

NED University of Engineering and Technology

Department of Biomedical Engineering

Bachelor of Engineering in Biomedical

**DEPARTMENTAL OUTCOME BASED EDUCATION (OBE)
CATALOGUE**

Batch 2021 and Onwards

Contents

1. Vision Statement.....	3
2. Mission Statement.....	3
3. Program Educational Objectives (PEOs).....	3
4. Mapping of PEOs to University and Departmental Vision and Mission	4
5. Program Learning Outcomes (PLOs)	5
6. Mapping of PLOs to PEOs.....	6
7. Scheme of Studies of Biomedical Engineering.....	7
8. Mapping of Curriculum to PLOs	10
9. Key Performance Indicators (KPIs).....	12
10. Continuous Quality Improvement (CQI)	13
11. Course Profiles.....	15

1. Vision Statement

a. University Vision

Be a leader in enabling Pakistan's social and economic transformation.

b. Department Vision

To be a leader in disseminating insightful knowledge and facilitating distinguished research in the field.

2. Mission Statement

a. University Mission

Acquire education and research excellence in engineering and allied disciplines to produce leadership and enabling application of knowledge and skills for the benefit of the society with integrity and wisdom.

a. Programme Mission

To produce graduates able to strengthen the Biomedical Engineering and allied sciences through a combination of educational, professional, and ethical values, and driving innovation by taking leadership roles in academia and industry.

3. Program Educational Objectives (PEOs)

Graduates of the BE Biomedical Engineering programme at NED University of Engineering and Technology will demonstrate:

PEO-1: Knowledge and skills to analyze problems and provide solutions aimed at improving the quality of life using state-of-the-art technology.

PEO-2: Leadership and interpersonal skills with ethical values for industrial and academic growth.

PEO-3: Dynamism to enhance careers by embarking on a lifelong journey of expanding knowledge, bringing about global sustainability along with societal impact.

4. Mapping of PEOs to University and Departmental Vision and Mission

Vision and Mission		Program Educational Objectives (PEOs)		
		PEO-1	PEO-2	PEO-3
University Vision	Be a leader ² in enabling Pakistan's social ³ and economic transformation ¹ .	✓	✓	✓
University Mission	Acquire education and research excellence in engineering and allied disciplines to produce leadership ² and enabling application of knowledge and skills ¹ for the benefit of the society ³ with integrity and wisdom.	✓	✓	✓
Department's Vision	To be a leader ² in disseminating insightful knowledge ¹ and facilitating distinguished research in the field ³ .	✓	✓	✓
Programme's Mission	To produce graduates able to strengthen the Biomedical Engineering ¹ and allied sciences through a combination of educational, professional, and ethical values, and driving innovation by taking leadership ² roles in academia and industry ³ .	✓	✓	✓

5. Program Learning Outcomes (PLOs)

The following graduate attributes as defined by PEC, have been adopted as Program Learning Outcomes (PLOs) by the department.

PLO-1 Engineering Knowledge: An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PLO-2 Problem Analysis: An ability to identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PLO-3 Design / Development of Solutions: An 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: An 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: An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations.

PLO-6 The Engineer and Society: An 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: An 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: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PLO-9 Individual and Teamwork: An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.

PLO-10 Communication: An 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: An 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: An ability to recognize importance of and pursue lifelong learning in the broader context of innovation and technological developments.

6. Mapping of PLOs to PEOs

Program Learning Outcomes (PLOs)	Program Educational Objectives (PEOs)		
	PEO-1	PEO-2	PEO-3
PLO 1: Engineering Knowledge	✓		
PLO 2: Problem Analysis	✓		
PLO 3: Design / Development of solutions	✓		
PLO 4: Investigation			✓
PLO 5: Modern Tool Usage	✓		
PLO 6: The Engineer and Society			✓
PLO 7: Environment and Sustainability			✓
PLO 8: Ethics		✓	
PLO 9: Individual and Team Work		✓	
PLO 10: Communication		✓	
PLO 11: Project Management		✓	
PLO 12: Lifelong Learning			✓

7. Scheme of Studies of Biomedical Engineering

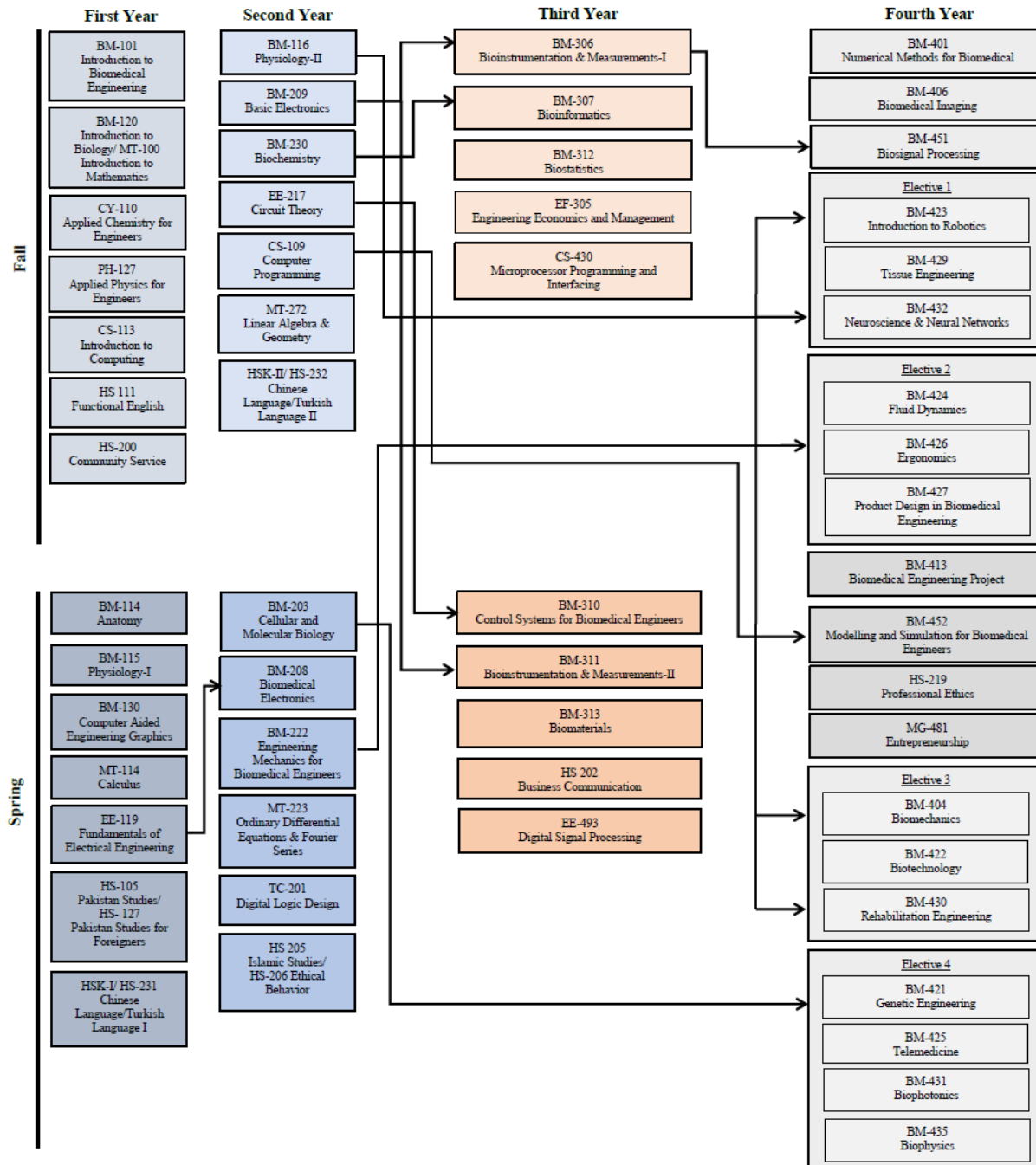
Biomedical Engineering									
First Year									
Fall Semester					Spring Semester				
Course Code	Course Title	Credit Hrs			Course Code	Course Title	Credit Hrs		
		Th	Pr	Total			Th	Pr	Total
BM-120/ MT-100	Introduction to Biology (3+1) or Introduction to Mathematics (4+0)	4	0	4	MT-114	Calculus	3	0	3
BM-101	Introduction to Biomedical Engineering	1	0	1	EE-119	Fundamentals of Electrical Engineering	3	1	4
CY-110	Applied Chemistry for Engineers	2	1	3	BM-114	Anatomy	3	1	4
PH-127	Applied Physics for Engineers	2	1	3	BM-115	Physiology-I	2	1	3
CS-113	Introduction to Computing	1	1	2	HS-105/ HS-127	Pakistan Studies (PS)/ PS for Foreigners	2	0	2
HS-111	Functional English	2	0	2	BM-130	Computer Aided Engineering Graphics	1	1	2
					HSK-I /HS-231	Chinese Language / Turkish Language I	NC		
Total		12	3	15	Total		14	4	18
Second Year									
Fall Semester					Spring Semester				
Course Code	Course Title	Credit Hrs			Course Code	Course Title	Credit Hrs		
		Th	Pr	Total			Th	Pr	Total
EE-217	Circuit Theory	2	0	2	BM-222	Engineering Mechanics for Biomedical Engineers	3	0	3
BM-209	Basic Electronics	3	1	4	MT-223	Ordinary Differential Equations & Fourier Series	3	0	3
CS-109	Computer Programming	2	1	3	BM-203	Cellular and Molecular Biology	2	0	2
MT-272	Linear Algebra & Geometry	3	0	3	TC-201	Digital Logic Design	2	1	3
BM-230	Biochemistry	2	1	3	HS-205/ HS-206	Islamic Studies or Ethical Behavior	2	0	2
BM-116	Physiology-II	2	1	3	BM-208	Biomedical Electronics	3	1	4
HSK-II /HS-232	Chinese Language / Turkish Language II	NC			HS-200	Community Service	NC		
Total		14	4	18	Total		15	2	17

Third Year									
Fall Semester					Spring Semester				
Course Code	Course Title	Credit Hrs			Course Code	Course Title	Credit Hrs		
		Th	Pr	Total			Th	Pr	Total
BM-312	Biostatistics	2	1	3	BM-310	Control Systems for Biomedical Engineers	2	1	3
EF-305	Engineering Economics and Management	3	0	3	BM-311	Bioinstrumentation & Measurements-II	3	1	4
BM-306	Bioinstrumentation & Measurements-I	3	1	4	HS-202	Business Communication	3	0	3
CS-430	Microprocessor Programming and Interfacing	3	1	4	BM-313	Biomaterials	3	1	4
BM-307	Bioinformatics	2	1	3	EE-493	Digital Signal Processing	3	1	4
Total		13	4	17	Total		14	4	18
Final Year									
Fall Semester					Spring Semester				
Course Code	Course Title	Credit Hrs			Course Code	Course Title	Credit Hrs		
		Th	Pr	Total			Th	Pr	Total
BM-###	<i>Elective 1</i>	2	1	3	BM-413	Biomedical Engineering Project	0	3	3
BM-401	Numerical Methods for Biomedical Engineering	3	0	3	MG-481	Entrepreneurship	3	0	3
BM-406	Biomedical Imaging	2	1	3	BM-452	Modelling and Simulation for Biomedical Engineers	2	1	3
BM-451	Biosignal Processing	2	1	3	BM-###	<i>Elective 3</i>	2	1	3
BM-###	<i>Elective 2</i>	3	0	3	HS-219	Professional Ethics	2	0	2
BM-413	Biomedical Engineering Project*	0	3	3	BM-###	<i>Elective 4</i>	3	0	3
Total		12	6	18	Total		12	5	17

* Duration one academic year: Requires literature survey and preliminary work during this Semester

ELECTIVES				
Course Code	Course Name	Credit Hours		
		Theory	Practical	Total
Elective 1				
BM-423	Introduction to Robotics	2	1	3
BM-429	Tissue Engineering	2	1	3
BM-432	Neuroscience & Neural Networks	2	1	3
Elective 2				
BM-424	Fluid Dynamics	3	0	3
BM-426	Ergonomics	3	0	3
BM-427	Product Design in Biomedical Engineering	3	0	3
Elective 3				
BM-404	Biomechanics	2	1	3
BM-422	Biotechnology	2	1	3
BM-430	Rehabilitation Engineering	2	1	3
Elective 4				
BM-421	Genetic Engineering	3	0	3
BM-425	Telemedicine	3	0	3
BM-431	Biophotonics	3	0	3
BM-435	Biophysics	3	0	3

Mapping of Pre-requisite Courses



8. Mapping of Curriculum to PLOs

		BE Biomedical Engineering Courses		Program Learning Outcomes (PLOs)												
		Course Code	Course Title	PLO-1	PLO-2	PLO-3	PLO-4	PLO-5	PLO-6	PLO-7	PLO-8	PLO-9	PLO-10	PLO-11	PLO-12	
First Year	Fall	BM-120	Introduction to Biology (3+1) or	C1	C2											
		MT-100	Introduction to Mathematics (4+0)	C1	C2											
		BM-101	Introduction to Biomedical Engineering	C1					C2		C2					
		CY-110	Applied Chemistry for Engineers	C2,P3	C3											
		PH-127	Applied Physics for Engineers	C2,P3	C3											
		CS-113	Introduction to Computing	C2				P2								
	HS-111	Functional English										A3,C2	C6			
	Spring	MT-114	Calculus	C1	C2,C3											
		EE-119	Fundamentals of Electrical Engineering	C1	C3		P2									
		BM-114	Anatomy	C2	C3							C4				
		BM-115	Physiology-I	C1,C2	P1										C2	
		HS-105/ HS-127	Pakistan Studies (PS)/ PS for Foreigners						C2							C2
		BM-130	Computer Aided Engineering Graphics	C2				P3								
HSK-I /HS-231	Chinese Language/ Turkish Language I															
Second Year	Fall	EE-217	Circuit Theory	C2	C3											
		BM-209	Basic Electronics	C1	C2			P2				A3				
		CS-109	Computer Programming	C2		C3		C3								
		MT-272	Linear Algebra & Geometry	C2	C3											
		BM-230	Biochemistry	C1			C3				P3					
		BM-116	Physiology-II	C2,P1			C4							C2		
	HSK-II /HS-232	Chinese Language/ Turkish Language II														
	Spring	BM-222	Engineering Mechanics for Biomedical Engineers	C2	C3		C3									
		MT-223	Ordinary Differential Equations & Fourier Series	C2	C3											
		BM-203	Cellular and Molecular Biology	C1								A3	C2			
		TC-201	Digital Logic Design	C2		C4	P3									
HS-205/ HS-206		Islamic Studies or Ethical Behavior									C2					
BM-208	Biomedical Electronics	C2		C5		P3								C2		
HS-200	Community Service							A3							A2	

		BE Biomedical Engineering Courses		Program Learning Outcomes (PLOs)												
		Course Code	Course Title	PLO-1	PLO-2	PLO-3	PLO-4	PLO-5	PLO-6	PLO-7	PLO-8	PLO-9	PLO-10	PLO-11	PLO-12	
Third Year	Fall	BM-312	Biostatistics	C2	C2				P3						C3	
		EF-305	Engineering Economics and Management							C2	C1				C3	
		BM-306	Bioinstrumentation & Measurements-I	C2		P3							A4		C5	
		CS-430	Microprocessor Programming and Interfacing	C3	C4			C3								
		BM-307	Bioinformatics	C2			C4			C2						
	Spring	BM-310	Control Systems for Biomedical Engineers	C2	C3		C5						P2			
		BM-311	Bioinstrumentation & Measurements-II	C1		C2			P2	A4						
		HS-202	Business Communication										A3,C3 C6			
		BM-313	Biomaterials	C1		C2		P1		C3						
EE-493	Digital Signal Processing	C1		C6	C4,P3											
Fourth Year	Fall	BM-xxx	Elective 1	C2	P2						C2					
		BM-401	Numerical Methods for Biomedical Engineering	C3	C4		C3									
		BM-406	Biomedical Imaging	C2	C3		P3		A4							
		BM-451	Biosignal Processing	C2	P3					C3						
		BM-xxx	Elective 2	C1					C2							C2
		BM-413	Biomedical Engineering Project		C	C				C	A	A	A	A	A	
	Spring	BM-413	Biomedical Engineering Project		C	C					A	C,A	C,A	C	C	
		MG-481	Entrepreneurship								A3			C3	C2	
		BM-452	Modelling and Simulation for Biomedical Engineers	C2			C4			A4					P2	
		BM-xxx	Elective 3	C3	P2				C3							
		HS-219	Professional Ethics								C2,C3 A3					
		BM-xxx	Elective 4	C1					C2							C2
		Internship	C	C				A		A	A	A				

9. Key Performance Indicators (KPIs)

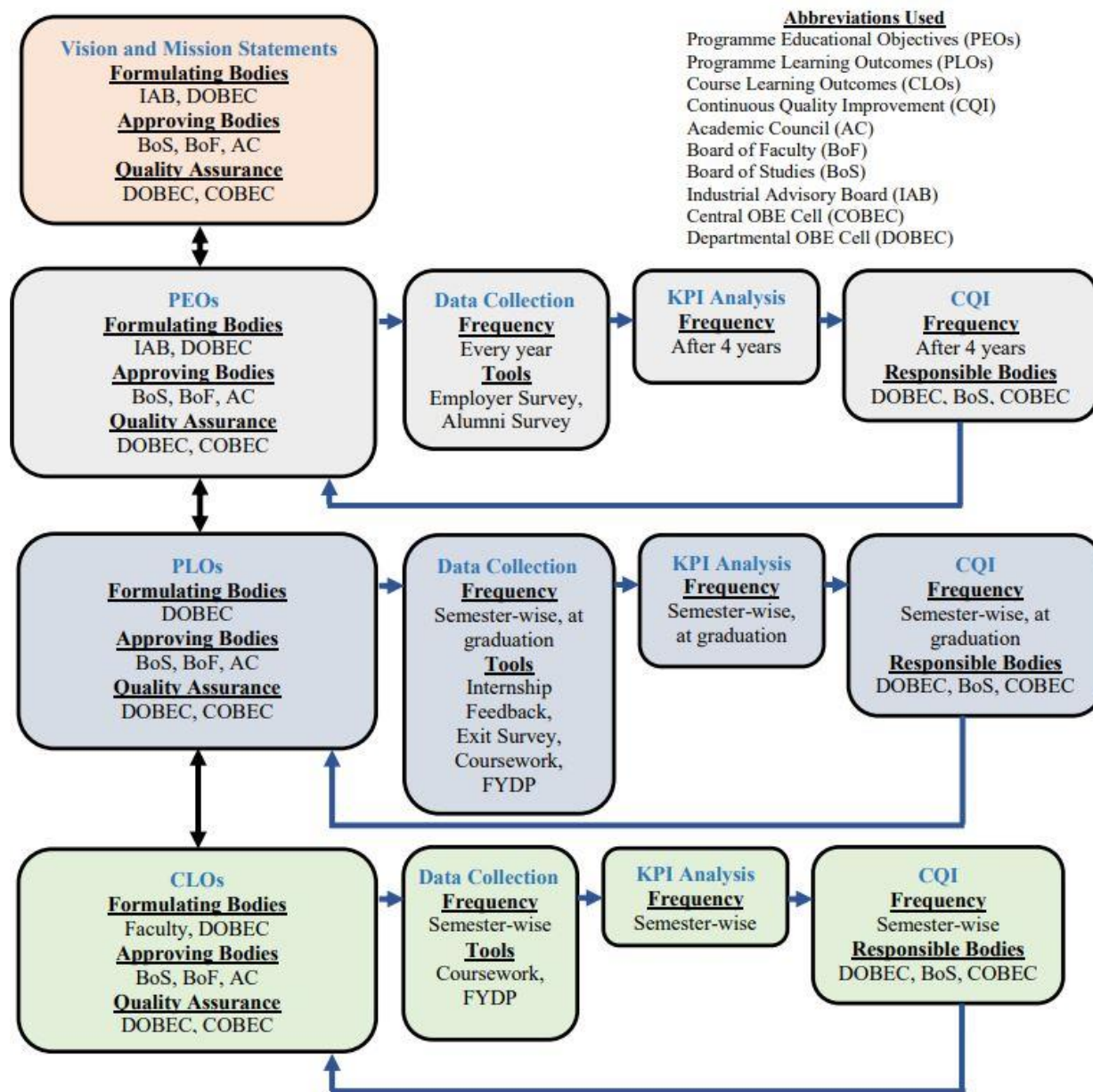
		Evaluation Tool	KPI	Data Collection Frequency	Analysis Frequency
PEO	Programme	<ul style="list-style-type: none"> ▪ Employer Feedback Survey ▪ Alumni Feedback Survey ▪ Employment Statistics 	50% of the Survey Form responses must attain a score of 3 or above (on a scale of 1 to 5), and 50% of the graduates must be employed and/or engaged in higher studies.	Every Year	4 years from graduation
PLO	Student	<ul style="list-style-type: none"> ▪ CLO scores of the student in the mapped course(s) 	Each PLO must be attained in at least 50% of the respective mapped course(s), with an average score of at least 50%.	Every Semester	Every Semester
	Course	<ul style="list-style-type: none"> ▪ PLO scores of all the students in the mapped course 	At least 50% of the students must attain that PLO	Every Semester	Every Semester
	Programme	<ul style="list-style-type: none"> ▪ Final PLO attainment statistics of all the courses including FYDP ▪ Internship Feedback Form ▪ Exit Survey 	At least 50% of the mapped courses must attain the PLO and at least 50% of the students/ responses must attain a score of 3 or above on a scale of 1 to 5.	At graduation	At graduation
CLO	Student	<ul style="list-style-type: none"> ▪ Course work 	The student must obtain at least 50% average percentage score from all attempts.	Every Semester	Every Semester
	Course	<ul style="list-style-type: none"> ▪ CLO scores of all students in the course 	At least 50% of the students must attain that CLO	Every Semester	Every Semester

10. Continuous Quality Improvement (CQI)

The following table shows the post KPI evaluation actions, severity-wise, as outlined in the Manual of Uniform OBE Framework.

	PEO CQI	PLO CQI			CLO CQI	
	Program KPI	Student KPI	Course KPI	Programme KPI	Student KPI	Course KPI
KPIs Achieved	<ul style="list-style-type: none"> ▪ No Action 	<ul style="list-style-type: none"> ▪ No Action 	<ul style="list-style-type: none"> ▪ No Action 	<ul style="list-style-type: none"> ▪ No Action 	<ul style="list-style-type: none"> ▪ No Action 	<ul style="list-style-type: none"> ▪ No Action
KPIs Not Achieved	<ol style="list-style-type: none"> 1. Review of curriculum strategies. 2. Review of assessment methods. 3. Review of the relevant KPIs. 4. Review of PEOs. 5. Revisions implemented. 	<ol style="list-style-type: none"> 1. Warning through the progressive attainment sheet. 2. Student counselling. 	<ol style="list-style-type: none"> 1. Review of teaching and learning process. 2. Review of CLOs assessment methods. 3. Review of CLO-PLO mapping and the relevant KPIs. 4. Review of curriculum design. 5. Revisions implemented 	<ol style="list-style-type: none"> 1. Review of teaching and learning process. 2. Review of PLOs assessment methods. 3. Review of Course-PLO mapping and the relevant KPIs. 4. Review of curriculum design. 5. Revisions implemented 	<ol style="list-style-type: none"> 1. Student provided further chances through direct assessment tools. 2. Student counselling 	<ol style="list-style-type: none"> 1. Review of CLO assessment methods. 2. Review of CLOs and taxonomy levels. 3. Review of students' course feedback. 4. Review of CLO KPIs. 5. Faculty advice by Departmental OBE Cell. 6. Faculty training.

The following figure shows the overall OBE framework for an Engineering Programme as outlined in the Manual of Uniform OBE Framework.



11.Course Profiles

Course Profiles for Batch 2021 and Onwards