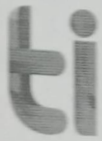

THAPAR INSTITUTE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

Professor & Head
Department of Civil Engineering
Thapar Institute of Engineering & Technology
Patiala-147004, Punjab

Contents

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1. Process of Program outcome attainment:

The Program Outcomes (PO) or the Program Specific Outcomes (PSO) are achieved through curriculum that offers a number of mandatory courses as well as elective courses. Each course in the curriculum has defined course outcomes that are mapped to the program outcomes and a set of performance criteria that are used to provide quantitative measurement of how well course outcomes are achieved. The process of PO or PSO attainment level is shown by the following flowchart:

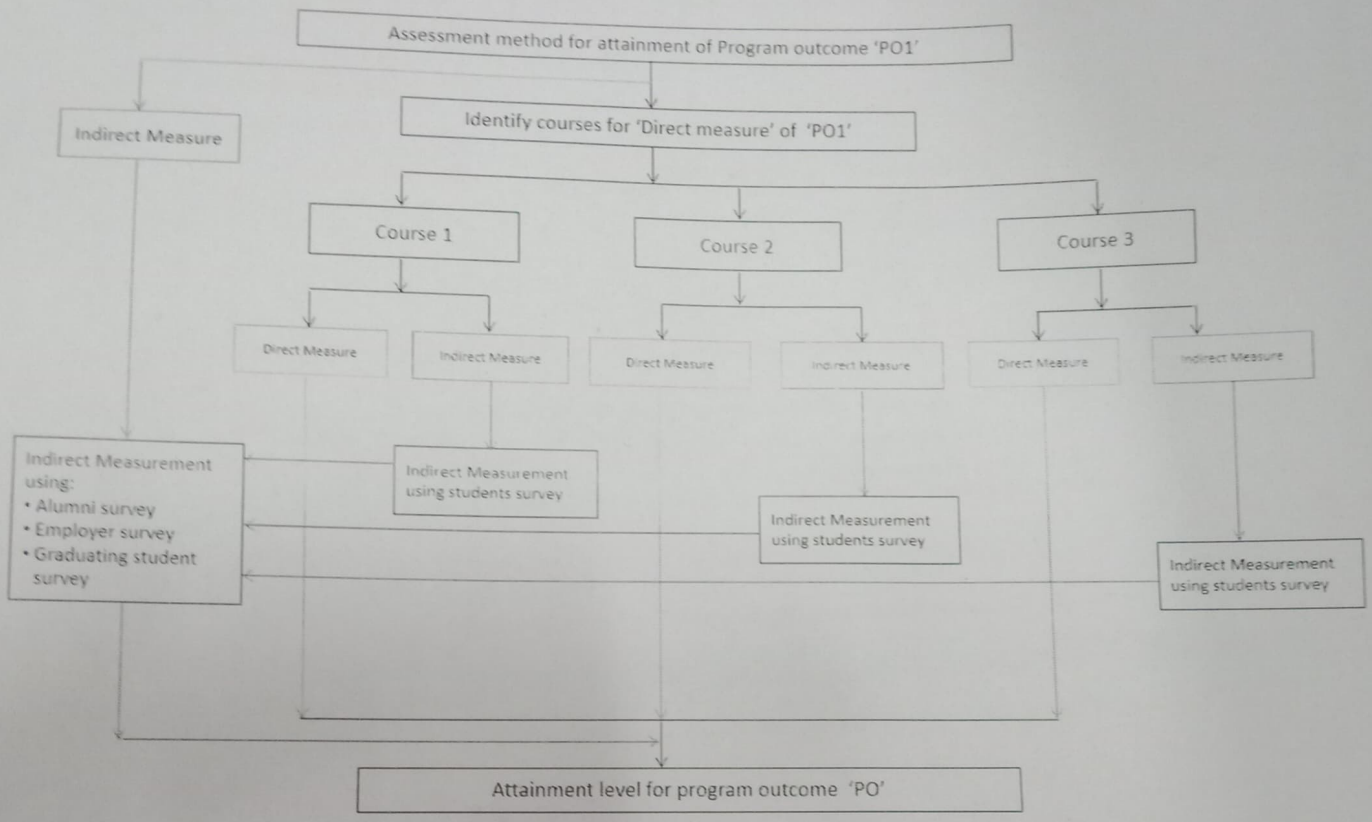

Figure 1 Flowchart showing the process of PO/PSO attainment level

As shown in the flowchart given above, each of the PO or the PSO are assessed using a direct and an indirect method.

This assessment is carried out using the following measurable and quantitative parameters and survey/questionnaire techniques/tools.

1.1 Assessment Tools used for measurement of Program Outcome attainment:

In the Outcome Based Education (OBE), the course outcome attainment scores measured using direct and indirect assessment tools is eventually used for measuring the attainment of Program Outcomes and Program specific outcomes. Thus, PO and PSO assessment process uses both direct and indirect measures to measure the attainment of each outcome. The examples of such measures are given below:

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ANNEXURE-I

SAMPLE FILLED STUDENT SURVEY FORMS:

Survey form to assess the level of attainment of program outcomes – Graduating Students

The program of BE Civil Engineering has been designed with certain program outcomes (the knowledge, skills and attitudes that students develop during the course of study). The students of graduating class are requested to answer the questionnaire given in this form to assess how well they judge they have attained the student outcomes set for the program. Please answer the questionnaire on a scale of 1 to 5 where 1 indicates little achievement or skill, and 5 indicates great deal of achievement.

	Survey questionnaire	Level of attainment (answer on a scale of 1 to 5)				
	I will be able to:	1	2	3	4	5
1	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.					✓
2	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 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	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	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	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	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.					✓
8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.					✓
9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.				✓	
10	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	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	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.					✓
PSO1	Evaluate, analyze and formulate a sustainable design of structural components of different types of buildings.					✓
PSO2	Design and devise a construction and management process within the ambit of realistic constraints, to satisfy the requirements of civil infrastructure projects.					✓
PSO3	Analyze and design various aspects of water and water related systems for cleaner and sustainable environment.					✓

What do you plan to do after graduation at TU.? Tick (√) whichever is applicable

(a) Employment (give details like employer name): _____

(b) Higher education (give the title of degree): _____

(c) Entrepreneur (specify): _____

Student Name: Aashima Shahma Regd. No.: 10170213

Suggestion, if any: _____

Survey form to assess the level of attainment of program outcomes – Graduating Students

The program of BE Civil Engineering has been designed with certain program outcomes (the knowledge, skills and attitudes that students develop during the course of study). The students of graduating class are requested to answer the questionnaire given in this form to assess how well they judge they have attained the student outcomes set for the program. Please answer the questionnaire on a scale of 1 to 5 where 1 indicates little achievement or skill, and 5 indicates great deal of achievement.

	Survey questionnaire	Level of attainment (answer on a scale of 1 to 5)				
	I will be able to:	1	2	3	4	5
1	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.		✓			
2	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 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	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	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	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	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.			✓		
8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.			✓	✓	
9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.			✓		
10	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	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	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.			✓		
13	Evaluate, analyze and formulate a sustainable design of structural components of different types of buildings.				✓	
14	Design and devise a construction and management process within the ambit of realistic constraints, to satisfy the requirements of civil infrastructure projects.				✓	
15	Analyze and design various aspects of water and water related systems for cleaner and sustainable environment.			✓		

t do you plan to do after graduation at TU.? Tick (√) whichever is applicable

mployment (give details like employer name): _____

igher education (give the title of degree): _____

ntrepreneur (specify): _____

nt Name: Anshul Regd. No.: 10150267

stion, if any: _____

Survey form to assess the level of attainment of program outcomes – Graduating Students

The program of BE Civil Engineering has been designed with certain program outcomes (the knowledge, skills and attitudes that students develop during the course of study). The students of graduating class are requested to answer the questionnaire given in this form to assess how well they judge they have attained the student outcomes set for the program. Please answer the questionnaire on a scale of 1 to 5 where 1 indicates little achievement or skill, and 5 indicates great deal of achievement.

	Survey questionnaire	Level of attainment (answer on a scale of 1 to 5)				
		1	2	3	4	5
	I will be able to:					
1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.					✓
2	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 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	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	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	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	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.					✓
8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.				✓	
9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.					✓
10	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	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	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.					✓
PSO1	Evaluate, analyze and formulate a sustainable design of structural components of different types of buildings.					✓
PSO2	Design and devise a construction and management process within the ambit of realistic constraints, to satisfy the requirements of civil infrastructure projects.					✓
PSO3	Analyze and design various aspects of water and water related systems for cleaner and sustainable environment.					✓

What do you plan to do after graduation at TU.? Tick (√) whichever is applicable

(a) Employment (give details like employer name): ✓

b) Higher education (give the title of degree): _____

c) Entrepreneur (specify): _____

Student Name: Arpon Handa Regd. No.: 10190246

Suggestion, if any: _____

SAMPLE FILLED EMPLOYER SURVEY FORMS:

Survey form to assess the level of attainment of student outcomes – Employer

Dear Sir

We express our sincere thanks for continually employing our graduate students over the years. We are sure our student are sufficiently equipped not only to take on the real world but also make a better place to live in through responsible and innovative use of technology.

We solicit your feedback on attainment of the student outcomes (the knowledge, skills and attitudes that students develop during the course of study at TIET) of the BE Civil Engineering program. Please answer the following questions on a scale of 1 to 5 where 1 indicates little achievement or skill, and 5 indicates great deal of achievement.

	Survey questionnaire	Level of attainment (answer on a scale of 1 to 5)				
		1	2	3	4	5
	The student has an ability to:					
1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.				✓	
2	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 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	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	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	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	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.			✓		
8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.				✓	
9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.					✓
10	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	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	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.					✓
PSO1	Evaluate, analyze and formulate a sustainable design of structural components of different types of buildings.				✓	
PSO2	Design and devise a construction and management process within the ambit of realistic constraints, to satisfy the requirements of civil infrastructure projects.					✓
PSO3	Analyze and design various aspects of water and water related systems for cleaner and sustainable environment.				✓	

(1) What courses/topics would you like to see offered as UG course at TIET or for continuing education to your staff.

_____

_____

(2) Overall how satisfied are you with BE Civil Engineering program at TIET and in your opinion how well isthe BECivil Engineering program meeting its stated educational objectives. Cross-out whichever not applicable.

Excellent/~~V. good~~/Good/~~Avg~~/~~Poor~~

Your Name and Signature with date: DEVINDER KUMAR DK

Organization Name: SYSTRA INDIA

Suggestion, if any: _____

Survey form to assess the level of attainment of student outcomes – Employer

Dear Sir

We express our sincere thanks for continually employing our graduate students over the years. We are sure our student are sufficiently equipped not only to take on the real world but also make a better place to live in through responsible and innovative use of technology.

We solicit your feedback on attainment of the student outcomes (the knowledge, skills and attitudes that students develop during the course of study at TIET) of the BE Civil Engineering program. Please answer the following questions on a scale of 1 to 5 where 1 indicates little achievement or skill, and 5 indicates great deal of achievement.

	Survey questionnaire	Level of attainment (answer on a scale of 1 to 5)				
		1	2	3	4	5
	The student has an ability to:					
1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.			✓		
2	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 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	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	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	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	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.				✓	
8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.			✓		
9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.			✓		
10	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	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	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.				✓	
PSO1	Evaluate, analyze and formulate a sustainable design of structural components of different types of buildings.				✓	
PSO2	Design and devise a construction and management process within the ambit of realistic constraints, to satisfy the requirements of civil infrastructure projects.					✓
PSO3	Analyze and design various aspects of water and water related systems for cleaner and sustainable environment.				✓	

(1) What courses/topics would you like to see offered as UG course at TIET or for continuing education to your staff.

Required detailed estimation related problems.

(2) Overall how satisfied are you with BE Civil Engineering program at TIET and in your opinion how well isthe BECivil Engineering program meeting its stated educational objectives. Cross-out whichever not applicable.

Excellent/V. good/Good/Avg./Poor

Your Name and Signature with date: Amrinder Singh, Asst. Eng.

Organization Name: PWD, B&R

Suggestion, if any: —

SAMPLE FILLED ALUMNI SURVEY FORMS:

Survey form to assess the level of attainment of student outcomes – Alumni

Dear Alumni

It is wonderful to reconnect with you after a few years. We hope you have been doing exceedingly well in your career. We are sure that your stay with TIET has enabled you to imbibe the process of life-long learning and to take up challenging careers. We are sure you were sufficiently equipped not only to take on the real world but also make it a better place to live in through responsible and innovative use of technology. We need your support to keep the TIET flag flying high. We solicit your feedback on attainment of the student outcomes (the knowledge, skills and attitude that you developed during the course of study at TIET and subsequent work experience) of the BE Civil Engineering program. Please answer the following questions on a scale of 1 to 5 where 1 indicates little achievement or skill, and 5 indicates great deal of achievement.

	Survey questionnaire	Level of attainment (answer on a scale of 1 to 5)				
		1	2	3	4	5
	I achieved an ability to:					
1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.					✓
2	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 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	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	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	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	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.					✓
8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.					✓
9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.					✓
10	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	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	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.					✓
PSO1	Evaluate, analyze and formulate a sustainable design of structural components of different types of buildings.				✓	
PSO2	Design and devise a construction and management process within the ambit of realistic constraints, to satisfy the requirements of civil infrastructure projects.				✓	
PSO3	Analyze and design various aspects of water and water related systems for cleaner and sustainable environment.				✓	

Note: Cross-out whichever not applicable

(1) GATE exam after BE: Passed/Failed/Not taken

(2) Promotion since graduation: Yes/No

(3) Enrollment in higher studies: Yes/No, if yes please answer following

(i) Name of program:_____ (ii) Year of completion:_____

(4) Involvement in professional societies as a _____

(5) Community service, if any: RWA Gurgaon

(6) Overall how satisfied are you with BE Civil Engineering program at TU and in your opinion how well is the BE Civil Engineering program me its stated educational objectives: Excellent/V. good/Good/Avg./Poor

Your Name with signature: Abhijeet/Abi Your current organization: NSIA, Gurgaon.

Regd. No.: 101702002 Year of graduation: 2021

Suggestion, if any:_____

Dear Alumni

Survey form to assess the level of attainment of student outcomes – Alumni

It is wonderful to reconnect with you after a few years. We hope you have been doing exceedingly well in your career. We are sure that your stay with TIET has enabled you to imbibe the process of life-long learning and to take up challenging careers. We are sure you were sufficiently equipped not only to take on the real world but also make it a better place to live in through responsible and innovative use of technology. We need your support to keep the TIET flag flying high. We solicit your feedback on attainment of the student outcomes (the knowledge, skills and attitude that you developed during the course of study at TIET and subsequent work experience) of the BE Civil Engineering program. Please answer the following questions on a scale of 1 to 5 where 1 indicates little achievement or skill, and 5 indicates great deal of achievement.

Survey questionnaire

	I achieved an ability to:	Level of attainment (answer on a scale of 1 to 5)
1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	4
2	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	4
3	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
4	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.	4
5	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.	4
6	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.	4
7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	4
8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	4
9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	4
10	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.	4
11	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.	4
12	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.	4
PSO1	Evaluate, analyze and formulate a sustainable design of structural components of different types of buildings.	4
PSO2	Design and devise a construction and management process within the ambit of realistic constraints, to satisfy the requirements of civil infrastructure projects.	4
PSO3	Analyze and design various aspects of water and water related systems for cleaner and sustainable environment.	4

Note: Cross-out whichever not applicable

(1) GATE exam after BE: Passed/Failed/Not taken

(2) Promotion since graduation: Yes/No

(3) Enrollment in higher studies: Yes/No, if yes please answer following

(i) Name of program: _____ (ii) Year of completion: _____

(4) Involvement in professional societies as a _____

(5) Community service, if any: _____

(6) Overall how satisfied are you with BE Civil Engineering program at TU and in your opinion how well is the BE Civil Engineering program meeting its stated educational objectives: Excellent/V. good/Good/Avg./Poor

Your Name with signature: _____ Your current organization: _____

Regd. No.: 10188206 Year of graduation: 2021

Suggestion, if any: _____

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1.1.1 Direct Assessment tools:

After evaluating the attainment of course outcomes using direct assessment tools (as mentioned in Table2. (a)), average direct CO score for each course is computed. Direct assessment score for attainment ofPO and PSO is computed by mapping the direct CO scores for all courses with corresponding PO's as defined in the Program articulation matrix. Following direct assessment tools are employed for measuring PO /PSO attainment:

- Mid Semester Examinations [Once during 8^{th} or 9^{th} week of a semester]
- End semester Examination [once during 15^{th} week of the semester]
- Tutorial Assignments [Varies depending on the tutorial engagement]
- Quizzes [Mostly once during semester, Varies and is decided by course coordinator]
- Projects [Mostly once during semester, Varies and is decided by course coordinator]

1.1.2 Indirect Assessment tools:

This includes feedbacks from all the stakeholders such as course exit survey, Graduating student survey, alumni feedback, Employer feedback etc.

Table: **Indirect Assessment Tools**

S. No.	Indirect Assessment Tool	Method Description
1	Course Survey [Twice before MST and EST]	Course Survey is completed for every course in each semester to get a formal feedback from students for the courses offered in a semester and provide objective information to the faculty for self-appraisal, self-improvement & development. The course survey is focussed on attainment of course outcomes. Formal student feedback is obtained online and it is mandatory for all students to participate in such surveys. The course survey results are compiled by the individual course instructors for his feedback.
2	Graduating student's survey [Once per year for the graduating batch]	A questionnaire survey is used to measure the level of achievement of expected program outcomes/program specific outcomes. It is mandatory for all graduating students to participate in this questionnaire. Each participant is asked to rate his/her perception of achievement of the program outcomes/program specific outcome on a scale of 1 to 5 where 1 signifies a poor outcome and 5 signifies a high level of achievement of objectives. The indirect CO scores measured through this tool are mapped to Likert scale of 1 to3. The assessment results are documented

		and discussed in the meeting of department faculty to make action points for initiating corrective and preventive actions. A sample filled copy of graduating students' survey form is provided in Annexure-I
3	Alumni survey [Once in three years]	It is believed that the perception of students changes from the time of graduation to some point in their respective careers as they get more mature and have learnt tricks of the trade on the job. At this point of time, they are in a better position to provide more valuable and objective feedback on the learning in their undergraduate program and also how much of the program outcomes (on some scale) have actually been possible. To obtain this information, a survey is conducted for practicing alumni who graduated during the last 2 to 5 years. This survey like the graduating student survey is targeted at the program outcomes & program specific outcomes achieved during the last 2 to 5 years. Again, the respondents are asked to rate each PO and PSO on a scale of 1 to 5. The indirect CO scores measured through this tool are mapped to Likert scale of 1 to3. The findings of the survey are processed and used for effecting improvements in the program to achieve the program educational objectives and program outcomes.
4	Employer survey [Once in three years]	All the students of program to be accredited are required to spend a full six month's semester in the industry completing an industrial project under the joint supervision of industry supervisors and TIET faculty. All the faculty members are required to visit one or two organizations two times during their six month's semester in the industry for evaluation of students placed for their work term in these organizations. This provides an opportunity to take feedback of our graduated students working in these organizations. During the course of interaction with the employer of our students, the employers provide information on their performance against POs &PSOsthrough survey form. This form, like the other forms, has questions related to the POs & PSOs. The rating is again given on a scale of 1 to 5 with 5 representing the best performance. The indirect CO scores measured through this tool are mapped to Likert scale of 1 to3.A sample copy of filled employer survey form is provided in Annexure-I

2Processes used for measurement of Program Outcome attainment:

CO Attainment scores for each subject obtained by direct assessment tools is mapped tocorrelatedPO or PSO using the course articulation matrix.Similarly, CO attainment scores achieved through indirect assessment tools are also mapped with the correlated PO or PSO.

PO/PSO Attainment (Direct Assessment) $= \left[\frac{\text{PO\_CO Mapping}}{3} \times CO\ Attainment\ (Direct\ Assessment\right]$

PO/PSO Attainment (Indirect Assessment) $= \left[\frac{\text{PO\_CO Mapping}}{3} \times CO\ Attainment\ (Indirect\ Assessment\right]$

Attainment for a program outcome is finally computed by taking weighted average of contributions of participating courses towards that particular PO or PSO.

Finally, program outcomes for entire course is assessed by taking weighted sum of direct and indirect assessment as

Overall PO/PSO = 80% weightage of direct PO Score + 20% weightage of Indirect PO Score

Table 1 below shows the frequency of data collection of each form.

Table 1: Assessment tools, frequency of data collection and weightage

Assessment Tool	When data is collected	Frequency of Data Analysis	Weightage
Course Portfolio	During the semester	Once in a year	**5**
Course Survey	End of the semester	Once in a year	**4**
Graduating Student's Survey	End of the program	Once in a year	**3**
Alumni Survey	After 2-5 year of graduation	Once in 3 years	
Employer Survey		Once in 3 years	

On the basis of results of assessment tools, the assessment of level of attainment of each PO or PSO outcome is carried out. The assessment loop for each program outcomes is shown in Figure 2.2

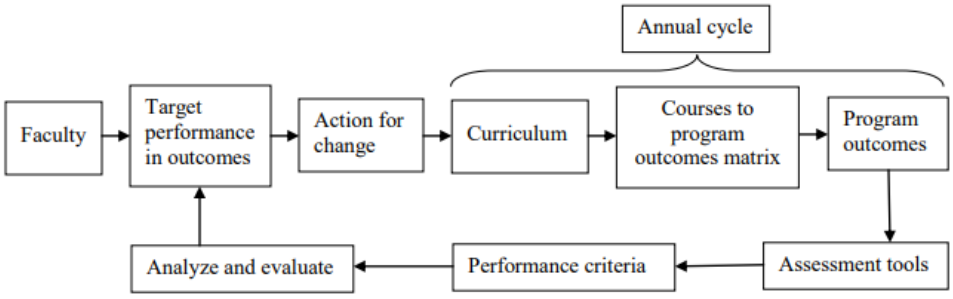


Figure 2 Assessment loop for PO/PSOActions taken based on the results of evaluation of each of the COs, POs & PSOs

Based on the CO, PO, and PSO attainment levels, subjects were identified whose CO attainment level was low but weightage towards calculation of a PO/PSO level was high. For such subjects, the concerned faculty prepared an Action Taken Report (ATR), providing details of reasons for the low attainment level and the actions to improve upon the same (please see Table 2).

Table 2: POs & PSOs Attainment Levels and Actions for improvement (2022-23)

POs	**Target Level**	**Attainment Level**	**Observations**
PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems			
PO1	**2.10**	**2.66**	For PO1, the target level has been achieved. A total of 43 subjects were considered for calculating the attainment level of PO1. Though the attainment level was higher than the set target, but there is always a scope for further improvement, as contribution of **two**subjects (UMA035, UCE613) was observed to be low. Thus, the attainment level of PO1 can be further improved by taking actions so as to improve the attainment level of COs of the above-mentioned courses.ATR for these courses are given below. It is also observed that PO1 score can further be improved by giving attention to the courses: UCE310, UCE501 as individual CO scores in each of these courses also show a scope of improvement. The observations and actions pertaining to these subjects are as given below:

Subject Name: Fluid Mechanics

Subject Code: UCE 310

Name of Teacher submitting the ATR: Dr. Sarbjit Singh

Reasons for low attainment of CLO:

- Fluid Mechanics is an analytical and conceptual subject requiring the thorough understanding of the topics and sufficient practice of solving the large variety of conceptual problems before the examination. A single day of study either before the exam or studying during reading week is not sufficient to clear the concepts. It requires regular solving the tutorial sheets.
- To overcome this difficulty, a tutorial class was reintroduced in the subject and a number of problems from each topic were discussed in the class. Probably, the majority of the students did not understand the importance of practicing solving the questions. The students were encouraged to ask doubts in the class and the students who were solving the problems regularly scored good marks in the exam.
- The analytical capability of the students was low and a number of them did not attend the lecture and tutorial classes regularly.

Actions taken for improvement:

A1. The students will be encouraged to attend the classes regularly and the importance of practicing solving the questions.

A2. Individual personal attention will be given to the academically weak students in the tutorial class.

Subject Name: Optimization Techniques

Subject Code: UMA035//UMA031

Name of Teacher Submitting the ATR: Mahesh Kumar Sharma

Reasons for the low attainment of CO:

1. The syllabus required good prerequisite knowledge and the students have to complete a significant portion of their prerequisite syllabus in the online mode due to pandemic. In view of this students did selective preparation of the topics of prerequisite course (As per the institute policy - during the pandemic period - in the End semester examination (EST) the students were given the option to attempt 5 out for 7 questions) . So, their prerequisite knowledge was not up to that mark to understand many topics in subject.

2. The syllabus is common to all branches of B.E/B.Techand from the branches like civil engineering and chemical engineering were from the lower side of merit in comparison to the other branches of engineering, so some of the topics (Non-linear and multi objective

programming) were totally ignored by large number of students (CLO 4 and CLO 5) due to higher difficulty level.

Action Taken for Improvement:

3. The major problems are temporary and situational. This issue will be gradually and automatically solved with time.

4. To improve CLO4 and CLO5, It is advised to revise the syllabus and to make it branch specific.
5. A crash course on pre-requisite for LEET students will be introduced

Subject Name: Hydraulic Engineering

Subject Code: UCE 614

Name of Teacher submitting the ATR: Dr. Sarbjit Singh

Reasons for low attainment of CLO 2:

1. CLO 2 is mapped with a quiz of 20 minutes based on the whole syllabus and conducted during the last week of the semester. Probably, the students did not devote sufficient time for revising the whole syllabus due to sessionals of other subjects (although the students were informed in the beginning of the semester about the date of quiz).

Action taken for improvement:

2. Try to avoid this type of situation

Subject Name: Design of Hydraulic Structures

Subject Code: UCE806

Name of Teacher submitting the ATR: Dr. RichaBabbar

Reasons for the low attainment of CO:

1. CLO 1 deals with several numerical problems that requires practice and active involvement in class tutorials.
2. CLO2 involves the design aspect of hydraulic structures and it is generally found that students fail to conceptualize the problems. Also the implementation part of applying the principles of hydraulics is sometimes lacking.

Action Taken for Improvement:

1. To improve the interaction and activeness in the subject, more home assignments will be given. These would also include a few assignments/problems on hydraulic engineering which can prove useful in the design aspects.
2. Field visits to barrage, cross drainage sites will be arranged so as to enhance the conceptualization of hydraulic structures and their design components.

Subject Name: Solids and Structures

Subject Code: UES010/UES017

Name of Teacher submitting the ATR: Dr. Shruti Sharma

Reasons for low attainment of CLO:

1. CLO1 and CLO3 requires a deep understanding of the basics of mechanics to understand the concept of stresses and strains in solid structural members. Students lack confidence and clarity in Free Body Diagrams and hence, find it difficult to answer various kinds and combinations of stresses in practical Civil engineering problems.
2. CLO4 deals with calculations of deformations and deflection in beams and trusses. I feel that large calculations involved in these problems inhibit their capability to score good marks.

Actions taken for improvement:

1. The students will be delivered Bridge Lectures (1-2 in number) to bring up their understanding level of basics of Mechanics to be applied to Civil Engineering Problems.
2. Bridge Tutorial Sheet (2 in Number) focussing on Mechanics Concepts like FBD's, Revision of SFD and BMD concept is proposed.
3. Additional practice problems over and above Tutorial Sheets are planned to be given.
4. Also doubt removal sessions will be scheduled specially for Lateral Entry Students who really find it difficult since they have not taken Mechanics Course during their Diploma which will help them in understanding the concepts of mechanics and applying them to Solids and Structures.

Subject Name: Numerical and Statistical Computations

Subject Code: UMA012

Name of Teacher submitting the ATR: Dr. Parimita Roy

Reasons for low attainment of CLO:

1. This courses syllabus covers Basic of Errors, Non-Linear Equations, Linear Systems and Eigen-Values, Interpolation and Approximations, Numerical Integration, Numerical solutions to Differential Equations, Curve Fitting and Regression, and Probability Distributions. These topics are relatively new to the students, and some students lacked prerequisite knowledge. Limited class time hindered students; ability to grasp the material and achieve the learning outcomes fully.
2. Lack of Student Engagement as they were interested more in civil engineering core subjects and problems.
3. Classroom Environment (E106, too small for 90 students)

Actions taken for improvement:

1. Offering additional support to students, like clearing doubts even after class.
2. To generate students' interest in the subject, more application-based problems in civil engineering that involve practical scenarios and require engineering analysis and solutions will be considered.

3. Advanced educational technology tools, such as online discussion forums to enhance learning experiences, will be incorporated.
4. Students were motivated to ask any queries (related to the topics of Numerical and Statistical Computations). E-content for Labs was also provided as students were finding difficulty in coding.

Subject Name: Manufacturing Processes

Subject Code: UTA026

Name of Teacher submitting the ATR: Dr. Ratnesh Kumar Raj Singh

Reasons for low attainment of CLO:

This course is a comprehensive program taught across all engineering branches, covering various topics beneficial for students pursuing Engineering. The curriculum encompasses diverse aspects of manufacturing, such as CNC programming, machining, casting, forming,

and welding, demands regular practice and teacher evaluation. However, students from the civil engineering department faced challenges in relating to the course. The students who were not well-versed with basics had faced difficulty in comprehending the subject. Irrespective of many extra as well as doubt sessions students found it difficult to get conceptual clarity. Also, the previous pandemic situation limited interactions among students and their instructors, potentially contributing to an unforeseen decline in their academic performance.

Actions taken for improvement:

1. The lecture classes will become more engaging by incorporating real-world problems,

2. Additional interactive lab sessions will be organized to enhance the learning experience.

3. Frequent formative assessments will be conducted to monitor students &; progress and understanding.

4. Students facing difficulties in problem-solving will be provided with extra sessions to receive support.

5. The next batch will experience a change in pedagogical methods, by providing animated PowerPoint presentations and supplementary learning materials.

6. Students will be encouraged to interact with their course teacher outside of regular class hours for better support and guidance.

7. Lab experiments will be conducted in smaller groups to promote a more focused, hands-on learning environment.

8. The course will be linked to real-time examples to facilitate better comprehension among students.

Subject Name: Architecture Drawing & Building Construction

Subject Code: UCE306

Name of Teacher submitting the ATR: Dr. Himanshu Chawla

Reasons for low attainment of CLO1 and CLO4:

- CLO1 is based on Plan and draw the constructional details of different building components. This requires a deep understanding of concepts, but students spend less time reading.
- CLO4 is "Capable of supervising building constructions". Some students lack imagination and have low confidence, so they are not able to write about the step-by-step process of construction.
- Less contact duration of the lecture class, as the subject needs more contact time.
- Some students lack imagination; therefore they are not able to solve the concept-based questions

Actions taken for improvement:

- More focus on the basics of the construction of building elements
- More practical-oriented class lectures will be adopted.
- For better attainment and understanding of concepts, more examples will be taught.
- Some students lack imagination, so doubt sessions will be arranged to help students solve difficulties with a practical approach in order to increase their imagination and give them the necessary drive to achieve brilliance.

Subject Name: **Basics of materials science**

Subject Code: **UES401**

Name of Teacher submitting the ATR: **Dr. Tirthankar Chakraborty**

Reasons for low attainment of CLO:

- This course does not have tutorial. Hence the students find it difficult to clarify their doubts, especially on topics of crystallography and electromagnetic properties despite of wholehearted willingness of the faculties for the same.
- These students have completed their preparatory years (+1 and +2) during COVID times in online mode. Their basic concepts are not clear due to the pandemic.

Actions taken for improvement:

- The revision of the said course is under process, where a tutorial will be added.
- The instructors have been requested to solve numerical problems in lectures and encourage students to participate in discussions.
- Additional lectures are conducted for LEET students for improve their fundamentals.

Subject Name:Hydrology& Groundwater

Subject Code: UCE401

Name of Teacher submitting the ATR: Dr. RichaBabbar

Reasons for the low attainment of CLO:

1. In this subject, students are required to deal with a lot of experimental data particularly for topics covered in CLO 2. Data is often represented in either tabular form or in the form of graphs. Understanding the data and comprehending the knowledge derived, often becomes difficult for the students.
2. The hydrological variables are expressed in different units and it has been observed that students care less about units and therefore commit mistakes that otherwise could be easily avoided.

Action Taken for Improvement:

1. Sufficient number of numerical problems, mainly drawn from real field study, will be discussed in the tutorial class. The main emphasis will be to discuss how data has been collected, what the likely constraints are and what meaningful conclusions can be drawn from it. With this it is expected that students will be able to relate the data to real life problems and be in a better position to appreciate the hydrology related problems.
2. A hydrology project based on real time data of a specific area has been developed. Students in groups will be asked to work on this real time data and produce data interpretation results in the form of graphs and tables. This will help them to understand the need of unit conversions and also be able to communicate the language of the hydrological variables in a form which is understandable.

Subject Name: Structural Analysis

Subject Code: UCE404

Name of Teacher submitting the ATR: Dr. Gurbir Kaur

Reasons for low attainment of CLO 2:

1. The CLO2 requires knowledge of conventional methods of structural analysis to analyze statically indeterminate beams/structures.

Actions taken for improvement:

1. Students lack basic understanding of drawing shear force diagrams and bending moment diagrams. Doubt sessions will be scheduled specially for such students.
2. Revision of complicated topics/methods from time to time may also prove beneficial for students.
3. Additional questions (based on method of consistent deformation, slope deflection method, moment distribution method) for practice in tutorial sessions.

Subject Name: Soil Mechanics

Subject Code: UCE 501

Name of Teacher submitting the ATR: Dr. Aditya Parihar

Reasons for the low attainment of CLO:

1. Problem solving capacity of students is sub-standard despite increased numerical discussed in lectures and step-by-step solutions explained in tutorial classes.
2. Waiving off detention in previous semester affected the presence in class and needs to be looked at seriously by institute.
3. Contact duration per class must be increased to 60 mins as the subject needs more contact time.

Action Taken for Improvement:

1. More number of questions will be added in the tutorial sheets for better understanding of the topics.
2. Tutorials are revised with more number of questions and with gradually increasing level of difficulty
3. Some of the students may lack imagination, so to boost their imagination and give them the required push to reach the excellence level, doubt removal sessions will be scheduled which will help the students in solving problems with a practical approach.

Subject Name:Innovation& Entrepreneurship

Subject Code: UTA025

Name of Teacher submitting the ATR: Dr. Gurbir Kaur

Reasons for the low attainment of CLO:

1. Innovation and Entrepreneurship is an interesting yet challenging course for the students. The course learning outcome scores low for students' in defining the fundamentals of entrepreneurship. Compared to other components of the course, this is more theoretical in nature and students fail to respond well in it.

Action Taken for Improvement:

2. It has been felt that students perform better when they are asked to perform activities based on some concept of entrepreneurship such as ideation, opportunity evaluation, developing a business model etc. Hence keeping this in view, an activity needs to be proposed that deals with the understanding of the fundamentals of entrepreneurship. Students are already assessing the personality of entrepreneurs based on Big five (OCEAN theory) but in addition to this, students are now encouraged to relate the fundamentals of entrepreneurship with the journey of entrepreneurs. This brings out the relevant features of entrepreneurship that a particular entrepreneur had adopted. This certainty is becoming useful in understanding a theoretical concept.

Subject Name: **Construction Management**

Subject Code: **UCE506**

Name of Teacher submitting the ATR: Dr. Manpreet Singh

Reasons for low attainment of CLO:

1. Lack of practice of calculations of students and unwillingness to study from books.
2. Students not attending regular classes and tutorials.

Actions taken for improvement:

1. More questions will be added in the tutorial sheets for better understanding of the topics.
2. More practice assignments and doubt-solving sessions will be arranged.

Subject Name:Design of Concrete Structure-I

Subject Code: UCE406

Name of Teacher submitting the ATR: Dr Shweta Goyal

Reasons for low attainment of CLO:

1. The design of structural components like flexural members, compression members, foundations etc. involves conceptual understanding, thorough step wise procedure and related calculations. Students missed out at some of these components and could not score well.

Actions taken for improvement:

1. For better attainment /understanding of concepts taught in class to the students, practical approach will be adopted
2. In order to clear the concepts for design, doubt removal sessions will be scheduled which will help the students in solving problems with a practical approach.
3. Sessions will be conducted for teaching the students how to include codal provisions easily in their design problems, Also, steps will be taken so that students understand the flow of design procedure, so that the design can be easily carried out without simply mugging up the steps.
4. The tutorial sheets will be made more comprehensive.

Subject Name: **Transportation Engineering-I**

Subject Code: **UCE511**

Name of Teacher submitting the ATR: **Dr. Tanuj Chopra**

Reasons for low attainment of CLO:

1. Lack of practice of numericals by students.
2. No tutorial class for this subject

Actions taken for improvement:

1. Will try to add tutorial sessions in the course scheme for this course so that more practice assignments / tutorial questions and doubt solving sessions can be arranged.

Subject Name: ADVANCED STRUCTURAL ANALYSIS

Subject Code: UCE507

Name of Teacher submitting the ATR: **Dr. Heaven Singh**

Reasons for low attainment of CLO:

1. Multiple overlapping concepts in analysis methodologies (i.e. stiffness matrix analysis, flexibility matrix analysis, and transformation matrices for both approaches) being taught over a short period of time, resulting in confusion among the students on the difference in analysis procedures.
2. Less effort on the part of students in tutorials to manually solve lengthy analysis problems like formulation of matrices and their application to analysis of structures

Actions taken for improvement:

1. Each analysis methodology follows a consistent defined pattern., this pattern will be pointed out to the students to enable them to understand that all methods of analysis are different ways to achieve the same output.
2. Full length problems to be given to students for practise in tutorial and as assignment submission, while examinations will generally focus on part-problems due to time constraints
3. Introduction of use of coding using Excel or MATLAB in a few lectures to model the matrix methods, to help students cement the concepts being covered in the class theoretically

Subject Name:Foundation Engineering

Subject Code: UCE613

Name of Teacher submitting the ATR: Dr. Aditya Parihar

Reasons for low attainment of CLO:

1. Problem solving capacity of students is substandard despite increased numericals discussed in lectures and step-by-step solutions explained in tutorial classes,
2. Contact duration per class must be increased to 60 mins as it's a design subject and needs more contact time.

Actions taken for improvement:

1. More number of questions will be added in the tutorial sheets for better understanding of the topics.

2. Tutorials are revised with more number of questions and with gradually increasing level of difficulty
3. Some of the students may lack imagination, so to boost their imagination and give them the required push to reach the excellence level, doubt removal sessions will be scheduled which will help the students in solving problems with a practical approach.

Subject Name: Water and Wastewater Engineering

Subject Code: UCE 606

Name of the teacher: Dr. DwarikanathRatha

Reasons for the low attainment of CLO:

1. One of the reasons could be the understanding of the design process of water treatment/sewage treatment system and lack of regular study/practices of hydraulic design of similar kind.
2. Another reason could be the Lack of Prerequisite Knowledge. If students lacked the necessary background knowledge or were not familiar with these prerequisites, they might have struggled to grasp the subject.

Action Taken for Improvement:

1. Supporting learning materials is to be provided to the students.
2. The students need to be persuaded to consider interaction with their teachers or among their peers to improve their concepts / basic understandings.
3. More practice hours will be added for the hydraulic design of the water/sewage treatment plant..

Subject Name: **Transportation Engineering-II**

Subject Code: **UCE605**

Name of Teacher submitting the ATR: Dr. Tanuj Chopra

Reasons for low attainment of CLO:

1. Lack of practice of numericals by students.
2. Students not regular in tutorials.

Actions taken for improvement:

1. More questions will be added in the tutorial sheets for better understanding of the topics.
2. More practice assignments and doubt solving sessions will be arranged.

Subject Name:Design of Steel Structures

Subject Code: UCE609/UCE512

Name of Teacher submitting the ATR: A B Danie Roy

Reasons for low attainment of CLO:

1. Lack of practice and willingness of students to solve the design problem by hand using calculators and IS codes
2. Use of no standardized youtube videos and other resources led the students to a fallow worse procedures and practices which resulted in low attendance and ultimately low attainment.

Actions taken for improvement:

1. Sessions will be conducted for teaching the students how to include codal provisions easily' in their design problems
2. The tutorial problems will contain more by-part problems rather than continuous whole problems
3. For better attainment /understanding of concepts taught in class to the students, practical approach will be adopted
4. Some of the students lack imagination, so to boost their imagination and give them the required push to reach the excellence level, doubt removal sessions will be scheduled which will help the students in solving problems with a practical approach.

Subject Name: **Seismic Resistant Design of Structures**

Subject Code: UCE808

Name of Teacher submitting the ATR: Dr. Trishna Choudhury

Reasons for low attainment of CLO:

1. The CLO4 required a deep understanding of IS 13920 for design and ductile detailing of RC buildings. This requires a basic understanding of designing for flexure and shear to proceed further for ductile provisions.

Actions taken for improvement:

1. More practical oriented class lectures will be adopted for better understanding.
2. More focus on practical examples of design and detailing will be done.
3. Some students lack the basic understanding of design and detailing. So time will be given for brushing up on basic design concepts.

Subject Name:Design of Structures

Subject Code: UCE807

Name of Teacher submitting the ATR: Dr. A B Danie Roy

Reasons for low attainment of CLO:

1. The design of water tank involves more load calculations students are not able to perform well in load calculation.

Actions taken for improvement:

1. For better attainment /understanding of concepts taught in class to the students, practical approach will be adopted
2. Some of the students lack imagination, so to boost their imagination and give them the required push to reach the excellence level, doubt removal sessions will be scheduled which will help the students in solving problems with a practical approach.
3. Sessions will be conducted for teaching the students how to include codal provisions easily' in their design problems
4. The tutorial problems will contain more by-part problems rather than continuous whole problems

Subject Name: Bridge Engineering

Subject Code: **UCE831**

Name of Teacher submitting the ATR: Dr. Heaven Singh

Reasons for low attainment of CLO:

1. Multiple overlapping concepts in design methodologies followed for a different type of bridge structures, resulting in confusion among the students on the procedure to be followed in each individual situation

2. Less effort on the part of students in tutorials to manually solve lengthy problems like analysis of truss bridge elements to find the forces in members (using construction of Influcence Lines) using calculators and IS codes

Actions taken for improvement:

1. Each design procedure is now being clearly demarcated under 2 headings: SLS checks and ULS checks, so that the students can clearly understand the overall consistency in the design process for each bridge structure

2. Full length design problems to be given to students for practice in tutorial and as assignment submissions, while examinations will generally focus on part problems due to time constraints

3. Introduction of use of software in a few lectures to model minor bridges/culverts, to help students visualize better the concepts being covered in the class theoretically

Subject Name:Advanced Construction Technology

Subject Code: UCE702

Name of Teacher submitting the ATR: Dr. Pratik Tiwari

Reasons for low attainment of CLO:

1. The CLO2 required a deep understanding of construction methods of bridges. Students were not able to differentiate between various methods and techniques. The construction methods were a bit advanced for students to comprehend.
2. The CLO3 required the students to understand the 3D Printing process in construction. The

3D printing process was foreign to the students thus it was difficult for them to understand the concepts and intricacies of the topic.

Actions taken for improvement:

1. For better attainment /understanding of concepts taught in class to the students, practical approach will be adopted.
2. More focus on the basics of the construction methods of bridges as well as 3D printing will be covered and for better understanding, concepts will be related to practical videos of the techniques.
3. Some of the students may lack imagination, so to boost their imagination and give them the required push to reach the excellence level, doubt removal sessions will be scheduled which will help the students in solving problems with a practical approach.

Subject Name: Advanced Construction Materials & Techniques

Subject Code: UCE725

Name of Teacher submitting the ATR: Dr. Arpit Goyal

Reasons for low attainment of CLO:

1. The CLO4 required a deep understanding of foundation, interior and external structural system, formwork and various construction methods and techniques for high rise buildings. Students were not able to differentiate between various formworks.

Actions taken for improvement:

1. For better attainment /understanding of concepts taught in class to the students, practical approach will be adopted
2. More focus on the basics of the high rise building will be covered and for better understanding, concepts will be related to practical videos of the techniques.
3. Some of the students may lack imagination, so to boost their imagination and give them the required push to reach the excellence level, doubt removal sessions will be scheduled which will help the students in solving problems with a practical approach.

PO2: 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.

PO2	**2.10**	**2.69**	For PO2, the target level was achieved. A total of 26 subjects were considered for calculating the attainment level of PO2. Though the attainment level was better than the set target, but there was scope for further improvement as contribution of a few subjects towards attainment of this program objective were observed to be low. This course is: UCE613. All these courses had shown low CO attainment levels. Thus, the attainment level of PO2 can be further improved by

			taking actions to improve the attainment level of COs of these courses. Few more courses: UCE310, UES012, UCE501 have additionally been identified to improve the overall attainment level. **The ATRs for these courses have already been provided in PO1.**
PO3: 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.			
PO3 .	**2.10**	**2.69**	For PO3, the achieved level was good. A total of 25subjects were considered for calculating the attainment level of PO3. Although attainment level was achieved, but keeping in view further scope of improvement, course that could have further improved the score was identified. This course is: UCE613. An action taken report was sought from the concerned faculty and given as below. ATRs for additional course was also sought because it is felt that an improvement in this course can further improve the overall attainment. Another course: UCE501has additionally been identified to improve the overall attainment level. **The ATRs for these courses have already been provided in PO1.**
PO4: 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.			
PO4	**2.10**	**2.75**	For PO4, the target level was achieved. A total of 17 subjects were considered for calculating the attainment level of PO4. In this PO, minimum attainment is achieved in all the courses.
PO5: 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.			

PO5	**2.10**	**2.61**	For PO5, the attainment level was well above the target level. A total of 27 subjects were considered for calculating the attainment level of PO5. Though the attainment level was better than the set target, but contributions of UMA035, UMA012, UCE609, UCE807 towards attainment of this program objective were observed to be low. In addition to these three courses, one more course also needed attention as this course scored less than the target value at each CO level. The course is: UCE511.Thus, the attainment level of this PO5 can be further improved by taking actions to improve the attainment level of CO. **The ATRs for these courses have already been provided in PO1.**
PO6: 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.			
PO6	**2.10**	**2.82**	For PO6, the score was calculated using 15 subjects. The attainment level was better than the set target.In this PO, minimum attainment is achieved in all the courses.
PO7: 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.			
PO7	**2.10**	**2.66**	Total 14 subjects were considered for calculating the attainment level of PO7. In the overall attainment score of this PO, the contribution of UCE310 was very less as compared to the other courses. Hence ATR was also sought for this course also. **The observations and actions pertaining to these courses are provided in PO1.**
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.			
PO8	**2.10**	**2.81**	For PO8, the attainment level was very good. Total 09 subjects were considered for attainment of PO 8. A 100% achievement in the attainment level was possible, if strategies to improve UCE 606 are provided. **Thus, ATR for these courses was**

			obtained and same has been provided in PO1
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.			
PO9	**2.10**	**2.67**	For PO9, the target level was well achieved. A total of 24 subjects were considered for calculating the attainment level of PO9. The overall attainment is good. However, improvement in UMA035 is needed as this would improve the PO score. **Thus, ATR for this course was obtained and same has been provided in PO1**
PO10: 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.			
PO10	**2.10**	**2.62**	For PO10, the target level was achieved. A total of 25 subjects were considered for calculating the attainment level of PO10. The subjects which required improvement was UMA035. **Thus, ATR for this course was obtained and same has been provided in PO1**
PO11: 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.			
PO11	**2.10**	**2.95**	Total 07 courses were mapped to evaluate this PO The attainment level was well above the target level. Each course individually scored the attainment level and hence average score is well above the target level.
PO12: 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.			
PO12	**2.10**	**2.81**	For PO12, the target level was achieved. A total of 19 subjects were considered for calculating

				the attainment level of PO12. The attainment level was better than the set target in all the courses.
	PSO1. Evaluate, analyze and formulate a sustainable design of structural components of different types of buildings.			
	PSO1	**2.10**	**2.74**	For PSO1, the target level was achieved. A total of 14 subjects were considered for calculating the attainment level of PSO1.
	PSO2. Design and devise a construction and management process within the ambit of realistic constraints, to satisfy the requirements of civil infrastructure projects.			
	PSO2	**2.10**	**2.76**	For PSO2, the target level was very well achieved. A total of 12 courses were considered for calculating the attainment level of PSO2. Overall performance was good and target value was well attained in all courses considered for attainment of PSO2. But keeping in view a further scope in improving the score, few more courses were identified and efforts to improve the CO attainment were made. These courses are UCE501, UCE613. **ATR for all these are provided in PO1.**
	PSO3: Analyze and design various aspects of water and water related systems for cleaner and sustainable environment.			
	PS O3	**2.10**	**2.50**	For PSO3, the target level was achieved. A total of 4 courses were considered for calculating the attainment level of PSO3. Although attainment level was achieved, but keeping in view further scope of improvement, course that could further improve the score is identified. This course is: UCE310. **The ATRs is provided in PO1.**

3. Continuous Improvement

Program Outcomes once mapped to the learning outcomes of a particular course gives us an insight of the level of achievement of students in that particular PO. Given this broaden picture of new understanding, we get an opportunity to improvise through initiativesand also implement certain changes that can be lead us to have better performances. For example, in an outcome measurement related to ability to identify and formulate problems for engineering system was assessed through courses that basically require an understanding of engineering problems and its formulation which may lead to problem solving. Therefore in order to further strengthen student learning, we implementeda paradigm shift in teaching from **Teacher Centric to Student Centric Learning Approach**. This concept was introduced to the faculty through **Centre for Academic Practices and Student Learning (CAPSL)** training workshop which started in year 2016. All faculty from the department have been completed the basic course of New Direction Program and benefitted through this workshop. Faculty was trained to adopt academic practices such as outcome based learning, creative thinking, introducing assessment methods involving students, and many more. With these approaches, students were more open to creatively formulate problem.

On the other hand, where student is assessed for his/her ability to solve complex engineering problems, role of problem solving through tutorials becomes very important. While student centric approach did help in 2018-2019 but a marginal fall was visible in 2019-2020. One of the main reasons for this can be attributed to a shift to an **Online Mode of Teaching because of COVID pandemic**. Many of the courses covered in this category were from even semester such as Surveying (UCE403), Design of Steel Structures –II (UCE805), Bridge Engineering (UCE831) i.e January-June, 2020. Faculty was still in a learning mode to teach online and conduct tutorials. Lecture/Tutorial sessions needed to be channelized in less time. As a result, **Thapar Learning Management System (TIET-LMS)** was developed and effective July 2020, all academic activities are conducted through it, and reviewing tutorials has also now become seamless. It is anticipated that with the coming up of TIET-LMS, we foresee a positive improvement in this regard in the future.

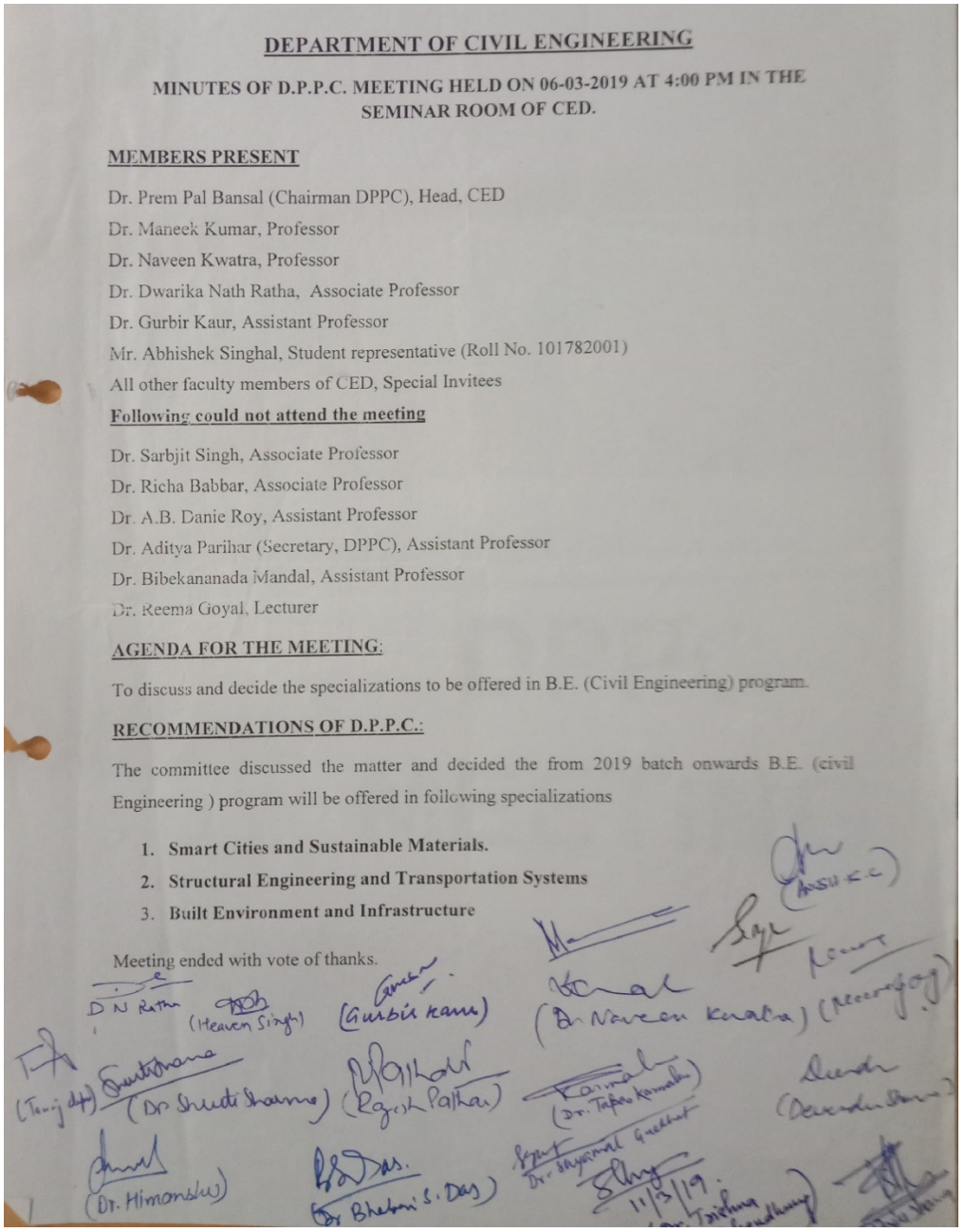
We strongly believe that a static curriculum cannot bring in changes in the understanding and applying engineering design to produce solutions in the context of global, cultural, social, environmental and economic factors.Keeping this in view, our scheme and syllabi are updated from time to time. A Board of Studies (BOS) meeting is held on a regular basis wherein an expert opinion is sought from Industry and Academic experts in the field of civil engineering. Based on their suggestions, curriculum is modified and updated to match with the latest market trends. The scheme is then sent to the Senate for approval. One of the recent and major changes that we have incorporated in our Curriculum includes:

- Three focus areas have been offered to B.E. Civil Engineering students admitted in 2019 onwards after the end of Second Year. The students shall be offered a certificate of Specialization done along with B.E. Civil Engineering Degree. These focus areas are:
    - Structural Engineering, Smart & Sustainable Materials
    - Smart Cities
    - Infrastructure Development and Management

The focus areas have been finalized after obtaining feedback and discussion with all stakeholders. The DPPC committee meeting (held on March 6, 2019) approved the focus areas at the departmental level, after discussion with faculty members. These were then put forward for approval in the Board of Studies (May 2, 2019) by academic and industry experts. Finally, these were ratified by the Senate.

The minutes of all meetings are attached herewith.

MINUTES OF DPPC MEETING REGARDING FOCUS AREAS:



DEPARTMENT OF CIVIL ENGINEERING

MINUTES OF D.P.P.C. MEETING HELD ON 06-03-2019 AT 4:00 PM IN THE SEMINAR ROOM OF CED.

MEMBERS PRESENT

Dr. Prem Pal Bansal (Chairman DPPC), Head, CED
Dr. Maneek Kumar, Professor
Dr. Naveen Kwatra, Professor
Dr. Dwarika Nath Ratha, Associate Professor
Dr. Gurbir Kaur, Assistant Professor
Mr. Abhishek Singhal, Student representative (Roll No. 101782001)
All other faculty members of CED, Special Invitees

Following could not attend the meeting

Dr. Sarbjit Singh, Associate Professor
Dr. Richa Babbar, Associate Professor
Dr. A.B. Danie Roy, Assistant Professor
Dr. Aditya Parihar (Secretary, DPPC), Assistant Professor
Dr. Bibekananda Mandal, Assistant Professor
Dr. Reema Goyal, Lecturer

AGENDA FOR THE MEETING:

To discuss and decide the specializations to be offered in B.E. (Civil Engineering) program.

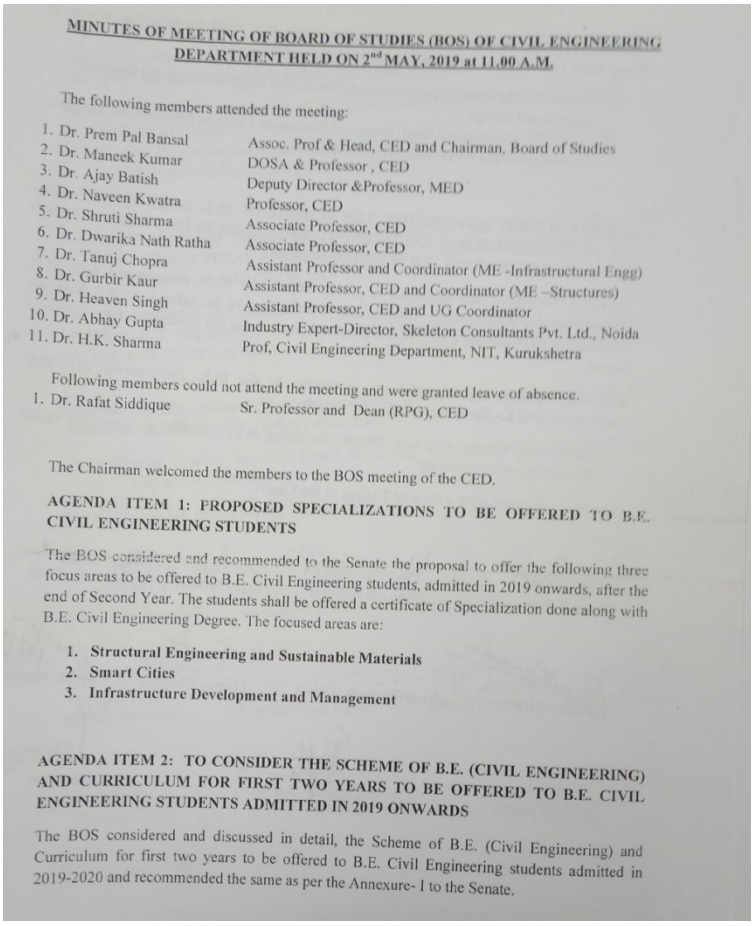
RECOMMENDATIONS OF D.P.P.C.:

The committee discussed the matter and decided the from 2019 batch onwards B.E. (civil Engineering) program will be offered in following specializations

1. **Smart Cities and Sustainable Materials.**
2. **Structural Engineering and Transportation Systems**
3. **Built Environment and Infrastructure**

Meeting ended with vote of thanks.

MINUTES OF BOARD OF STUDIES REGARDING FOCUS AREAS:



MINUTES OF MEETING OF BOARD OF STUDIES (BOS) OF CIVIL ENGINEERING DEPARTMENT HELD ON 2nd MAY, 2019 at 11.00 A.M.

The following members attended the meeting:

1.	Dr. Prem Pal Bansal	Assoc. Prof & Head, CED and Chairman, Board of Studies
2.	Dr. Maneek Kumar	DOSA & Professor , CED
3.	Dr. Ajay Batish	Deputy Director &Professor, MED
4.	Dr. Naveen Kwatra	Professor, CED
5.	Dr. Shruti Sharma	Associate Professor, CED
6.	Dr. Dwarika Nath Ratha	Associate Professor, CED
7.	Dr. Tanuj Chopra	Assistant Professor and Coordinator (ME -Infrastructural Engg)
8.	Dr. Gurbir Kaur	Assistant Professor, CED and Coordinator (ME –Structures)
9.	Dr. Heaven Singh	Assistant Professor, CED and UG Coordinator
10.	Dr. Abhay Gupta	Industry Expert-Director, Skeleton Consultants Pvt. Ltd., Noida
11.	Dr. H.K. Sharma	Prof, Civil Engineering Department, NIT, Kurukshetra

Following members could not attend the meeting and were granted leave of absence.

1.	Dr. Rafat Siddique	Sr. Professor and Dean (RPG), CED

The Chairman welcomed the members to the BOS meeting of the CED.

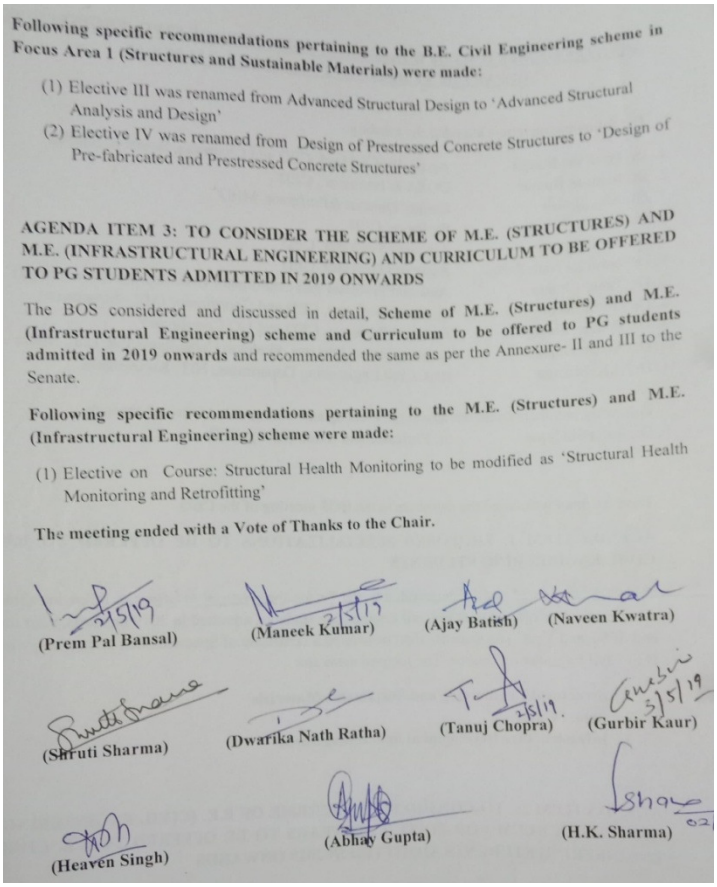
AGENDA ITEM 1: PROPOSED SPECIALIZATIONS TO BE OFFERED TO B.E. CIVIL ENGINEERING STUDENTS

The BOS considered and recommended to the Senate the proposal to offer the following three focus areas to be offered to B.E. Civil Engineering students, admitted in 2019 onwards, after the end of Second Year. The students shall be offered a certificate of Specialization done along with B.E. Civil Engineering Degree. The focused areas are:

1. **Structural Engineering and Sustainable Materials**
2. **Smart Cities**
3. **Infrastructure Development and Management**

AGENDA ITEM 2: TO CONSIDER THE SCHEME OF B.E. (CIVIL ENGINEERING) AND CURRICULUM FOR FIRST TWO YEARS TO BE OFFERED TO B.E. CIVIL ENGINEERING STUDENTS ADMITTED IN 2019 ONWARDS

The BOS considered and discussed in detail, the Scheme of B.E. (Civil Engineering) and Curriculum for first two years to be offered to B.E. Civil Engineering students admitted in 2019-2020 and recommended the same as per the Annexure- I to the Senate.



Following specific recommendations pertaining to the B.E. Civil Engineering scheme in Focus Area 1 (Structures and Sustainable Materials) were made:

(1) Elective III was renamed from Advanced Structural Design to 'Advanced Structural Analysis and Design'

(2) Elective IV was renamed from Design of Prestressed Concrete Structures to 'Design of Pre-fabricated and Prestressed Concrete Structures'

AGENDA ITEM 3: TO CONSIDER THE SCHEME OF M.E. (STRUCTURES) AND M.E. (INFRASTRUCTURAL ENGINEERING) AND CURRICULUM TO BE OFFERED TO PG STUDENTS ADMITTED IN 2019 ONWARDS

The BOS considered and discussed in detail, **Scheme of M.E. (Structures) and M.E. (Infrastructural Engineering) scheme and Curriculum to be offered to PG students admitted in 2019 onwards** and recommended the same as per the Annexure- II and III to the Senate.

Following specific recommendations pertaining to the M.E. (Structures) and M.E. (Infrastructural Engineering) scheme were made:

(1) Elective on Course: Structural Health Monitoring to be modified as 'Structural Health Monitoring and Retrofitting'

The meeting ended with a Vote of Thanks to the Chair.

(Prem Pal Bansal) (Maneek Kumar) (Ajay Batish) (Naveen Kwatra)

(Shruti Sharma) (Dwarika Nath Ratha) (Tanuj Chopra) (Gurbir Kaur)

(Heaven Singh) (Abhay Gupta) (H.K. Sharma)

MINUTES OF SENATE APPROVAL FOR FOCUS AREAS:

8. The Senate recommended the following elective focus areas to be offered to BE Civil Engineering students admitted w.e.f. session 2019.
   a. Structural Engineering, Smart and Sustainable Materials
   b. Smart Cities
   c. Infrastructure Development and Management
9. The Senate recommended that project semester duration should be of six months out of which minimum 5 months should be at the industry/organization. Evaluation of students going on project semester in the 8th semester should be completed by 30th June.

Revised schemes after incorporating the above mentioned points shall be placed in next Senate for approval.

B) TO CONSIDER THE SCHEME OF BE (COMPUTER SCIENCE & ENGINEERING) TO BE OFFERED AT DERABASSI CAMPUS.

The Senate considered and approved the 2nd year scheme of batch 2018 of BE (Computer Science & Engineering) to be offered at Derabassi Campus.

C) SHIFTING OF PROJECT SEMESTER FROM SCHEME 2017 ONWARDS FOR CHEMICAL ENGINEERING STUDENTS

The Senate discussed the proposal of shifting of project semester from scheme 2017 onwards for Chemical Engineering students and recommended that status quo should be maintained.

D) TO CONSIDER THE REVISION IN CREDIT STRUCTURE OF "UCS304 - INFORMATION MANAGEMENT SYSTEM (2 SELF EFFORT HOURS)" AND "UCS406 - DATA STRUCTURES AND ALGORITHMS (2 SELF EFFORT HOURS)"

The Senate considered and approved the revision in credit structure of "UCS304 - Information Management System (2 Self Effort Hours)" AND "UCS406 - Data Structures and Algorithms (2 Self Effort Hours)".

E) TO CONSIDER THE REVISED SCHEMES OF BE-ECE 2017 BATCH

The Senate considered and approved the revised scheme of BE-ECE 2017 batch.

F) TO CONSIDER THE REVISED SCHEMES OF BE-ECE 2018 BATCH

The Senate considered and approved the revised scheme of BE-ECE 2018 batch to balance the number of subjects in 3rd, 4th and 6th semesters.

G) TO CONSIDER THE MAKE-UP TEST REQUESTS MADE BY THE STUDENTS.

The Senate considered and approved the recommendations of SUGC to reduce the weightage of marks secured by the student in make-up test from existing 75% to 60%. Further the Senate authorize DoAA to decide the weightage of the

- In Structural Engineering and Sustainable Materials, a new course on **Sustainable & Smart Materials (UCE837)** has been introduced

- **Design of Smart Transportation Systems (UCE851), Internet of Things (IoT& Smart Cities (UCE852)** and **Design of Smart & Sustainable Public Utilities (UCE853)** have been included under the specialization in Smart Cities

- Under Infrastructure Development and Management several new courses have been introduced and include: **Infrastructure Planning &Design(UCE861), Building Infrastructure & Construction Practices (UCE862), Infrastructure Contracts & Risk Management (UCE863)** and **Geotechniques of Design of Underground Structures(UCE864)**

- The course syllabi, for these newly included courses, has been carefully designed giving due consideration to suggestions and rectifications proposed by the experts called from academia and industry both, during Board of Studies meetings held in the year 2020.

Over the past three years, particularly, we are laying **more stress on writing and presentation skills**. Casual, unprofessional writing is no more accepted in project report, capstone, or laboratory reports etc. This is keeping in view the need to communicate effectively with range of audiences through writing, with peers and with people in professional organizations. Now Students have to undertake several proof reading before the final report is accepted for evaluation purposes. Several templates of project writing have been prepared by the faculty and are circulated to students much before the submission time. Students are encouraged to read research papers and asked to bring in a small write up, which becomes useful in undertaking a Capstone Project (UCE 892). Students who go for project semester are exclusively judged for their writing and communications skills by their Industrial Mentor, which in itself is a motivation for students to work harder even when outside the campus.The**Centre for Training & Development (CTD) on campus** has been establishedto build upon the communication skills through lecture series, workshops and several other activities. We do see several benefits emanating from this Centre and we expect that a positive change will be reflected in the PO score over the next few years.

We have managed to continuously improve in our outcomes related to experimentation, analyzing and interpreting data for making informed engineering judgments. **Experiential Learning Centre (ELC)** activities have been introduced recently and at very early stage in the curriculum. Several activities have been accomplished successfully as ELC activities in the last 2 years such as:

- **Design and Construction of a Low Cost Housing Project Using Sandwich Panels**
- **Design and Fabrication of Concrete Canoe**
- **Design and Fabrication of a Steel Structure**
- **Design of Pervious Concrete for Pavements**
- **Design of Modified Bituminous Mixes for Pavements,**

Many more such Experiential activities are lined up for all Ist –IVth Year BE Civil Engineering students to give them Hands-On-Training as well as experience of real life field problems and applications. Few glimpses of the experiential learning centre events held at CED are shown in **Fig. 3-4**. These activities do not contribute to the total credits earned, rather are an initiative to inculcate team spirit and make students learn to design, fabricate and commission a real world problem while working in a team. This puts the students in a practice to do more similar projects (e.g. Capstone project, group design project, project semester) in their latter part of the curriculum.

Fig. 3: Students involved in design and construction of Low Cost Housing Project

Fig. 4: Students involved in design and fabrication Concrete Canoe

Over the past 5 years we have worked very hard in procuring best of equipment's for our core labs. For example, following Laboratories which have seen addition in major equipment's are as follows:

- *Structures Laboratory*: ACM corrosion analyzer, Cube Abrasion Testing Machine, Oscilloscope, 100T Displacement Sensor Strain Gauge, Precision LCR Meter, Penetrometer Make Humbolt, Marsh Cone Viscometer, Double Acting Hydraulic Jack with electric operated power unit
- *Geotechnical Laboratory*: Consolidation Test Apparatus, Liquid Limit App (Motorised), Proctor Compaction Mould with Hammer,
- *Transportation Laboratory*: Centrifugal Extractor, Mild Steel CBR Mould& Extension Collar, Light Weight Deflectometer, Modular Compact Rehometer