



Metric No. 2.6.2

Attainment of programme outcomes and course outcomes are evaluated by the institution



Laxminarayan Institute of Technology, Nagpur
Self-Study Report

OUTCOME BASED EDUCATION (OBE)

POs, PEO, PSOs and COs

Defining, Mapping and Attainment Scheme

- 1. POs, PEO, PSOS Defined**
- 2. Bloom's Taxonomy Levels of Learning used for CO-PO Mapping**
- 3. Scheme for CO-PO Attainment**
- 4. Framing the Formulae for CO –PO Attainment**

1. POs, PEO, PSOS Defined

Program Outcomes as defined by NBA (PO)

Engineering Graduates will be able to:

- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Educational Objectives (PEO):

PEO-1: To produce graduates having a strong background of basic science, Mathematics & Engineering and ability to use these tools.

PEO-2: To produce graduates who can demonstrate technical competence in the field of Chemical Engineering and Chemical Technology and develop solutions to the complex problems.

PEO-3: To produce graduates having professional competence through life-long learning such as advanced degrees, professional skills and other professional activities related globally to engineering & society.

PEO- 4: To produce graduates who function effectively in a multi-disciplinary environment and individually, within a societal and environmental context.

PEO-5: To produce graduates who would be able to take individual responsibility and work as a part of a team towards the fulfillment of both individual and organizational goals.

PSOs Defined for CE

- PSO1** A student graduating from the Department shall possess the ability to understand the fundamentals of Chemical Engineering Science and shall be able to apply the knowledge gained in the Core Subjects while working in Chemical Process Industry, Academia and Research Organizations.
- PSO2** A student graduating from the Department shall possess the ability to analyze the problems in Core Subjects of Chemical Engineering and shall be able to formulate the methodology and identify the tools to obtain a feasible, optimal and cost effective solution.
- PSO3** A student graduating from the Department shall understand his/her responsibility towards the Society and the Country in order to work towards betterment of quality of life of the People by using his/her knowledge and experience following Professional Ethics.

PSOs Defined for CT

- PSO1** A student graduating from the Department shall possess the ability to understand the fundamentals of Chemical Technology and shall be able to apply the knowledge gained in the Subjects of his/her Specialization while working in Chemical Process Industry, Academia and Research Organizations.
- PSO2** A student graduating from the Department shall possess the ability to analyze the problems in the Subjects of his/her Specialization in Chemical Technology and shall be able to formulate the methodology and identify the tools to obtain a feasible, optimal and cost effective solution.
- PSO3** A student graduating from the Department shall understand his/her responsibility towards the Society and the Country in order to work towards betterment of quality of life of the People by using his/her knowledge and experience following Professional Ethics.

2. Bloom's Taxonomy Levels of Learning used for CO-PO Mapping



Active verbs developed based on Bloom's Taxonomy

Knowledge	Understand	Apply	Analyze	Evaluate	Create
define identify describe label list name state match recognize select examine locate memorize quote recall reproduce tabulate tell copy discover duplicate enumerate	explain describe interpret paraphrase summarize classify compare differentiate discuss distinguish extend predict associate contrast convert demonstrate estimate express Identify indicate Infer relate	solve apply illustrate modify use calculate change choose demonstrate discover experiment relate show sketch complete construct dramatize interpret Manipulate Paint Prepare produce	analyze compare classify contrast distinguish infer separate explain select categorize connect differentiate discriminate divide order point out prioritize subdivide survey advertise appraise Break down	reframe criticize evaluate order appraise judge support compare decide discriminate recommend summarize assess choose convince defend estimate find errors grade measure predict rank	design compose create plan combine formulate invent hypothesize substitute write compile construct develop generalize integrate modify organize prepare produce rearrange rewrite role-play

3. Scheme for CO-PO Attainment

Criteria for Distribution – B tech Theory----- Target 60% Before Jan 2019

	Int (20)	Uni (80)	Total weightage	Above 70= 3
CO1	5	16	20	55-70=2
CO2	5	16	20	45-55= 1
CO3	5	16	20	Below 45= 0
CO4	5	16	20	(ALL CO SAME LEVEL)

Criteria for Distribution – B tech Theory----- Target 60% Jan 2019-Till Date

CO	UT1 (3)	UT2 (3)	Sessional (12)	Assignment (2)	Uni Exam (80)	Total weightage	Above 70= 3
CO1	1.5	--	2.5	--	16	20	55-70=2
CO2	1.5	--	2.0	0.5	16	20	35-55= 1
CO3	--	1.5	2.5	--	16	20	Below 35= 0
CO4	--	1.5	2.0	0.5	16	20	
CO5	--	--	3.0	1.0	16	20	

Criteria for Distribution – B tech Practical/minor project----- Target 80% Jan 2019-Till Date

	Int (25)	Ext (25)	Total weightage	Above 70= 3
CO1	4	8.5	12.5	55-70=2
CO2	6	6.5	12.5	45-55= 1
CO3	7	5.5	12.5	Below 45= 0
CO4	8	4.5	12.5	

Criteria for Distribution – Seminar/Project----- Target 80% Jan 2019-Till Date

	Int (100)	Ext (100)	Total weightage	Above 75= 3
CO1	20	30	50	60-75=2
CO2	24	26	50	35-60= 1
CO3	26	24	50	Below 35= 0
CO4	30	20	50	

Criteria for Distribution – Major Project----- Target 80% Jan 2019-Till Date

	Int (200)	Ext(200)	Total weightage	Above 75= 3
CO1	40	60	100	60-75=2
CO2	48	52	100	35-60= 1
CO3	52	48	100	Below 35= 0
CO4	60	40	100	

Criteria for Distribution – Seminar/Project----- Target 80% 7th sem

	Presentation (50)	Viva (50)	Total weightage	Above 70= 3
CO1	8	17	25	55-70=2
CO2	12	13	25	45-55= 1
CO3	14	11	25	Below 45= 0
CO4	16	9	25	

Criteria for Distribution –Project----- Target 80% 8th sem

	Int (50)	Ext (150)	Total weightage	Above 75= 3
CO1	10	40	50	

CO2	12	38	50	60-75=2
CO3	13	37	50	35-60= 1
CO4	15	35	50	Below 35= 0

Criteria for Distribution – M Tech Theory----- Target 70% Jan 2019-Till Date

	Int (30)	Ext (70)	Total weightage	Above 75= 3
CO1	10	17.5	27.5	60-75=2
CO2	9	17.5	26.5	35-60= 1
CO3	6	17.5	23.5	Below 35= 0
CO4	5	17.5	22.5	

Criteria for Distribution – Eth Sci----- Target 60% Jan 2019-Till Date

	UT1 (25)	UT2 (20)	Assign(5)	Total weightage	Above 70= 3
CO1	8	4	2.5	12.5	55-70=2
CO2	7	5	1.5	12.5	35-55= 1
CO3	6	5	0.5	12.5	Below 35= 0
CO4	4	6	0.5	12.5	

Criteria for Distribution – computational skill----- Target 80% Jan 2019-Till Date

	Pract (12.5)	Assign+Viva (12.5)	Total weightage	Above 70= 3
CO1	2	4.25	6.25	55-70=2
CO2	3	3.25	6.25	45-55= 1
CO3	3.5	2.75	6.25	Below 45= 0
CO4	4	2.25	6.25	

Criteria for Distribution – B tech Theory----S-20Lockdown--- Target 60% S- 2020

CO	UT1	UT2	Sessional	Assignment	Uni Exam	Total weightage	Above 70= 3 55-70=2 35-55= 1 Below 35= 0
All CO merged for attainment as no sessional or uni exam conducted	CO attainment is calculated from the int and uni marks on AVG level						

Criteria for Distribution – B tech Practical----- Target 80% NEW SYLLABUS June 2020

	Int (25)	Ext (25)	Total weightage	Above 70= 3
CO1	4	8.5	12.5	55-70=2
CO2	6	6.5	12.5	45-55= 1
CO3	7	5.5	12.5	Below 45= 0
CO4	8	4.5	12.5	

Criteria for Distribution – B tech Theory (35+15) -----Target 60% NEW SYLLABUS(1st Year) June 2020

CO	UT1 (3)	UT2 (3)	Sessional (6)	Project/Assign(3)	Uni Exam(35)	Total weightage	Above 70= 3 55-70=2 35-55= 1 Below 35= 0
CO1	2	--	1	0.75	8.75	12.5	
CO2	1	--	2	0.75	8.75	12.5	
CO3	--	1	2	0.75	8.75	12.5	
CO4	--	2	1	0.75	8.75	12.5	

Criteria for Distribution – B tech Theory (70+30) -----Target 60% NEW SYLLABUS (1st Year) June 2020

CO	UT1(5)	UT2(5)	Sessional(12)	Project (8)	Uni Exam	Total weightage	Above 70= 3 55-70=2
CO1	2.5	--	--	2.5	11.6666667	16.6666667	7

CO2	1.5		3	0.5	11.6666667	16.6666667	35-55= 1
CO3	1		3	1	11.6666667	16.6666667	Below 35= 0
CO4	--	1	3	1	11.6666667	16.6666667	
CO5		1.5	3	0.5	11.6666667	16.6666667	
CO6		2.5		2.5	11.6666667	16.6666667	

Criteria for Distribution – Communication Skill----- Target 60% NEW SYLLABUS (1st Year) June 2020

	PS(10)	GD (10)	Sessional(25)	Assign(5)	Above 70= 3
CO1	--	--	11	1.5	55-70=2
CO2	--	--	9	3.5	
CO3	10	--	2.5	--	35-55= 1
CO4	--	10	2.5	--	Below 35= 0

4. Framing the Formulae for CO –PO Attainment

Sample Sheet

Criteria for Distribution – B tech Theory----- Target 60% Jan 2019-Till Date

CO	UT1 (3)	UT2 (3)	Sessional (12)	Assignment (2)	Uni Exam (80)	Total weightage	Above 70= 3
CO1	1.5	--	2.5	--	16	20	55-70=2
CO2	1.5	--	2.0	0.5	16	20	
CO3	--	1.5	2.5	--	16	20	35-55= 1
CO4	--	1.5	2.0	0.5	16	20	Below 35= 0
CO5	--	--	3.0	1.0	16	20	

Stage 1- Calculations of CO and CO levels

Step1-

CO1= (marks of UT1 X 1.5/3) + (marks of Sessional X 2.5/12) +(marks of Uni Exam /5)

CO2= (marks of UT1 X 1.5/3) + (marks of Sessional X 2.0/12) +(marks of Assignment X 0.5/2)
+(marks of Uni Exam /5)

CO3= (marks of UT2 X 1.5/3) + (marks of Sessional X 2.5/12) +(marks of Uni Exam /5)

CO4= (marks of UT2 X 1.5/3) + (marks of Sessional X 2.0/12) +(marks of Assignment X 0.5/2)
+(marks of Uni Exam /5)

CO5= (marks of Sessional X 3.0/12) +(marks of Assignment X 1.0/2) +(marks of Uni Exam /5)

Step2-

From all the CO score out of 20, % of COs attained has been calculated.

Step 3-

After getting the values of all % COs, the level 0,1,2,3 is assigned indicating the attainment of unattained, low, medium and high level by using the assigned rubrics.

Step 4-

Average of all levels for all COs has been calculated.

Stage 2- Calculations of CO/PO matrix for Attainment

Course Objectives:

Students will gain an understanding of:

- The application of mathematical tools to calculate thermodynamic properties
- The use of thermodynamic principles, and apply them to a variety of phase and reaction equilibria
- Modification and Applications of distribution law
- The reaction of electrochemical cells and its types as applied to scientific problems.

While designing the CO, lecturers of each course map their CO to the appropriate PO and PSOs to ensure that all PO are delivered throughout the study. For example-

Course Outcome	Bloom Taxonomy	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1- To develop a competent knowledge of thermodynamic principles, free energy, chemical potential and apply them to a variety of phase (gas, liquid, solid, and solution) and reaction equilibria	L3	3	3	1	1	-	-	-	-	-	-	-	-	2	-	-
CO2- To Interpret the phase equilibrium in simple systems and adapt the Clapeyron equation to the solid-liquid, liquid-gas and solid-gas equilibrium and analyzing its use in extraction or purification of solute.	L4	3	3	1	1	-	1	-	-	-	-	-	-	3	2	1
CO3- To modify and apply Nernst distribution law when solute undergoes dissociation, association and chemical combination.	L3	3	3	2	1	-	-	-	-	-	-	-	-	3	1	-
CO4- To describe the ideal solution and able to recognize, use and compare the colligative properties for determining molar masses.	L5	3	3	2	1	-	-	-	-	-	-	-	-	2	1	-
CO5- To recognize the reaction of electrochemical electrodes, cells and its types and able to formulate Nernst equation	L5	3	3	3	2	-	1	-	-	-	-	-	1	3	1	1

Calculating PO attainment –

The PO attainment is calculated by using the above predefined CO/PO matrix and the value of Final CO attainment for the subject.

The PO attainment is calculated by using the formula-

$$\text{PO1 attainment} = \{(\text{Avg, of CO1 X matrix weightage of CO1}) + (\text{Avg, of CO2 X matrix weightage of CO2}) + (\text{Avg, of CO3 X matrix weightage of CO3}) + (\text{Avg, of CO4 X matrix weightage of CO4}) + (\text{Avg, of CO5 X matrix weightage of CO5})\} / (\text{Avg, of PO1 matrix weightage})$$

Similar formulae will be applied to other PO attainment calculations.

Fixing the Desired Target Level

Target levels for theory, practical and different courses have been set.

Achievement of the Desired Target Level

If the levels achieved are above the targeted expectations, then the teaching methods and tools are continued.

But in case, if the target level is not achieved as expected, the course coordinator personally looks after the curricular gaps and take necessary efforts in the desired direction to improve attainment.

Sr. No.	Name	Link for CO-PO attainment
	SAMPLE FILE	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/1 Sample Files COPO.xlsx
<i>Department of Chemical Engineering</i>		
1	Dr. R.B. Mankar	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/2 CE RB Mankar.xlsx
2	Dr. B. A. Bhanvase	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/3 CE BA Bhanvase.xlsx
3	Mr. S. L. Pandharipande	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/4 C SL Pandharipande.xlsx
4	Dr. R. P. Ugwekar	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/5 CE RP Ugwekar.xlsx
5	Dr. S. P. Shirsat	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/6 CE SP Shirsat.xlsx
6	Mr. R. P. Birmod	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/7 CE RP Birmod.xlsx
7	Dr. S. N. Joglekar	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/8 CE SN Joglekar.xlsx
8	Dr. V. G. Lade	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/9 CE VG Lade.xlsx
<i>Department of Food Technology</i>		
1	Dr. M.G. Bhotmange	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/13 Food MG Bhotmange.xlsx
2	Dr. S.V. Karadbhajne	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/14 Food SV Karadbhajne.xlsx
3	Dr. (Mrs.) S. D. Deshmukh	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/15 Food SD Deshmukh.xlsx
<i>Department of Oil, Fats & Surfactants Technology</i>		
1	Dr. V. Y. Karadbhajne	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/16 Oil VY Karadbhajne.xlsx
2	Mr. V. M. Gawande	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/17 Oil VM Gawande.xlsx
<i>Department of Petrochemical Technology</i>		
1	Dr. G. M. Deshmukh	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/18 Petro GM Deshmukh.xlsx
2	Dr. V. N. Ganvir	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/19 Petro VN Ganvir.xlsx
3	Mr. A. C. Shende	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/20 Petro AC Shende.xlsx
4	Mr. A. J. Agrawal	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/21 Petro AJ Agrawal.xlsx
<i>Department of Plastics & Polymer Technology</i>		
1	Dr. J.B.Modak	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/22 Polymer JB Modak.xlsx
2.	Mr. M. M. Yenkie	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/23 Polymer MM Yenkie.xlsx

Department of Pulp & Paper Technology		
1	Dr. S. S. Sen	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/24 Paper SS Sen.xlsx
2	Dr. J. B. Bhasakar	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/25 Paper JB Bhasarkar.xlsx
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3	Dr. S.K.Deshmukh	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/12 CT SK Deshmukh.xlsx
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2	Dr. P.N. Belkhode	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/28 GE PN Belkhode.xlsx
3	Dr. (Mrs.) P.J. Giri	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/29 GE PJ Giri.xlsx
4	Mr. C.M. Chawhan	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/30 GE CM Chavhan.xlsx
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2	Dr. N.T. Khaty	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/32 CHEM NT Khaty.xlsx
3	Dr. S. U. Meshram	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/33 CHEM SU Meshram.xlsx
4	Dr. Asar Ahmed	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/34 CHEM A Ahmed.xlsx
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2	Dr. N. M. Patil	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/36 PHY NM Patil.xlsx
3	Dr. Vijay Pawade	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/37 PHY VB Pawde.xlsx
4	Dr.(Mrs) N. T. Kalyani	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/38 PHY NT Kalyani.xlsx
Department of Mathematics		
1	Dr. S. P. Dautpure	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/39 MATHS SP Dautpure.xlsx
2	Dr. S.D.Warbhe	https://www.litnagpur.in/wp-content/uploads/2021/10/C02/262/40 MATHS SD Warbe.xlsx