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PROGRAM LEARNING OUTCOMES

Dr. Shafqat Ali

AGENDA

Introduction

Statements and Publicity

Areas Formulation and Review

Process of PLOs

PLOs mapping to PEOs

Mapping of Courses to PLOs

CQI mechanism for PLOs

Student Work

FAQs

INTRODUCTION

- Program learning outcomes (PLOs) for an academic program are defined as the knowledge, skills, or behaviors that a program's students should be able to demonstrate upon program completion.
- PLOs are the statements that describe what the knowledge, skills and attitudes students should have at the time of graduation from an engineering program.
- PLOs help students understand why this knowledge and these competencies will be useful to them
- PLOs show how students can make use of the material and content, both inside and outside of the classroom

STATEMENTS AND PUBLICITY

As per PEC's recommendation, the twelve graduate attributes (GAs) given in the PEC accreditation manual 2019 were considered as the baseline for the formulation of the PLOs for the faculty of engineering sciences (FES).

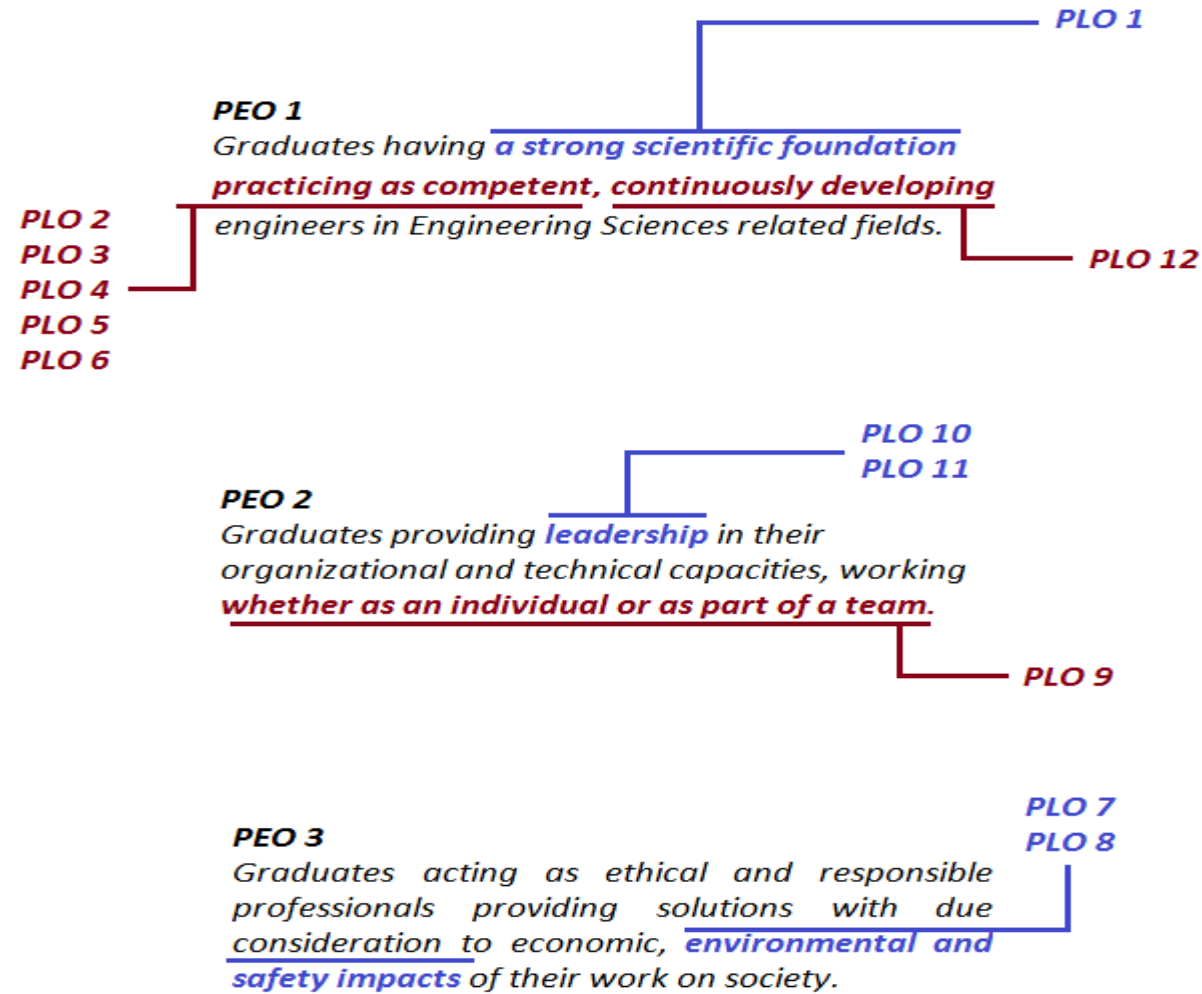
Program Learning Outcomes		
PLO 1	Engineering Knowledge	Ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PLO 2	Problem Analysis	Ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PLO 3	Design/Development of Solutions	Ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PLO 4	Investigation	Ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.
PLO 5	Modern Tool Usage	Ability to 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.
PLO 6	The Engineer and Society	Ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.
PLO 7	Environment and Sustainability	Ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
PLO 8	Ethics	Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
PLO 9	Individual and Team Work	Ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.

STATEMENTS AND PUBLICITY CONTD.

Program Learning Outcomes		
PLO 10	Communication	Ability to communicate effectively, orally as well as in writing, 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.
PLO 11	Project Management	Ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.
PLO 12	Lifelong Learning	Ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments.

PLOS MAPPING TO PEOS

The PLOs should help achieve the larger Program Educational Objectives (PEOs). Therefore, a mapping between the two should exist which is shown in table



PLOS MAPPING TO PEOS

PEO-PLO Correlation Table												
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Investigation	Modern Tool Usage	The Engineer and Society	Environment and Sustainability	Ethics	Individual and Team Work	Communication	Project Management	Lifelong Learning
PEO 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
PEO 2									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
PEO 3							<input type="checkbox"/>	<input type="checkbox"/>				

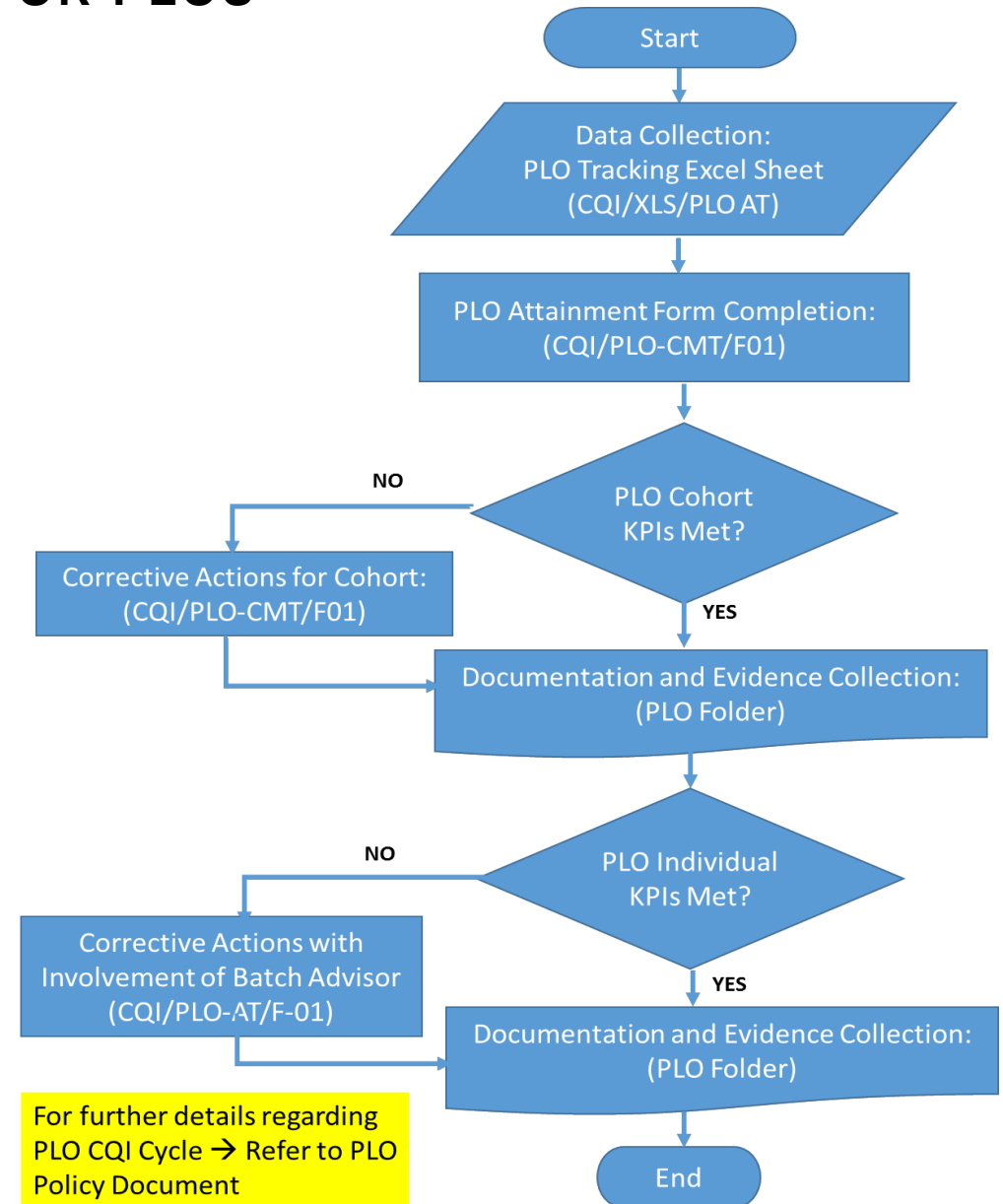
MAPPING OF COURSES TO PLOS

- Different courses in the FES curriculum are mapped to all the PLOs for the ES program
- Each course has a set of CLOs, and each CLO of the course is mapped to one of the twelve PLOs of the faculty
- It is decided at the faculty level that only a particular CLO will only be mapped to a single PLO for ease of mapping and analysis (**possible to map one CLO to two PLOs?**)
- Sample: ES-475 (Optical communications and computing)

Mapping of CLOs and PLOs			
Sr. No.	Course Learning Outcomes	PLOs	Blooms Taxonomy
CLO1	• Solve problems related to optical principles used in optical fibers and characteristics of optical fibers	PLO1	C2
CLO2	• Analyze important components used in optical communication links e.g. optical sources, optical detectors etc.	PLO1	C3
CLO3	• Design an optical communication link using link budget calculations for a target set of desirables and constraints.	PLO3	C5
CLO4	• To analyze components and technologies used in optical networks	PLO1	C4

CQI MECHANISM FOR PLOS

- A CQI mechanism has been formulated for the regular annual review of PLOs and their corresponding KPIs
- This process was discussed and approved in a meeting by the CQI team and then standardized in the form of a flow chart, as depicted in figure.



For further details regarding PLO CQI Cycle → Refer to PLO Policy Document

CQI MECHANISM FOR PLOS

1) Assessment mechanism for PLO attainment (student level)

- PLOs mapped to a course are evaluated by the course instructor in the form of a binary result for each concerned PLO, for each student enrolled in the course, and based upon the student's attainment of the relevant CLOs
- At the end of the semester the instructor passes the PLO result report to the faculty's student office, which further communicates these files to the PLO team for the compilation of the results at the student as well as cohort level
- Batch advisors will be notified to discuss the PLOs and the importance of their attainments with the students in the batch advisor meeting
- Students missing PLO KPIs will be notified via the batch advisor

PLOs	KPI thresholds
PLO1,PLO2,PLO3,PLO4,PLO5,PLO6,PLO8, PLO10	70%
PLO7,PLO9,PLO11 PLO12	50%

CQI MECHANISM FOR PLOS

2) Assessment mechanism for PLO attainment (Cohort level)

- A cohort/intake level PLO attainment assessment is also done every year, for all the intakes, in the annual PLO CQI meeting
- The same PLO data sheet, as the one used for individual assessment, is used to calculate the average cohort-level PLO attainment for a particular intake.
- In table below, one of the top rows is showing the cohort-level PLO attainment for intake 2018, as assessed in the year 2020
- These results are also shared with the batch advisors and the dean to see if any corrective measures are needed.

Batch 28																
Index	Reg. #		Names	Status	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
Cohort Summary					86.11	89.74	89.14	94.00	98.71	98.28	85.71	100.00	100.00	100.00		
1	2018012	1	Abdul Rafay		87.50	76.92	87.50	100.00	100.00	100.00	100.00	100.00	100.00	100.00		
2	2018065	1	Ali Zain Murad		95.45	78.57	85.71	100.00	100.00	100.00	100.00	100.00	100.00	100.00		
3	2018072	1	Aqib Abdullah		81.82	100.00	100.00	100.00	100.00	50.00		100.00	100.00			
4	2018093	1	Bilal Hassan Qureshi		83.33	76.92	71.43	100.00	87.50	100.00	100.00	100.00	100.00	100.00		
5	2018094	1	Bilal Shaheen Malik		91.30	100.00	85.71	100.00	100.00	100.00	100.00	100.00	100.00	100.00		
6	2018119	1	Gulsher Khan		83.33				100.00	100.00	100.00		100.00	100.00		
7	2018138	1	Hariss Jamal Bhutta		91.67	100.00	85.71	100.00	100.00	100.00	100.00	100.00	100.00	100.00		
8	2018154	1	Hussain Tariq		95.83	100.00	85.71	100.00	100.00	100.00	100.00	100.00	100.00	100.00		
9	2018156	1	Huzaiifa Abbas		83.33	84.62	87.50	100.00	100.00	100.00	100.00	100.00	100.00	100.00		
10	2018190	1	Mahnoor Syed		69.57	46.15	85.71	100.00	100.00	100.00	100.00	100.00	100.00	100.00		
11	2018195	1	Mian Maziyar Rehan		92.31	100.00			100.00	100.00	100.00		100.00	100.00		
12	2018237	1	Muhammad Ali Hassan		73.68	40.00	50.00	0.00	75.00	100.00	100.00	100.00	100.00	100.00		
13	2018261	1	Muhammad Ghufraan Akbar		86.96	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		

ASSESSMENT PROCEDURE

The twelve PLOs of the ES program are assessed through a variety of assessment procedures. The assessments can firstly be classified into direct and indirect assessment tools. PLOs are mostly assessed via the direct assessment tool, the program also employs some indirect assessment tools to qualitatively assess the achievement of PLOs by the ES graduates.

1) Direct Assessment

Direct assessments constitute the primary method by which the students' attainment of PLOs is assessed in the program. A number of direct assessment tools and learning activities are employed in different courses across the curriculum to cover all the PLOs such as;

- assignments
- Quizzes
- midterms
- final exams
- course/design projects
- complex engineering problems
- lab experiments including open-ended labs
- senior design projects etc.

STUDENT WORK

1) Indirect Assessment

- Indirect assessment of PLOs is done through the internship reports, and graduating batch survey
- The graduating, Alumni and Employer survey forms help to identify the loopholes in the students and curriculum designed
- Internship assessment is also used as an indirect assessment tool for the students' learning outcomes that reveals the level of performance and understanding of students in a real world
- These assessment tools have been deliberated over by the PLO committee, and a formal mechanism has been charted out for the inclusion of such indirect assessment tools in the review of PLOs.

STUDENT WORK

2) Indirect Assessment

Internship Evaluation Report - Batch 27

S.No	Name	Reg #	Evaluator	Industry										Presentation				Report			Final Evaluation								
				Professional Knowledge & Skills	Ability of student to Apply his/her knowledge	Analytical approach towards solving	Capability to adapt to a new working environment	Initiative and Drive	Ability to meet the given target in a given time duration	Self-reliance in accomplishing the project	Ability to cooperate with associates	Punctuality and discipline	Interpersonal Skills	Marks (100)	Obtained Professional Knowledge (10)	Organization (10)	Communication Skills & Q/A (10)	Marks (30)	Layout/Structure (15)	Technical Details/Activities (15)	Marks (30)	Industrial					Faculty (Presentation + Report)		
																						INDIRECT ASSESSMENT					DIRECT ASSESSMENT		
																						PLO1	PLO1	PLO2	PLO11	PLO12	PLO11	PLO11	PLO9
1	Qammar Ahmed	2016397	Dr. Tahseen	8	7	7	8	7	10	6	8	9	8	78	5	8	6	19	10	10	20	75	70	80	77.5	70	50	68	
2	Abdul Rehman Ahmed	2017011		9	9	9	9	9	9	9	9	9	9	9	90	10	8	10	28	12	12	24	90	90	90	90	90	100	84
3	Abdullah Bin Masood	2017016		9	8	9	9	8	9	9	9	9	9	9	88	4	4	6	14	10	8	18	85	90	90	90	80	40	56
4	Adeel	2017030		9	8	10	9	9	8	8	9	10	9	89	8	8	9	25	14	14	28	85	100	90	90	90	80	90	
5	Ahmed Rehab	2017048		10	9	10	9	9	9	10	9	10	9	94	8	7	8	23	13	13	26	95	100	90	95	90	80	82	
6	Ahsan Jamal	2017053		7	8	7	9	9	8	8	8	9	7	81	8	9	8	25	14	14	28	75	70	80	82.5	90	80	90	
7	Ahsan Zia	2017054		9	8	9	9	8	9	9	8	10	10	89	8	7	8	23	8	8	16	85	90	80	95	80	80	62	
8	Ali Absar Ahmad Khan	2017058		10	10	10	10	10	10	10	10	10	10	100	8	8	8	24	14	14	28	100	100	100	100	100	100	80	88
9	Ali Aman	2017060		8	9	9	10	8	9	9	8	10	9	89	6	7	8	21	12	12	24	85	90	80	95	80	60	78	
10	Atif Tahir	2017086	8	7	9	10	8	8	9	8	9	9	85	5	6	6	17	14	14	28	75	90	80	92.5	80	50	80		
11	Fahad Bin Faisal	2017109	8	9	7	9	9	8	8	5	7	10	7	79	5	7	7	19	12	12	24	85	70	70	77.5	90	50	76	
12	Hassan Nawaz	2017153	10	9	10	10	9	10	10	10	9	9	96	5	7	6	18	10	10	20	95	100	100	95	90	50	66		
13	Meer Gohram Qaisrani	2017198	9	10	9	10	10	9	9	10	10	10	96	7	8	8	23	10	10	20	95	90	100	97.5	100	70	72		
14	Muhammad Mashhood Khan	2017214	7	7	7	7	7	7	7	7	7	7	77	6	6	7	19	10	10	20	70	70	70	90	82.5	70	60	66	
15	Muhammad Haseem Zafar	2017266											0	5	4	5	14	8	8	16	0	0	0	0	0	0	50	50	
16	Muhammad Junaid Javed	2017283	10	9	10	7	9	10	10	10	9	10	94	6	6	6	18	12	12	24	95	100	100	100	90	90	60	72	
17	Muhammad Shehryar	2017322	9	8	9	10	10	9	8	9	8	9	89	6	6	5	17	11	12	23	85	90	90	87.5	100	60	68		
18	Muhammad Waleed Bin Saif	2017340											0				0			0	0	0	0	0	0	0	0	0	
19	Muhammad Zikriya	2017346	8	10	10	9	9	10	10	9	10	9	94	7	6	9	22	13	13	26	90	100	90	95	90	70	82		
20	Muneeb Ahmed Malik	2017351											0				0			0	0	0	0	0	0	0	0	0	
21	Rana Abdullah Inam	2017384	9	9	8	9	8	9	9	9	9	10	89	6	5	6	17	10	9	19	90	80	90	92.5	80	60	60		
22	Rumaisa Afzal	2017389	8	9	8	9	9	8	9	9	9	8	86	7	7	8	22	10	10	20	85	80	90	87.5	90	70	70		
23	Syed Ali Haider	2017450	8	9	8	10	9	9	10	10	9	10	92	7	5	5	17	14	14	28	85	80	100	97.5	90	70	76		
24	Talha Islam	2017474	4	6	6	7	4	6	6	6	8	5	58	6	5	6	17	10	10	20	50	60	60	65	40	60	62		

FREQUENTLY ASKED QUESTIONS

Anticipated Questions	Answer	Evidence
PLOs are well defined, aligned with PEOs , and well publicised/understood		
How Many PLOs does the Program Have?	12	SAR (2.1) – Pg. 37, Prospectus 2020 Pg. 116, Faculty Boards, PLO Folder (Criterion – 2)
What are they?	Engineering Knowledge, Problem Analysis, Design/development of Solutions, Investigation, Modern Tool Usage, The Engineer and Society, Environment and Sustainability, Ethics, Individual and Teamwork, Communication, Project Management, Lifelong Learning	SAR (2.1) – Pg. 37, Prospectus 2020 Pg. 116, Faculty Boards, PLO Folder (Criterion – 2)
Do they Map well to the PEO?	Yes, PLO1-7, 12 (mapped to PEO1), PLO 9, 10, 11 (mapped to PEO2) and PLO 7, 8 (mapped to PEO3),	SAR (2.3) – Pg. 40 – PLO Folder (criterion – 2)
Are they publicized well?	Yes, as per evidence	Faculty Lobby, Faculty Website. Prospectus 2020 Pg. 94
Involvement of stakeholders in formulation/review of PLOs		
When and how were the PLOs first formulated?	PLOs discussed and approved in BoS meetings in May 27, 2015 and Feb 29, 2016, formally approved by Academic Council in 2021	BoS and Academic Council meeting minutes in PLO Folder (criterion – 2)
Who are the typical stakeholders?	Students, Employers, Faculty	
What is the mechanism in place for reviewing the PLOs?	PLO CQI Cycle for reviewing PLOs	SAR (2.5) – Pg. 41
How often are the PLOs reviewed?	PLO committee sits every year in Summers to review PLOs	SAR (2.5) – Pg. 41
When was the last review?	Summers 2020	CQI Cycle for Batch 27,28,29 – PLO – CQI Folder
What were the results of the last review?	PLO4, PLO11 and PLO12 frequency in the courses to be reviewed	<ul style="list-style-type: none"> - PLO committee annual CQI form (CQI/PLO-AT/F-01) (PLO folder) - PLO attainment excel sheets for each batch (available in PC / PLO Folder) - student PLO CQI forms (PLO CQI folder)
Can you show in past several years if there has been any change to the PEOs as a result of a review process?	No because PEO review cycle has not been reached	
What is meant by GAs?	Graduate Attributes	Manual of Accreditation 2019 (3.2.2) – PG.

FREQUENTLY ASKED QUESTIONS

Anticipated Questions	Answer	Evidence
PLOs encompass all Graduate Attributes (GAs)		
Do your PLOs cover all the GAs defined by PEC?	Yes, one-to-one mapping	SAR (2.1) – Pg. 37, Prospectus 2020 Pg. 116, Faculty Boards, PLO Folder (Criterion – 2)
Are PLOs properly assessed?	Yes	Course Grade sheets. Sample attached in PLO Folder – Evaluation Section
Do you carry out separate assessment of all PLOs	Yes (both Individual as well as cohort level)	course folders, PLO attainment excel sheets for each batch (available in PC / PLO Folder)
Mapping of courses to PLOs		
Do you have well-defined mapping table of courses vs PLOs?	Yes,	SAR Annex D. Criterion 2 – PLO Folder.
Show evidence of this mapping being implemented in course files	Yes.	Course Outlines, CLO – PLO mapping Matrix in Course Folders.
Teaching/Assessment methods appropriate for PLOs and also reviewed regularly		
How do you ensure that teaching/assessment methods are appropriate for the PLOs?	<ul style="list-style-type: none"> - Appropriate CLOs with respect to the nature of PLOs are formed for each course with dedicated one-to-one mapping of CLOs with PLOs - Then, teaching methods and assessments are given according to the nature of the CLO - Finally Dean reviews the assessment methods at the end of the course 	<ul style="list-style-type: none"> - CLO committee meeting minutes (Criterion3 – Curriculum Folder (C3CF)) - Course Review Form in Course Folders
Can you prove that you use all types of assessments (direct and indirect) in assessing PLO achievement?	<ul style="list-style-type: none"> - Direct assessment via Quizzes, Projects, Mid and Final Exams - Indirect assessment via Survey form from Internship 	<ul style="list-style-type: none"> - Course Folders - PLO committee meeting March 16, 2021 meeting minutes (PLO Folder) - Internship excel sheet
Convince us that your program uses problem-based learning methods throughout	CEP, OEL and semester projects are some of the avenues via which problem-based learning is given. Program Learning Outcomes	<ul style="list-style-type: none"> - Relevant Course Folders

FREQUENTLY ASKED QUESTIONS

Anticipated Questions	Answer	Evidence
A high-quality process in place to evaluate PLO attainment		
How is PLO attainment evaluated?	<ul style="list-style-type: none"> - Data of PLO attainment in each course is put into a central OBE attainment excel sheet for each batch - PLO committee sits every year in summers to review PLO attainment at both students and cohort level 	<ul style="list-style-type: none"> - PLO Assessment in Course Folders - Batch-wise PLO data Excel Sheets - PLO committee annual meeting minutes (PLO Folder)
How often is that done	Annually	SAR (2.5) – Pg. 41
Is PLO assessment and analysis done on all three levels (student, course, program)?	<p>Student level – yes, student level PLO attainment assessment done in the annual PLO committee meeting in Summers</p> <p>Course level – from future, via Course Review form</p> <p>Program level – yes, cohort level PLO attainment assessment done in the annual PLO committee meeting in Summers</p>	<p>Student – PLO assessment data in course folders, batch-wise PLO excel sheets, student PLO CQI forms</p> <p>Program Level – batch-wise PLO excel sheets, PLO committee annual CQI form (CQI/PLO-AT/F-01) (PLO folder)</p>
Documentary evidence of the entire evaluation process on three levels	<p>Student level</p> <p>Course level</p> <p>Program level</p>	<p>Student – PLO assessment data in course folders, batch-wise PLO excel sheets, student PLO CQI forms (PLO CQI Folder)</p> <p>Program Level – batch-wise PLO excel sheets, PLO committee annual CQI form (CQI/PLO-AT/F-01) (PLO folder)</p>
Evidence of corrective actions taken on all three levels?	<p>Student level</p> <p>Course level</p> <p>Program level</p>	<p>Student Level – Advisor Emails + Student submissions (PLO CQI Folder)</p> <p>Last year PLO Committee form</p> <p>Program Level – PLO committee annual CQI form (CQI/PLO-AT/F-01) (PLO Folder)</p>
Evidence that QEC, Dean/OBE-coordinator, and advisors were involved?	Meetings	<ul style="list-style-type: none"> - PLO committee annual CQI form (CQI/PLO-AT/F-01) (PLO Folder) (PLO folder) - Emails to and from the advisors (PLO CQI folder)

FREQUENTLY ASKED QUESTIONS

Anticipated Questions	Answer	Evidence
A high-quality process in place to evaluate PLO attainment		
Are the KPIs being achieved? If not, what is the plan?	- Students not achieving KPI are given reminders/tasks to make-up for it - Achieved at cohort level for cycles run in 2019 and 2020	- student PLO CQI forms (PLO CQI Folder) - PLO committee annual CQI form (CQI/PLO-AT/F-01) (PLO Folder) (PLO folder)
How exactly does the program use PLO attainment evaluations to improve itself?	PLO attainment score at cohort level is used to come up with recommendations for improvements in the program curriculum. For example, in 2020 PLO committee annual meeting, it was suggested to increase the frequency of courses for some courses	- PLO committee annual CQI form (CQI/PLO-AT/F-01) (PLO Folder) (PLO folder)
Do you have documents showing analysis of results of PLO evaluation?	Yes	Student – PLO assessment data in course folders, batch-wise PLO excel sheets, student PLO CQI forms (PLO CQI Folder) ***Course Level – PLO assessment data in Course folders, Course Review form from future Program Level – batch-wise PLO excel sheets, PLO committee annual CQI form (CQI/PLO-AT/F-01) (PLO folder)
Do you have documents showing PLO evaluation-based recommendations for improvement in assessment methods?	PLOs are related to the CLOs in the courses. Based on CLO attainment, Dean recommends review of assessment methods used in the courses.	Course Review Forms in Course Folders
Do you have documents showing actions taken on all (or some) recommendations?	*** Need forms for this, which will ensure that action is taken against the recommendations given by the CLO/PLO team and/or Dean.	
Do you have documents showing PLO evaluation based recommendations for updating defined KPIs and/or the evaluation process itself?	KPIs for CLOs have been increased for some courses where KPIs were consistently met for a few years. Program Learning Outcomes	***** Course folders, but we need to identify the courses which have taken this measure and then put their old and updated KPIs as evidence

The image features a black background with several white, thin, overlapping geometric lines on the left side. These lines form various polygons and intersect at several points, creating a complex, abstract pattern. The lines are primarily oriented vertically and diagonally.

THANK YOU