the individual performance criteria J1 and J2 have been assessed. The performance for attainment of outcome J has been completed using the attainment values for J1 and J2 and is provided below:

Table J4.17 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome J.

Table J4.17: Overall score for outcome J at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
J1	27.75	43.44	18.72	6.51	3.30	3.85	5
J2	29.76	36.54	20.91	6.14	5.93	3.76	5
Overall score	28.75	39.99	19.82	6.33	1.65	3.80	10

**Assessment of Attainment of Program Outcome
'K'
(Year 2015)**

for the

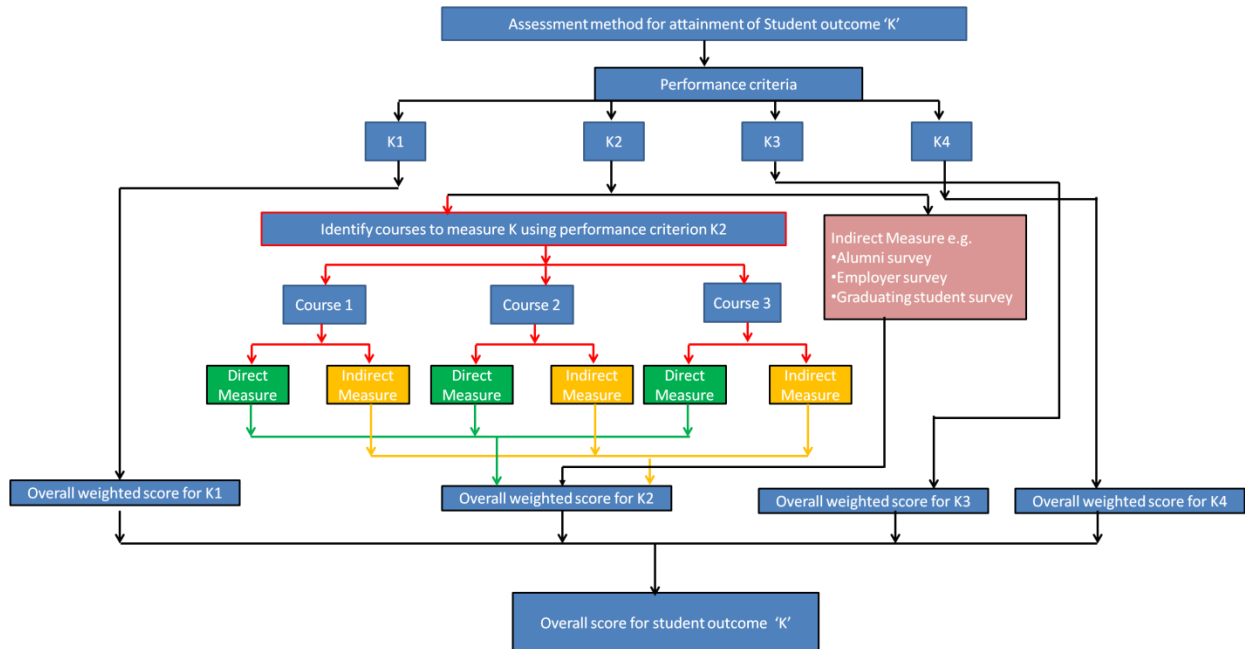
***Bachelor of Engineering
in
Mechanical Engineering***



**Thapar University
Patiala (Punjab) - 147004
INDIA**

Attainment of Outcome K

The attainment of each outcome has been measured using a standard procedure explained in the Self Assessment Report for the program. A flow chart depicting the step by step methodology used to measure each attainment is provided below for ready reference.



The following courses have been considered for the assessment of student outcome 'K'

Courses:

1. Computer Aided Design(UME 401)
2. Manufacturing Technology(UME505)
3. Computer Aided Manufacturing(UME702)
4. Machining Science(UME705)
5. Mechanical System Design(UME801)
6. Mechatronics(UME802)

Outcome K has been assessed by four performance criteria K1, K2, K3 and K4. The sections below provide data for separate assessments for each of these performance criteria and in the end the results for these four performance criteria has been used to measure the overall measure of outcome K.

1) Assessment of Outcome 'K' using performance criterion K1

Performance criteria 'K1': K1.Able to operate engineering equipments

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Manufacturing Technology (UME505) and Machining science(UME705) were used to assess performance criteria J1 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Manufacturing Technology (UME505)

The above performance criteria is used to measure the attainment of outcome 'K1' by evaluating the performance of the students followed by viva on different machines in the lab.

Student's performance in the above question is given below in Table K4.1:

Table K4.1: Student's performance in question targeting 'K1'; course: UME 505

S. No.	Roll No.	Marks	Score
		(MM: 05)	(Scale 1 to 5)
1	101308001	4	4
2	101308003	3	3
3	101308004	4	4
4	101308006	5	5
5	101308007	4	4
6	101308009	1	1
7	101308010	3	3
8	101308011	4	4
9	101308012	3	3
10	101308013	5	5
11	101308014	1	1
12	101308016	5	5
13	101308017	2	2
14	101308018	3	3
15	101308019	5	5
16	101308020	4	4
17	101308021	2	2
18	101308023	5	5
19	101308024	2	2
20	101308025	5	5
21	101308026	1	1
22	101308027	2	2
23	101308028	4	4
24	101308029	5	5
25	101308032	3	3
26	101308034	2	2

27	101308035	5	5
28	101308036	5	5
29	101308037	3	3
30	101308038	4	4
31	101308039	3	3
32	101308040	5	5
33	101308042	3	3
34	101308043	4	4
35	101308044	3	3
36	101308045	5	5
37	101308046	4	4
38	101308047	2	2
39	101308050	4	4
40	101308051	3	3
41	101308052	4	4
42	101308053	3	3
43	101308054	4	4
44	101308055	5	5
45	101308057	4	4
46	101308060	1	1
47	101308061	5	5
48	101308063	3	3
49	101308064	4	4
50	101308065	3	3
51	101308066	4	4
52	101308068	3	3
53	101308072	4	4
54	101308073	4	4
55	101308076	4	4
56	101308100	3	3
57	101488002	4	4
58	101488003	2	2
59	101488004	5	5
60	101488005	2	2
61	101488006	5	5
62	101488007	4	4
63	101488009	4	4
64	101488010	5	5
65	101488011	5	5

The overall performance of student in the above question is then summarised as given below in Table K4.2:

Table K4.2: average score of the student performance in the course UME505 for criteria K1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME505	26.15	32.31	23.08	12.31	6.15	3.60

(ii) Course: Machining Science (UME705)

The above performance criterion is used to measure the attainment of outcome ‘K1’ by evaluating the performance of the students during experiment on “**Measurement of Tool Tip Temperature using a Work Tool Thermocouple**”.

Student’s performance in the above question is given below in Table K4.3:

Table K4.3: Student’s performance in question targeting ‘K1’; course: UME705

S. No.	Roll No.	Marks	Score
		(MM: 05)	(Scale 1 to 5)
1	101208001	5	5
2	101208002	5	5
3	101208003	3	3
4	101208004	4	4
5	101208005	4	4
6	101208006	3	3
7	101208007	5	5
8	101208008	3	3
9	101208009	4	4
10	101208010	2	2
11	101208011	1	1
12	101208012	4	4
13	101208013	4	4
14	101208016	4	4
15	101208017	5	5
16	101208019	4	4
17	101208020	5	5
18	101208022	4	4
19	101388001	4	4
20	101388002	3	3
21	101208114	2	2
22	101208115	4	4
23	101208116	2	2
24	101208117	5	5
25	101208118	4	4

26	101208120	3	3
27	101208121	1	1
28	101208123	2	2
29	101208125	5	5
30	101208126	4	4
31	101208129	4	4
32	101208131	5	5
33	101208132	4	4
34	101208133	4	4
35	101208134	4	4
36	101208136	5	5
37	101208138	4	4
38	101208139	5	5
39	101388006	3	3
40	101388008	3	3

The overall performance of students in the above question is then summarized as given below in Table K4.4:

Table K4.4: Average score of student performance in the course UME705 for criteria K1

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME705	42.5	25	17.5	10	5	3.9

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria K1 as given below in Table K4.5:

Table K4.5: Weighted Average Student class performance (course portfolio) for criteria K1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME505	26.15	32.31	23.08	12.31	6.15	3.60	5
UME705	42.5	25	17.5	10	5	3.90	5
Weighted average score	34.33	28.66	20.29	11.16	5.58	3.75	10

b) Indirect measures for Performance criteria K1 (Surveys)

i.) Assessment Tool: Student Course Survey

Table K4.6: Average score of student course survey for criteria K1

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME505	6.21	21.38	40.69	26.21	5.52	2.97	5
UME705	28	34.67	29.67	7	0.67	3.82	5
Weighted average score	17.11	28.02	35.18	16.61	3.09	3.39	10

ii.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table K4.7: Assessment for criteria K1 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	33.33	46.67	20	0	0	4.13
Alumni survey	61.54	35.9	2.56	0	0	4.59
Employer Survey	4.55	50	45.45	0	0	3.59

c) Overall weighted average score of performance criterion ‘K1’

Finally overall weighted average score of performance criterion ‘K1’ is evaluated as given below in Table K4.8:

Table K4.8: Overall weighted average score of performance criterion ‘K1’

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	34.33	28.66	20.29	11.16	5.58	3.75	5
Weighted average student course survey	17.11	28.02	35.18	16.61	3.09	3.39	4
Graduating student survey	33.33	46.67	20	0	0	4.13	3
Alumni survey	61.54	35.9	2.56	0	0	4.58	3
Employer survey	4.55	50	45.45	0	0	3.59	3
Overall weighted score	29.91	36.28	24.79	6.79	2.24	3.85	18

Assessment of Outcome ‘K’ using performance criterion K2

Performance criteria ‘K2’: Able to program machines.

a.) Assessment Tool: Student’s performance using course portfolio

Step 1: Two courses namely Computer Aided Manufacturing (UME702) and Mechatronics(UME802) were used to assess performance criteria K2 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Computer Aided Manufacturing (UME702)

The above performance criteria is used to measure the attainment of outcome 'K2' by giving the following question (Question No. 1: during MST in September 2015, weightage 20 marks) to the students.

Question:

Write a NC part program in ABSOLUTE MODE for a vertical milling center to machine the given part. Consider the tool diameter compensation in your program assuming the tool motion in specified direction of arrows. Outer profile is to be started from point A.

Use following machining data to compute spindle speed and feed rate:

Milling: Cutting speed = 150 m/min and feed=0.40 mm/rev

Drilling: Cutting speed = 200 m/min, Feed = 0.5 mm/rev

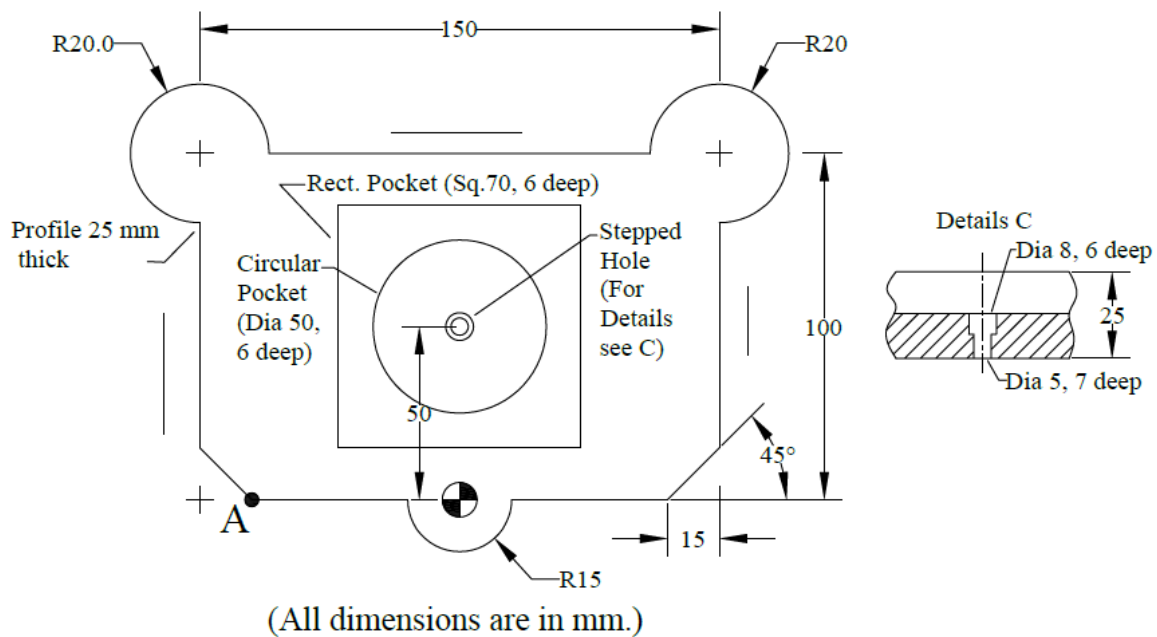
The milling center is equipped with an ATC holding the tools as per the following sequence.

Tool no.1 (Milling cutter for profile cutting- Dia 6mm),

Tool no. 2 (Drill Dia- 5mm),

Tool no. 3 (Drill / Pocketing cutter Dia- 8 mm; allowable %age cut width 80%)

Maximum allowable peck increment = 3 mm



Student's performance in the above question is given below in Table K4.9:

Table K4.9: Student's performance in question targeting 'K2'; course: UME702

S.No.	R.No.	Marks MM(20)	Score (Scale 1 to 5)
1	101208001	18	5
2	101208002	5	1
3	101208003	19	5
4	101208004	17	5
5	101208005	14.5	4
6	101208006	13.5	4

7	101208007	13.5	4
8	101208008	12.5	3
9	101208009	10.5	3
10	101208010	8.5	2
11	101208011	13.5	4
12	101208012	3	1
13	101208013	6	1
14	101208016	19.5	5
15	101208017	14.5	4
16	101208019	14.5	4
17	101208020	4.5	1
18	101208022	5	1
19	101208023	19.5	5
20	101208024	7	2
21	101208025	14.5	4
22	101208026	14	4
23	101208027	19.5	5
24	101208028	19.5	5
25	101208030	19	5
26	101208031	18	5
27	101208032	2	1
28	101208034	10.5	3
29	101208035	2	1
30	101208036	16.5	5
31	101208037	13	4
32	101208038	11.5	3
33	101208039	19.5	5
34	101208040	15.5	4
35	101208042	9	2
36	101208044	13.5	4
37	101208045	5	1
38	101208046	9	2
39	101208048	10.5	3
40	101208049	15	4
41	101208051	19.5	5
42	101208052	15.5	4
43	101208053	13	4
44	101208054	6	1
45	101208055	17.5	5

46	101208056	13.5	4
47	101208057	8	2
48	101208060	8	2
49	101208061	12	3
50	101208062	4	1
51	101208063	15	4
52	101208064	15	4
53	101208065	19	5
54	101208076	12	3
55	101208080	19.5	5
56	101208081	19.5	5
57	101208084	19	5
58	101208092	19	5
59	101208106	11	3
60	101208125	20	5
61	101208126	18.5	5
62	101208139	17	5
63	101208140	11.5	3
64	101388001	13.5	4
65	101388002	1.5	1
66	101388003	11.5	3
67	101388004	11	3
68	101388005	14.5	4
69	101388006	17.5	5
70	101388007	9	2
71	101388008	19	5
72	101208058	6.5	1
73	101208066	16	5
74	101208068	18.5	5
75	101208069	20	5
76	101208070	15.5	4
77	101208072	19	5
78	101208073	16	5
79	101208075	5	1
80	101208077	10.5	3
81	101208078	14.5	4
82	101208079	19.5	5
83	101208082	17.5	5
84	101208083	19	5

85	101208085	8.5	2
86	101208086	20	5
87	101208090	0	1
88	101208091	16.5	5
89	101208095	11.5	3
90	101208096	20	5
91	101208097	19	5
92	101208101	18.5	5
93	101208102	20	5
94	101208104	17	5
95	101208107	18.5	5
96	101208108	19.5	5
97	101208111	18	5
98	101208112	8	2
99	101208113	8.5	2
100	101208114	20	5
101	101208115	18.5	5
102	101208116	19	5
103	101208117	19	5
104	101208121	11.5	3
105	101208129	8	2
106	101208131	18	5
107	101208132	19	5
108	101208133	20	5
109	101208134	14	4
110	101208136	18.5	5
111	101208138	18	5
112	101208142	20	5
113	101388009	14.5	4
114	101388010	18.5	5
115	101388011	19	5
116	101388012	18	5

The overall performance of student in the above question is then summarised as given below in Table K4.10:

Table K4.10: average score of the student performance in the course UME702 for criteria K2

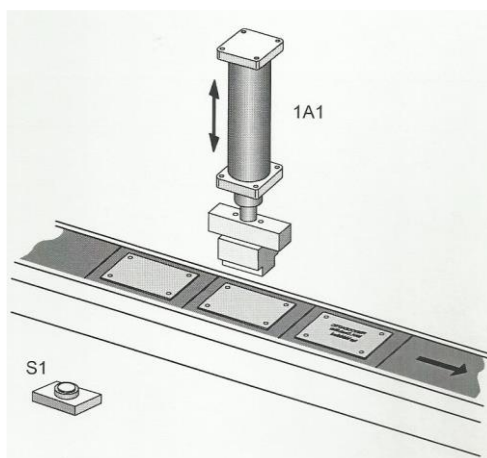
Course	% of students in each score					Average Score
	5	4	3	2	1	
UME702	46.55	19.83	12.07	9.483	12.07	3.79

(ii) Course: Mechatronics(UME802)

The above performance criteria is used to measure the attainment of outcome 'E2' by giving the following question (Question No.:2 during ESE in May 2015, weightage 15 marks) to the students.

Question:

A workpiece is to be embossed by activating a start button (S1) as shown below. In order to ensure that the embossing cycle is not triggered inadvertently, the embossing cycle is to be triggered only after 3 seconds have expired. During this time the start button must be permanently actuated. The position of the cylinder 1A1 is established by means of the proximity sensors 1B1 (retracted end position) and 1B2 (extended end position).



- Identify the number of I/Os (inputs/outputs) in terms of digital and analog.
- Draw the electrical circuit diagram of the identified I/Os with PLC.
- Formulate the PLC program into Ladder Logic language.

Student's performance in the above question is given below in Table K4.11:

Table K4.11: Student's performance in question targeting 'K2'; course: UME802

S. No.	Roll No.	Marks (MM: 07)	Score (Scale 1 to 5)
1	101008020	0	1
2	101108001	10	5
3	101108002	3	2
4	101108003	10	5
5	101108004	-	1
6	101108005	13	5
7	101108007	6	3
8	101108008	11	5
9	101108009	14	5
10	101108010	9	4
11	101108012	3	2

12	101108013	-	1
13	101108014	4	2
14	101108015	14	5
15	101108016	2	1
16	101108017	7	4
17	101108018	10	5
18	101108019	7	4
19	101108020	10	5
20	101108021	14	5
21	101108022	14	5
22	101108023	9	4
23	101108024	2	1
24	101108026	-	1
25	101108027	6	3
26	101108028	2	1
27	101108029	14	5
28	101108030	7	4
29	101108031	13	5
30	101108032	1	1
31	101108033	0	1
32	101108034	10	5
33	101108035	8	4
34	101108036	13	5
35	101108037	11	5
36	101108038	14	5
37	101108039	10	5
38	101108040	8	4
39	101108041	14	5
40	101108042	12	5
41	101108043	12	5
42	101108044	8	4
43	101108045	14	5
44	101108046	-	1
45	101108047	13	5
46	101108049	8	4
47	101108050	13	5
48	101108051	12	5
49	101108052	12	5
50	101108054	13	5
51	101108055	8	4
52	101108056	10	5
53	101108122	5	3
54	101108123	12	5
55	101108124	8	4
56	101108125	4	2
57	101108126	0	1
58	101108128	6	3

59	101108129	0	1
60	101108131	7	4
61	101158003	6	3
62	101288001	14	5
63	101288002	12	5
64	101288003	14	5
65	101288004	7	4
66	101288008	-	1
67	101288009	6	3
68	101288011	10	5
69	101288013	12	5
70	101288016	12	5
71	101288017	7	4
72	101288020	8	4
73	101288025	9	4

The overall performance of students in the above question is then summarized as given below in Table K4.12:

Table K4.12: Average score of student performance in the course UME802 for criteria K2

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME802	46.58	21.92	8.22	5.48	17.81	3.74

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria K2 as given below in Table K4.13:

Table K4.13: Weighted Average Student class performance (course portfolio) for criteria K2

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME802	46.58	21.92	8.22	5.48	17.81	3.74	4
UME702	46.55	19.55	12.07	9.48	12.07	3.78	5
Weighted average score	46.56	20.60	10.36	7.70	14.62	3.76	9

b.) Assessment Tool: Student Course Survey

Table K4.14: Average score of student course survey for criteria K2

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

UME802	18	70	12	0	0	4.06	4
UME702	37.795	40.157	18.897	3.149	0	4.13	5
Weighted average score	29.00	53.42	15.83	1.75	0.00	4.10	9

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table K4.15: Assessment for criteria K2 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	33.33	46.67	20	0	0	4.13
Alumni survey	61.54	35.9	2.56	0	0	4.59
Employer Survey	4.55	50	45.45	0	0	3.59

Finally overall weighted average score of performance criterion 'A2' is evaluated as given below in Table A4.16:

Table A4.16.: Overall weighted average score of performance criterion 'A2'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	46.56	20.60	10.36	7.70	14.62	3.76	5
Weighted average student course survey	29.00	53.42	15.83	1.75	0.00	4.10	4
Graduating student survey	33.33	46.67	20	0	0	4.13	3
Alumni survey	61.54	35.9	2.56	0	0	4.59	3
Employer survey	4.55	50	45.45	0	0	3.59	3
Overall weighted score	35.95	39.69	17.73	2.53	4.06	4.01	18

Assessment of Outcome 'K' using performance criterion K3

Performance criteria 'K3': Able to use solid modeling softwares for engineering applications

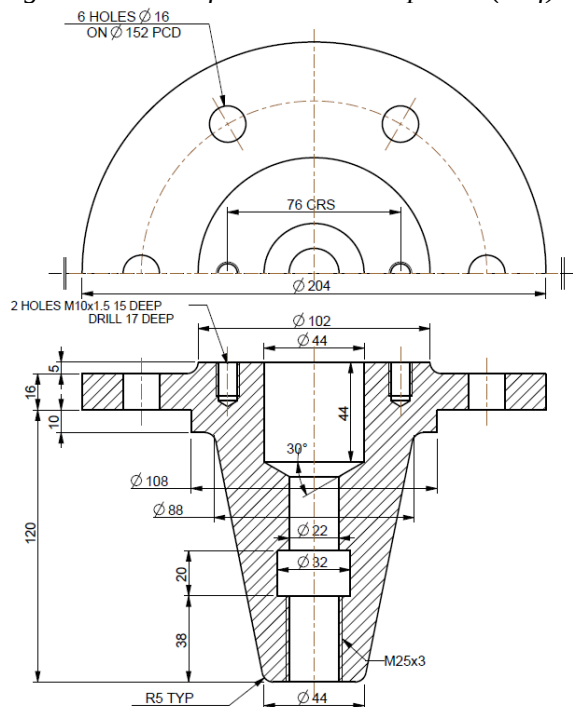
a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Computer Aided design(UME401) and Mechanical System Design (UME801) were used to assess performance criteria K3 as a direct measure. The analysis for each of these courses is provided below:

(i) Course: Computer Aided Design (UME401)

The above performance criteria is used to measure the attainment of outcome 'K' by giving the following question 2 in Mid Semester Exam to the students.

Model the cover part below given sectional front view and top view (half).



Student's performance in the above question is given below in Table K4.17:

Table K4.17: Student's performance in question targeting 'K3'; course: UME401

S. No.	Roll No.	Name	Marks (10)	Weight
1.	101308069	KIRAT SINGH BASUR (CR)	10	5
2.	101308082	PARAMJOT SINGH	10	5
3.	101308083	PARAS	10	5
4.	101308081	NITIN BANSAL	9.5	5
5.	101308085	PRABHMAN VIR	9.5	5
6.	101308096	SAHIL SHARMA	9.5	5
7.	101308075	MANISH PANDOH	9	5
8.	101308091	RAMNISH KUMAR	9	5
9.	101308099	SARTAJ SINGH GILL (CR)	9	5
10.	101308117	VAIBHAV PRATAP SINGH PUNDIR	9	5
11.	101308077	MANUTKARSH KIRPAL	8.5	5
12.	101488012	MOHIT GOYAL	8.5	5
13.	101308033	EKANSH KUMAR SRIVASTAVA	8	5
14.	101308073	Manavdeep Singh Grover	8	5
15.	101308074	MANIK SAHARAN	8	5
16.	101488014	NIKHIL GUPTA	8	5
17.	101308080	NIKHIL GANTA	8	5
18.	101308088	PULKIT KAPOOR	8	5
19.	101308090	RAJAT GUPTA	8	5

20.	101308102	SHREYAS BHAYANA	8	5
21.	101308114	TANJAY PATHAK	8	5
22.	101488015	SANKIT	7.5	4
23.	101308109	SIDDHARTH GUPTA	7.5	4
24.	101308115	TANUJ LAMBA	7.5	4
25.	101308116	UTSAV MUDGAL	7.5	4
26.	101488017	VARUN BANSAL	7.5	4
27.	101488018	VISHNU KALRA	7.5	4
28.	101308070	KSHITIJ SHARMA	7	4
29.	101308112	SIMRANDEEP SINGH BHULLAR	7	4
30.	101308113	SOURAV SINGLA	7	4
31.	101308120	VEDANT MANSOTRA	7	4
32.	101308121	VIKRANT NANDA	7	4
33.	101308123	VIVEK MITTAL	7	4
34.	101308105	SHUBHAM CHAUDHARY	6.5	4
35.	101308110	SIDDHARTH VASU	6.5	4
36.	101308119	VARUN ATRI	6.5	4
37.	101308084	PRABAL SHARMA	6	4
38.	101308078	NIDAN PRAKASH	6	4
39.	101308103	SHUBHAM	6	4
40.	101308108	SIDDHARTH GHIYA	6	4
41.	101308118	VARMEET SINGH GULATI	6	4
42.	101308124	VIVEK PUNDIR	6	4
43.	101308122	VISHAL SOLANKI	5.5	3
44.	101308079	NIKHIL AGGARWAL	5	3
45.	101308089	PUNEET SINGH	5	3
46.	101308093	ROHAN KAUSHAL	5	3
47.	101308094	SAGAR SINGLA	5	3
48.	101488013	NAVJOT RIHAL	4	2
49.	101308098	SAMEER BHALLA	4	2
50.	101308101	SHIKHAR GAUR	3.5	2
51.	101488008	ISHAN	3	1
52.	101308106	SHUBHAM GUPTA	3	1
53.	101308071	LOKENDRA KUMAR	0	1
54.	101308097	SAMDEEP SINGH SABHARWAL	0	1
55.	101308104	SHUBHAM BHAMA	0	1
56.	101488016	SARANG VASHISHT	0	1
57.	101308111	SIDHANT	0	1
58.	101308125	YASHWARDHAN SHARMA	0	1

The overall performance of student in the above question is then summarised as given below in Table K4.18:

Table K4.18: average score of the student performance in the course UME401 for criteria K3

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

UME401	36.2	36.21	8.620689655	5.172413793	13.8	3.8
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(II) Course: Mechanical system Design (UME801)

The above performance criteria is used to measure the attainment of outcome 'K' by giving the following question (Question No.: 20 in the final report) to the students.

Question:

- (a) How has the project made you able to use solid modelling software for (5) engineering applications?

Student's performance in the above question is given below in Table A4.19:

Table K4.19: Student's performance in question targeting 'K3'; course: UME801

S. No.	Roll No.	K3	Weight (Scale 1 to 5)
		(Q. No. 20 in Final report) (5 Marks)	
1	101108003	4	4
2	101108124	4	4
3	101288002	4	4
4	101108128	4	4
5	101008020	4	4
6	101108001	3	3
7	101108122	3	3
8	101108123	3	3
9	101158003	3	3
10	101108129	3	3
11	101108002	4.5	4.5
12	101108004	4.5	4.5
13	101108007	4.5	4.5
14	101108008	4.5	4.5
15	101108012	4.5	4.5
16	101108005	4.5	4.5
17	101108013	4.5	4.5
18	101288001	4.5	4.5
19	101288013	4.5	4.5
20	101288020	4.5	4.5
21	101108009	5	5
22	101108010	5	5
23	101108125	5	5
24	101108126	5	5
25	101108020	4	4
26	101108021	4	4
27	101108022	4	4
28	101108023	4	4

29	101108029	4	4
30	101108014	3.5	3.5
31	101108015	3.5	3.5
32	101108016	3.5	3.5
33	101108017	3.5	3.5
34	101108018	3.5	3.5
35	101108027	3	3
36	101108030	3	3
37	101108031	3	3
38	101108034	3	3
39	101288025	3	3
40	101108019	3	3
41	101108024	3	3
42	101108026	3	3
43	101288003	3	3
44	101288011	3	3
45	101108028	3	3
46	101108032	3	3
47	101108033	3	3
48	101288008	3	3
49	101108131	3	3
50	101108035	4.5	4.5
51	101108038	4.5	4.5
52	101108046	4.5	4.5
53	101108054	4.5	4.5
54	101288017	4.5	4.5
55	101108036	4.5	4.5
56	101108037	4.5	4.5
57	101108041	4.5	4.5
58	101108045	4.5	4.5
59	101108056	4.5	4.5
60	101108039	4.5	4.5
61	101108040	4.5	4.5
62	101108042	4.5	4.5
63	101108043	4.5	4.5
64	101108051	4.5	4.5
65	101108044	4.5	4.5
66	101108049	4.5	4.5
67	101108050	4.5	4.5
68	101108055	4.5	4.5
69	101288016	4.5	4.5

The overall performance of students in the above question is then summarized as given below in Table K4.20:

Table K4.20: Average score of student performance in the course UME801 for criteria K3

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME801	49	22	29	0	0	4.2

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria K3 as given below in Table K4.21:

Table K4.21: Weighted Average Student class performance (course portfolio) for criteria K3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME401	36.2	36.21	8.62	5.17	13.8	3.76	5
UME801	49	22	29	0	0	4.20	4
Weighted average score	41.89	29.89	17.68	2.87	7.67	3.95	9

b.) Assessment Tool: Student Course Survey

Table K4.22: Average score of student course survey for criteria K3

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME401	29.69	37.67	26.57	2.89	2.89	3.88	5
UME801	16.27	30.05	38.28	12.19	3.22	3.44	4
Weighted average score	23.73	34.28	31.77	7.02	3.04	3.68	9

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table K4.23: Assessment for criteria K3 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	33.33	46.67	20	0	0	4.13
Alumni survey	61.54	35.9	2.56	0	0	4.59
Employer Survey	4.55	50	45.45	0	0	3.591

Finally overall weighted average score of performance criterion 'K3' is evaluated as given below in Table K4.24:

Table K4.24: Overall weighted average score of performance criterion 'K3'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	41.89	29.89	17.68	2.87	7.67	3.95	5
Weighted average student course survey	23.73	34.28	31.77	7.02	3.04	3.68	4
Graduating student survey	33.33	46.67	20	0	0	4.13	3
Alumni survey	61.54	35.9	2.56	0	0	4.58	3
Employer survey	4.55	50	45.45	0	0	3.59	3
Overall weighted score	33.48	38.02	23.31	2.36	2.80	3.97	18

Assessment of Outcome 'K' using performance criterion K4

Performance criteria 'K4' : Able to analyze engineering problems using software tools.

a.) Assessment Tool: Student's performance using course portfolio

Step 1: Two courses namely Computer Aided design (UME401) and Mechanical System Design (UME801) were used to assess performance criteria K4 as a direct measure. The analysis for each of these courses is provided below:

(I) Course: Computer Aided Design (UME401)

The above performance criteria is used to measure the attainment of outcome 'K' by giving the following project 2 to the students.

Model the parts of OLDHAM coupling and assemble them using mechanism constraints in Creo. Animate and make mpeg file for the Oldham's coupling running at 6rpm. Also plot the sliding velocity of the disc part with rotation of shaft.

Student's performance in the above question is given below in Table K4.25:

Table K4.25: Student's performance in question targeting 'K4'; course: UMA401

SNo.	Roll No.	Name	Project 2 (5 MARKS)	Weight
1.	101308069	KIRAT SINGH BASUR (CR)	5	5
2.	101308070	KSHITIJ SHARMA	5	5
3.	101308075	MANISH PANDOH	5	5
4.	101308077	MANUTKARSH KIRPAL	5	5
5.	101308079	NIKHIL AGGARWAL	5	5
6.	101308082	PARAMJOT SINGH	5	5
7.	101488012	MOHIT GOYAL	5	5
8.	101488013	NAVJOT RIHAL	5	5
9.	101488014	NIKHIL GUPTA	5	5
10.	101308088	PULKIT KAPOOR	5	5

11.	101308090	RAJAT GUPTA	5	5
12.	101308091	RAMNISH KUMAR	5	5
13.	101308093	ROHAN KAUSHAL	5	5
14.	101308098	SAMEER BHALLA	5	5
15.	101308099	SARTAJ SINGH GILL (CR)	5	5
16.	101308101	SHIKHAR GAUR	5	5
17.	101308104	SHUBHAM BHAMA	5	5
18.	101488016	SARANG VASHISHT	5	5
19.	101308102	SHREYAS BHAYANA	5	5
20.	101308106	SHUBHAM GUPTA	5	5
21.	101308108	SIDDHARTH GHIYA	5	5
22.	101308109	SIDDHARTH GUPTA	5	5
23.	101308110	SIDDHARTH VASU	5	5
24.	101308111	SIDHANT	5	5
25.	101308113	SOURAV SINGLA	5	5
26.	101308114	TANJAY PATHAK	5	5
27.	101308116	UTSAV MUDGAL	5	5
28.	101308117	VAIBHAV PRATAP SINGH PUNDIR	5	5
29.	101308118	VARMEET SINGH GULATI	5	5
30.	101308119	VARUN ATRI	5	5
31.	101308120	VEDANT MANSOTRA	5	5
32.	101308124	VIVEK PUNDIR	5	5
33.	101488017	<u>VARUN BANSAL</u>	5	5
34.	101308073	Manavdeep Singh Grover	4.5	4
35.	101308083	PARAS	4.5	4
36.	101308094	SAGAR SINGLA	4.5	4
37.	101308103	SHUBHAM	4.5	4
38.	101488015	SANKIT	4.5	4
39.	101308115	TANUJ LAMBA	4.5	4
40.	101308121	VIKRANT NANDA	4.5	4
41.	101308122	VISHAL SOLANKI	4.5	4
42.	101308123	VIVEK MITTAL	4.5	4
43.	101308033	EKANSH KUMAR SRIVASTAVA	4	4
44.	101308071	LOKENDRA KUMAR	4	4
45.	101308081	NITIN BANSAL	4	4
46.	101308078	NIDAN PRAKASH	4	4
47.	101308080	NIKHIL GANTA	4	4
48.	101308085	PRABHMAN VIR	4	4
49.	101308089	PUNEET SINGH	4	4
50.	101308096	SAHIL SHARMA	4	4
51.	101488008	ISHAN	4	4
52.	101308105	SHUBHAM CHAUDHARY	4	4
53.	101308112	SIMRANDEEP SINGH BHULLAR	4	4
54.	101308125	YASHWARDHAN SHARMA	4	4
55.	101488018	VISHNU KALRA	4	4
56.	101308084	PRABAL SHARMA	3.5	4

57.	101308074	MANIK SAHARAN	3	3
58.	101308015	ANKIT SEHGAL	2.5	3

The overall performance of student in the above question is then summarised as given below in Table K4.26:

Table K4.26: average score of the student performance in the course UME401 for criteria K4

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME401	56.9	39.65	3.44	0	0	4.5

(II) Course: Mechanical System Design (UME801)

The above performance criteria is used to measure the attainment of outcome 'K' by giving the following question (Question No.:_19___ in the Final report) to the students.

Question:

- (a) List the software tools used to analyze engineering problems in the project. (5)

Student's performance in the above question is given below in Table K4.27:

Table K4.27: Student's performance in question targeting 'K4'; course: UME801

S. No.	Roll No.	K4	Weight (Scale 1 to 5)
		(Q. No. 19 in Final report) (5 Marks)	
1	101108003	5	5
2	101108124	5	5
3	101288002	5	5
4	101108128	5	5
5	101008020	5	5
6	101108001	4.5	5
7	101108122	4.5	5
8	101108123	4.5	5
9	101158003	4.5	5
10	101108129	4.5	5
11	101108002	4	4
12	101108004	4	4
13	101108007	4	4
14	101108008	4	4
15	101108012	4	4
16	101108005	4.5	5
17	101108013	4.5	5

18	101288001	4.5	5
19	101288013	4.5	5
20	101288020	4.5	5
21	101108009	4.5	5
22	101108010	4.5	5
23	101108125	4.5	5
24	101108126	4.5	5
25	101108020	4	4
26	101108021	4	4
27	101108022	4	4
28	101108023	4	4
29	101108029	4	4
30	101108014	3.5	4
31	101108015	3.5	4
32	101108016	3.5	4
33	101108017	3.5	4
34	101108018	3.5	4
35	101108027	4	4
36	101108030	4	4
37	101108031	4	4
38	101108034	4	4
39	101288025	4	4
40	101108019	4	4
41	101108024	4	4
42	101108026	4	4
43	101288003	4	4
44	101288011	4	4
45	101108028	3.5	4
46	101108032	3.5	4
47	101108033	3.5	4
48	101288008	3.5	4
49	101108131	3.5	4
50	101108035	3.5	4
51	101108038	3.5	4
52	101108046	3.5	4
53	101108054	3.5	4
54	101288017	3.5	4
55	101108036	4	4
56	101108037	4	4
57	101108041	4	4
58	101108045	4	4
59	101108056	4	4
60	101108039	4	4
61	101108040	4	4

62	101108042	4	4
63	101108043	4	4
64	101108051	4	4
65	101108044	4.5	5
66	101108049	4.5	5
67	101108050	4.5	5
68	101108055	4.5	5
69	101288016	4.5	5

The overall performance of students in the above question is then summarized as given below in Table K4.28:

Table K4.28: Average score of student performance in the course UME801 for criteria K4

Course	% of students in each score					Average Score
	5	4	3	2	1	
UME801	35	65	0	0	0	4.35

Step 2: The above data is used to evaluate weighted average student class performance (course portfolio) for criteria K4 as given below in Table K4.29:

Table K4.29: Weighted Average Student class performance (course portfolio) for criteria K4

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME401	56.9	39.65	3.44	0	0	4.53	5
UME801	35	65	0	0	0	3.86	4
Weighted average score	47.17	50.92	1.92	0.00	0.00	4.23	9

b.) Assessment Tool: Student Course Survey

Table K4.30: Average score of student course survey for criteria K4

Courses	% of students in each score					Average Score	Weight
	5	4	3	2	1		
UME401	29.69	37.67	26.57	2.89	2.89	3.88	5
UME801	16.27	30.05	38.28	12.19	3.22	3.44	4
Weighted average score	23.73	34.28	31.77	7.02	3.04	3.68	9

c.) Assessment Tool: Graduating student survey, Alumni Survey and Employer Survey

Table K4.31: Assessment for criteria K4 using Graduating student survey, alumni survey and employer survey tool

Assessment Tools	% of students in each score					Average score
	5	4	3	2	1	
Graduating student survey	33.33	46.67	20	0	0	4.13
Alumni survey	61.54	35.9	2.56	0	0	4.59
Employer Survey	4.55	50	45.45	0	0	3.59

Finally overall weighted average score of performance criterion 'K4' is evaluated as given below in Table K4.32:

Table K4.32: Overall weighted average score of performance criterion 'K4'

Assessment tools	% of students in each score					Average weighted score	Assessment tool weight
	5	4	3	2	1		
Weighted average student class performance	47.17	50.92	1.92	0.00	0.00	4.23	5
Weighted average student course survey	23.73	34.28	31.77	7.02	3.04	3.68	4
Graduating student survey	33.33	46.67	20	0	0	4.13	3
Alumni survey	61.54	35.9	2.56	0	0	4.58	3
Employer survey	4.55	50	45.45	0	0	3.59	3
Overall weighted score	34.94	43.86	18.93	1.56	0.67	4.05	18

Overall assessment of student outcome K using scores of K1, K2, K3 and K4

In the above sections, each of the individual performance criteria K1, K2, K3 and K4 have been assessed. The performance for attainment of outcome K has been completed using the attainment values for K1, K2, K3 and K4 and is provided below:

Table K4.33 summarizes the scores of each of the four performance criteria and these scores have been used to assess an overall score for outcome K.

Table K4.33: Overall score for outcome K at the program level

Performance criteria	% of students in each score					Overall weighted average score	Criteria weight
	5	4	3	2	1		
K1	29.91	36.28	24.79	6.79	2.24	3.85	4
K2	35.95	39.69	17.73	2.53	4.06	4.01	5
K3	33.48	38.02	23.31	2.36	2.80	3.97	5
K4	34.94	43.86	18.93	1.56	0.67	4.05	5
Overall score	33.76	39.63	21.00	3.13	2.04	3.97	19