Procedure for CO-PO Attainment

- First the mapping between the individual Courses or subjects and the learning outcomes in terms of program Outcomes and Program Specific Outcomes has been carried out.

- Performance in these courses is then analyzed in detail to measure the degree to which the Program Outcomes and Program Specific Outcomes are attained.

- PO Assessment Tools
  - Assessment tools are categorized into direct and indirect methods to assess the program Specific outcomes, program outcomes and course outcomes.
  - Direct method increases the student knowledge and skill for their performance in the continuous assessment tests, end–semester examinations, presentations, and classroom assignments etc.

    1. **Direct Tools:**
    - Internal Assessment I & II
    - Assignments
    - Tutorials
    - Experiments
    - Subject / Course Project
    - Industrial Visits
    - Presentation
    - Final University Examination (Subject / Oral /Practical)

- **CALCULATION OF COURSE OUTCOME ATTAINMENT LEVEL**

Estimating the Levels wrt student's marks	
Cut-off %	**Level**
No. of students having marks>=60%	**3**
No. of students having marks between 50% to 59%	**2**
No. of students having marks between 40% to 49%	**1**

Note: High Scoring subjects can elevate the attainment level with justification (If the results are observed consistently high, No failures or Number of failures are less, any other) for e.g. PCE I and PCE II

Enter the data of each student:

ATTAINMENT THROUGH SUBJECTS

Name of students	IA 1		IA2		ASSIGNMENT		EXPERIMENT		COURSE PROJECT / IV / PRESENTATION	UNIVER - SITY EXAM
	Q1	Q2	Q1	Q2	A1	A2	E1	E2		
Max Marks										
Student 1										
Student 2										
Student 3										
. .										
Student 100										
Total No. of students appeared										
Total No. of students scored above 60										
Total No. of students scored =>50 and <59										
Total No. of students scored =>40 and <49										
Mapping CO										**All COs**
Attainment Level										

Calculation of Attainment Level

Eg. If Total no of students are 100

Total No. of students scored above 60 = 50

Total No. of students scored above 50 and <59 = 25

Total No. of students scored above 40 and <49 = 25

Then Attainment Level = (50 x 3 + 25x2 + 25x1) / 100 = 2.25

External Assessment 80% and Internal Assessment 20% Calculation

	Internal Assessment (20%)				External Assessment (80%)	80% of External+20% of internal examination
Course Outcome	IA-I OR IA-II	Experiment	Assignment	Internal Evaluation Average	University Evaluation	
CO1	2.87	2.87	2.66	2.8	1.7	1.92
CO2	2.92	2.81	2.66	2.8	1.7	1.92
CO3	2.66		2.66	2.66	1.7	1.89
CO4	2.82		2.66	2.74	1.7	1.91
CO5			2.66	2.66	1.7	1.89
CO6			2.66	2.66	1.7	1.89

Articulation Matrix: (Converting Levels to Scores)

- **Level 3 = Actual score**
- **Level 2 = Actual Score x 2 / 3**
- **Level 1 = Actual Score x 1 / 3**

Actual Score	CO PO Attainment as per weightage		
	3	2	1
1.92	1.92	1.28	0.64
1.92	1.92	1.28	0.64
1.89	1.89	1.26	0.63
1.91	1.91	1.27	0.64
1.89	1.89	1.26	0.63
1.89	1.89	1.26	0.63

DIRECT ATTAINMENT OF COURSE OUTCOMES WITH PO (Articulation Matrix gets converted to Score Based Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1.92	1.28	0.64	1.28	--	--	--	--	--	--	-	1.28	--	--
CO2	1.28	1.28	1.28	1.92	0.64	--	--	--	--	--	1.28	1.28	--	--
CO3	1.26	1.89	1.89	1.89	1.26	1.26	0.63	1.26	--	--	1.26	1.26	--	--
CO4	1.19	1.27	0.64	1.27	1.27	--	0.64	--	--	--	0.64	0.64	--	--
CO5	0.64	1.26	0.63	0.63	--	--	--	--	--	--	1.26	1.26	--	--
CO6	1.26	1.89	1.89	1.89	1.89	1.26	1.26	0.63	--	--	1.26	1.26	--	--
AVG	**1.26**	**1.48**	**1.16**	**1.48**	**1.27**	**1.26**	**0.84**	**0.95**	**--**	**--**	**1.14**	**1.16**	**--**	**--**

For Calculation of Direct attainment level of PO = $\frac{\text{Total of attainment Level}}{\text{No of courses for that particular PO}}$

Articulation Matrix														
COURSE NAME: Applied Data Science													COURSE CODE: CSDC8013	
COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	1	1	2	1	--	--	--	--	1	--	--	--	--
CO-2	2	3	1	3	1	2	--	--	--	--	--	--	1	--
CO-3		1	1	2	1	--	--	--	--	--	--	--	--	--
CO-4	2	1	1	2	1	--	--	--	--	--	--	--	1	2
CO-5	2	2	1	2	3	--	--	--	--	1	--	1	--	2
CO-6	1	2	1	2	2	--	--	--	--	--	--	1	3	3
AVERAGE TARGET ATTAINMANT	2.00	1.67	1.00	2.17	1.50	2.00	--	--	--	1.00	--	1.00	1.67	2.33

As per Articulation matrix, mapping of CO with PO (Attainment Matrix)														
COURSE NAME: Applied Data Science													COURSE CODE: CSDC8013	
COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	2.78	0.92	0.92	1.83	0.92	--	--	--	--	0.92	--	--	--	--
CO-2	1.81	2.75	0.91	2.75	0.91	1.81	--	--	--	--	--	--	0.91	--
CO-3	--	0.91	0.91	1.82	0.91	--	--	--	--	--	--	--	--	--
CO-4	1.82	0.91	0.91	1.82	0.91	--	--	--	--	--	--	--	0.91	1.82
CO-5	1.83	1.83	0.91	1.83	2.77	--	--	--	--	0.91	--	0.91	--	1.83
CO-6	0.91	1.83	0.91	1.83	1.83	--	--	--	--	--	--	0.91	2.77	2.77
AVERAGE DIRECT ATTAINMANT	1.83	1.53	0.91	1.98	1.38	1.81	--	--	--	0.92	--	0.91	1.53	2.14

MANJARA CHARITABLE TRUST

RAJIV GANDHI INSTITUTE OF TECHNOLOGY, MUMBAI

Department of Computer Engineering

DIRECT ATTAINMENT OF PROGRAM OUTCOMES (Considering all Subjects)

CO-PO-PSO Direct Attainment Matrix (R-19 C Scheme)													
Sem	Course Code	Name of Course	Program Outcomes										
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
I	FEC101	Engineering Mathematics-I	1.49	0.75	0.75	0.75	0.75	—	—	—	—	—	—	0.75
	FEC102	Engineering Physics-I	2.05	1.46	0.88	—	—	—	—	—	—	—	—	1.32
	FEC103	Engineering Chemistry-I	0.93	—	0.94	—	0.93	—	—	—	—	—	—	1.71
	FEC104	Engineering Mechanics	1.83	0.91	0.91	0.91	—	—	—	—	—	0.91	—	—
	FEC105	Basic Electrical Engineering	1.33	0.66	—	—	—	—	—	—	—	—	—	—
	FEL103	Engineering Mechanics Lab	1.23	0.62	0.62	0.62	—	—	—	—	—	0.62	—	—
	FEL104	Basic Electrical Engineering Lab	1.99	1.99	—	—	—	—	—	0.99	3.00	—	—	—
	FEL105	Basic Workshop Practice - I	1.99	1.44	0.89	—	1.81	1.81	—	0.89	—	1.81	—	1.44
II	FEC201	Engineering Mathematics-II	1.74	0.87	0.87	0.87	0.87	—	—	—	—	—	—	0.87
	FEC202	Engineering Physics-II	1.63	1.19	—	—	—	—	—	—	1.78	—	—	1.04
	FEC203	Engineering Chemistry-II	1.40	1.57	0.93	—	—	2.86	2.21	—	—	—	—	0.93
	FEC204	Engineeering Graphics	0.97	—	—	—	—	—	—	—	—	0.97	—	—
	FEC205	C Programming	2.07	1.58	1.16	1.93	1.69	—	—	—	—	—	—	1.52

	FEC206	Professional Communication and Ethics-I	—	—	—	—	—	—	—	0.76	0.76	0.76	—	0.76
	FEL203	Engineeering Graphics Lab	0.97	—	—	—	—	—	—	—	—	0.97	—	—
	FEL206	Basic Workshop Practice -II	1.46	1.30	0.99	—	—	—	—	—	—	0.90	—	1.02
III	CSC301	Engineering Mathematics-III	1.12	0.96	--	0.96	0.96	--	--	--	--	--	--	0.96
	CSC302	Discrete Structures and Graph Theory	2.27	2.43	1.61	1.77	--	--	--	--	--	--	--	--
	CSC303	Data Structure	1.92	1.94	1.15	2.03	2.18	--	--	--	--	--	--	2.07
	CSC304	Digital Logics and Computer Architecture	1.46	1.13	1.16	1.35	0.97	--	--	--	--	--	--	--
	CSC305	Computer Graphics	1.85	1.57	1.00	-	-	-	-	-	-	-	-	0.80
	CSL301	Data Structure lab	2.37	2.20	0.94	1.88	2.86	--	--	--	--	--	--	2.20
	CSL303	Computer Graphics Lab	1.69	1.95	0.98	--	0.98	--	--	--	--	--	--	0.98
	CSL304	Skill base Lab Course OOPJ	2.48	1.82	1.49	2.15	1.99	--	--	--	2.98	2.98	--	1.24
	CSM 301	Mini Project 1A	1.75	1.75	1.67	1.29	1.50	2.25	1.00	1.67	2.50	2.00	1.00	1.25
IV	CSC401	Engineering Mathematics-IV	2.25	0.96	--	0.96	0.96	--	--	--	--	--	--	0.96
	CSC402	Analysis of Algorithms	1.99	2.49	1.66	1.82	1.66				0.66	1.66	0.83	1.66
	CSC403	Database Management System	2.60	1.78	0.97	1.95	0.97	2.43	0.97	--	--	2.83	0.97	0.97
	CSC404	Operating System	1.97	1.64	0.99	1.58	0.99	--	--	--	--	--	--	1.97

	CSC405	Microprocessor	1.96	1.14	0.97	0.98	0.98	--	--	--	--	--	--	0.99
	CSL401	Analysis of Algorithms Lab	1.98	1.65	1.65	1.65	1.98	--	--	--	0.99	1.65	0.99	1.65
	CSL402	Database Management System Lab	2.41	1.85	0.93	2.04	0.94	1.85	0.95	--	--	2.83	0.93	0.95
	CSL403	Operating System Lab	1.86	1.55	0.93	1.49	0.93							1.86
	CSL405	Skill Base Lab Course: Python Programming.	2.82	1.97	1.81	2.31	2.31	--	--	--	2.99	2.99	--	1.32
	CSM 401	Mini Project 1B	1.75	1.75	1.67	1.29	1.50	2.25	1.00	1.67	2.50	2.00	1.00	1.25
V	CSC501	Theoretical Computer Science	1.61	1.61	0.98	0.98	0.98	--	--	--	--	--	--	--
	CSC502	Software Engineering	2.17	1.97	1.64	1.38	1.77	1.97	0.98	2.99	2.99	1.97	1.97	0.98
	CSC503	Computer Network	1.94	1.62	1.79	1.77	1.71	1.95	--	--	--	--	--	--
	CSC504	Data Warehousing and Mining	2.27	2.08	0.91	1.70	1.85	--	0.94	--	--	0.94	--	0.94
	CSDLO 5012	Internet Programming	0.97	1.95	2.78	1.95	2.95	2.95	0.97	2.95	2.95	0.97	--	2.95
	CSDLO 5013	Advance Database Management System	1.3	1.2	1.2	1.2	1.0	-	-	-	1.31	-	-	-
	CSL501	Software Engineering Lab	1.97	1.97	1.97	1.48	1.64	1.97	-	2.99	2.99	1.97	1.97	0.98
	CSL502	Computer Network Lab	2.06	1.43	1.74	1.22	1.84	1.84	--	--	--	--	--	--
	CSL503	Data Warehousing and Mining Lab	2.58	2.58	1.63	2.11	2.19	--	0.93	--	--	--	--	0.92

	CSL504	Professional Commucation & Ethics II	--	--	--	--	--	--	--	3	1.75	1.75	--	1
	CSM 501	Mini Project 2A	1.73	1.73	1.78	2.32	1.24	1.99	1.32	2.00	2.66	2.19	1.49	1.74
VI	CSC601	System Programming and Compiler Construction	1.60	1.60	-	1.39	0.88	-	-	-	-	-	-	0.87
	CSC602	Cryptography & System Security	1.65	0.90	0.90	1.57	1.79	--	--	--	--	--	--	1.78
	CSC603	Mobile Computing	1.64	1.63	1.57	1.79	1.80	2.96	0.99	0.98	2.97		1.23	1.31
	CSC604	Artificial Intelligence	2.65	1.65	1.86	0.94	--	--	--	--	--	--	--	0.93
	CSDLO 6011	Internet of Things	1.30	1.95	2.95	-	-	-	-	-	-	-	-	-
	CSDLO 6012	Digital Signal and Image Processing	2.74	1.65	1.08	1.81	0.90	--	--	0.90	--	--	--	0.90
	CSDLO 6013	Quantitative Analysis	2.37	1.47	0.88	1.77	0.88	--	--	0.88	--	--	--	1.42
	CSL601	System Programming and Compiler Construction Lab	1.8	1.8	-	1.8	1	-	-	-	-	-	-	1
	CSL604	Artificial Intelligence Lab	2.68	1.61	1.92	0.96	-	-	-	-	-	-	-	0.96
	CSL605	Skill Based Lab Course Cloud Computing Lab	1.50	1.66	1.99	1.99	1.99	2.49	--	--	--	--	--	--
	CSM 601	Mini Project Lab 2B	1.70	1.70	1.75	2.28	1.22	1.96	1.30	1.96	2.62	2.16	1.46	1.71
VII	CSC701	Machine Learning	2.07	1.43	1.75	1.90	1.14	--	--	--	1.44	--	1.91	1.27
	CSC702	Big Data Analysis	2.05	1.57	1.41	1.57	0.94	-	-	-	1.65	1.40	-	0.96

	CSDC 7011	Machine Vision	2.46	2.16	1.47	2.78	1.38	--	--	--	--	2.73	--	2.78
	CSDC 7013	Natural Language Processing	2.13	1.41	1.02	2.04	1.71	--	--	0.85	--	--	--	0.85
	CSDC 7022	Blockchain	1.77	1.06	0.88	1.77	0.88	1.77	0.88	--	2.65	2.65	--	--
	ILO 7013	Management Information System	1.44	--	0.96	0.95	0.96	1.9	1.445	1.9	--	--	0.96	1.93
	ILO 7016	Cyber Security and Laws	1.17	1.48	1.36	1.90	1.52	2.26	1.68	_	_	_	_	_
	ILO 7017	Disaster Management and Mitigation Measures	1.72	1.03	1.29	--	--	2.60	2.31	1.72	0.86	1.87	1.94	1.43
	CSL701	Machine Learning Lab	2.31	1.96	1.96	2.30	0.98	--	--	--	--	--	--	--
	CSL702	Big Data Analysis Lab	2.13	1.73	1.35	1.54	0.96	-	-	-	1.94	1.28	-	0.96
	CSP701	Major Project -I	1.73	1.73	1.78	2.32	1.24	2.49	0.99	2.00	2.49	1.98	1.49	1.66
VIII	CSC801	Distributed Computing	1.95	1.80	1.35	1.43	1.80	0.90	--	--	--	--	--	--
	CSDC 8013	Applied Data Science	1.83	1.53	0.91	1.98	1.38	1.81	--	--	--	0.92	--	0.91
	CSDC 8023	Social Media Analytics	1.80	1.37	0.98	1.37	1.99	2.95	--	0.97	--	--	--	--
	ILO 8028	Digital Business Management	1.57	2.27	1.57	1.57	1.80	2.73	1.81	1.81	2.73	1.81	1.79	0.90
	ILO 8029	Environmental Management	1.06	0.70	--	--	--	0.70	2.13	2.13	--	2.13	--	2.13
	CSL 801	Distributed Computing Lab	2.05	1.90	1.42	1.51	1.89	0.94	--	--	--	--	--	--
	CSDL 8013	Applied Data Science Lab	2.63	1.97	1.96	1.63	2.30	--	--	--	--	--	--	--

	CSDL 8023	Social Media Analytics Lab	1.79	1.36	0.97	1.36	1.96	2.95	-	0.97	--	--	--	--
	CSP801	Major Project-II	1.74	1.66	1.65	1.82	1.82	1.48	2.00	2.99	1.99	1.79	0.99	1.65
Direct Attainment			**1.86**	**1.59**	**1.35**	**1.61**	**1.46**	**2.11**	**1.34**	**1.74**	**2.17**	**1.76**	**1.35**	**1.31**
80% Direct attainment			**1.48**	**1.27**	**1.08**	**1.29**	**1.17**	**1.69**	**1.07**	**1.39**	**1.73**	**1.41**	**1.08**	**1.05**

Result of evaluation of each CO-PO

Sem	Course Code	Name of Course	Program Specific Outcomes	
			PSO1	POS2
I	FEC101	Engineering Mathematics-I	—	—
	FEC102	Engineering Physics-I	—	—
	FEC103	Engineering Chemistry-I	—	—
	FEC104	Engineering Mechanics	—	—
	FEC105	Basic Electrical Engineering	—	—
	FEL103	Engineering Mechanics Lab	—	—
	FEL104	Basic Electrical Engineering Lab	—	—
	FEL105	Basic Workshop Practice - I	—	—
II	FEC201	Engineering Mathematics-II	—	—
	FEC202	Engineering Physics-II	—	—
	FEC203	Engineering Chemistry-II	—	—

	FEC204	Engineeering Graphics	—	—
	FEC205	C Programming	1.74	1.16
	FEC206	Professional Communication and Ethics-I	0.76	—
	FEL203	Engineeering Graphics Lab	—	—
	FEL206	Basic Workshop Practice -II	—	—
III	CSC301	Engineering Mathematics-III	--	--
	CSC302	Discrete Structures and Graph Theory	0.97	--
	CSC303	Data Structure	1.33	1.77
	CSC304	Digital Logics and Computer Architecture	--	--
	CSC305	Computer Graphics	1.57	-
	CSL301	Data Structure lab	1.64	1.88
	CSL303	Computer Graphics Lab	1.96	--
	CSL304	Skill base Lab Course Object Oriented Programmming in Java	1.98	2.31
	CSM 301	Mini Project 1A	1.75	2.17
IV	CSC401	Engineering Mathematics-IV	--	--
	CSC402	Analysis of Algorithms	1.99	1.99
	CSC403	Database Management System	1.85	1.93
	CSC404	Operating System	1.97	2.99
	CSC405	Microprocessor	--	--

	CSL401	Analysis of Algorithms Lab	1.98	1.98
	CSL402	Database Management System Lab	1.85	1.83
	CSL403	Operating System Lab	0.93	1.86
	CSL405	Skill Base Lab Course: Python Programming.	1.97	2.31
	CSM 401	Mini Project 1B	1.75	2.17
V	CSC501	Theoretical Computer Science	--	--
	CSC502	Software Engineering	-	1.96
	CSC503	Computer Network	0.97	1.93
	CSC504	Data Warehousing and Mining	1.41	2.52
	CSDLO5012	Internet Programming	2.10	1.95
	CSDLO5013	Advance Database Management System	1.0	1.0
	CSL501	Software Engineering Lab	0.98	1.97
	CSL502	Computer Network Lab	0.61	1.83
	CSL503	Data Warehousing and Mining Lab	1.84	2.49
	CSL504	Professional Communication & Ethics II	1	--
	CSM 501	Mini Project 2A	1.33	2.24
VI	CSC601	System Programming and Compiler Construction	0.87	-
	CSC602	Cryptography & System Security	0.90	1.79
	CSC603	Mobile Computing	1.30	1.96
	CSC604	Artificial Intelligence	1.96	--

	CSDLO 6011	Internet of Things	2.96	-
	CSDLO 6012	Digital Signal and Image Processing	1.27	2.28
	CSDLO 6013	Quantitative Analysis	1.18	2.06
	CSL601	System Programming and Compiler Construction Lab	1	-
	CSL604	Artificial Intelligence Lab	1.93	-
	CSL605	Skill Based Lab Course Cloud Computing Lab	1.50	1.99
	CSM 601	Mini Project Lab 2B	1.30	2.20
VII	CSC701	Machine Learning	1.53	1.91
	CSC702	Big Data Analysis	0.94	1.88
	CSDC 7011	Machine Vision	1.84	1.83
	CSDC 7013	Natural Language Processing	1.36	2.21
	CSDC 7022	Blockchain	1.77	1.77
	ILO 7013	Management Information System	1.93	2.88
	ILO 7016	Cyber Security and Laws	1.39	1.52
	ILO 7017	Disaster Management and Mitigation Measures	0.88	0.86
	CSL701	Machine Learning Lab	1.96	1.96
	CSL702	Big Data Analysis Lab	0.96	1.93
	CSP701	Major Project -I	1.66	2.32
VIII	CSC801	Distributed Computing	--	1.80
	CSDC 8013	Applied Data Science	1.53	2.14

	CSDC 8023	Social Media Analytics	1.97	--
	ILO 8028	Digital Business Management	0.89	1.81
	ILO 8029	Environmental Management	1.18	--
	CSL 801	Distributed Computing Lab	--	1.89
	CSDL 8013	Applied Data Science Lab	2.30	2.47
	CSDL 8023	Social Media Analytics Lab	1.95	--
	CSP801	Major Project-II	1.49	2.31
Direct Average			1.51	2.00
80% Direct attainment			1.21	1.60

Indirect Attainment

INDIRECT ATTAINMENT TOOLS:

- Program Exit Survey
- Employer Feedback: Rubrics is given in department
- Alumni Feedback: Rubrics is available in Academic Diary
- Parents Feedback: Rubrics is available in Academic Diary
- Feedback from Industry

Tools	PO1	PO2	PO3	PO4	PO5	PO6	PO7	P08	P09	P10	P11	P12	PSO1	PSO2
Program Exit Survey	1.94	1.92	1.93	1.92	1.86	2.02	2.02	2.05	1.94	2.02	1.89	2.08	2.05	2.02
Employer Feedback	1.94	1.86	1.85	1.86	1.82	2	2	2.05	1.94	2	1.83	2.04	2.02	2

Alumni Feedback	1.94	1.92	1.86	1.92	1.84	2.07	2.07	2	1.84	1.93	1.89	2.16	2.12	2.07
Parents Feedback	1.94	1.93	1.93	2.02	1.94	2.08	2.08	2.08	2.03	2.12	1.98	2.13	2.1	2.08
Professional Bodies	2	1	2	-	1	1	-	2	-	-	-	2.13	1.38	1.75
Average	1.95	1.73	1.91	1.93	1.69	1.83	2.04	2.04	1.94	2.02	1.9	2.11	1.93	1.98
20% of Indirect Attainment	**0.39**	**0.35**	**0.38**	**0.39**	**0.34**	**0.37**	**0.41**	**0.41**	**0.39**	**0.4**	**0.38**	**0.42**	**0.39**	**0.4**

Overall PO Attainment

Program Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**P08**	**P09**	**P10**	**P11**	**P12**	**PSO 1**	**PSO 2**
Direct Attainment	1.48	1.28	1.10	1.31	1.17	1.66	1.07	1.38	1.70	1.41	1.08	1.05	1.21	1.59
Indirect Attainment	0.39	0.35	0.38	0.39	0.34	0.37	0.41	0.41	0.39	0.4	0.38	0.42	0.39	0.4
Overall attainment	**1.87**	**1.63**	**1.48**	**1.70**	**1.51**	**2.03**	**1.48**	**1.79**	**2.09**	**1.81**	**1.46**	**1.47**	**1.60**	**1.99**