



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: Under Graduate

Branch: Environmental Engineering

Subject Code: BE03013041

Subject Name: Statistical Techniques for Environmental Engineering

w.e.f. Academic Year:	2024-25
Semester:	3
Category of the Course:	Basic Science Courses

<b>Prerequisite:</b>	Basic knowledge of subjects like mathematics and statistics.
<b>Rationale:</b>	Knowledge of Statistic is the first step to control/improve quality of analysis results data for environmental engineers

### Course Outcome:

After Completion of the Course, Student will able to:

No.	Course Outcomes
01	Develop the sources of data collection and presentation of statistical data.
02	Understand and Apply Measures of Central Tendency and Variability
03	Develop and Interpret Regression Equations and Correlation.
04	Perform Hypothesis Testing and Analyze Variance

### Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
L	T	P	PBL*	TH		Theory		Tutorial / Practical			
						ESE (E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
45	15	30	30	120	04	70	30	50	30	0	180

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End-Semester Examination, PA = Progressive Assessment

\* Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.



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## Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1	Statistical Techniques for Environmental Engineering, Types of statistical data, Applications of statistical data in Environmental Engineering field, common statistical terms, sources for statistical data collection, Methods of presentation of data: tabularization and drawing , Presentation of quantitative data: histogram, frequency distribution, frequency polygon, frequency curve, line chart, scatter diagram, Presentation of qualitative data: Bar diagram, Pie diagram, Pictogram, Map Diagram	10	24
2	Measures of Central tendency: Averages- Mean, Median, Mode Partition Values: Quartiles, Deciles, Percentiles, Measurement of Variability: Real and Experimental Measures of Variability of Individual Observations: Range, Mean deviation, Standard Deviation, Coefficient of Variation Measures of Dispersion: Range, Quartile deviation, mean deviation, standard deviation, relative measures of dispersion	12	28
3	Skewness and its measures, kurtosis and its measures, Correlation and regression : Bivariate data, correlation analysis, Coefficient of determination, Regression Analysis	11	24
4	Probability: Basic concepts, laws of probability , testing of hypothesis: large sample test and small sample test, analysis of variance: one way analysis of variance and two analysis of variance	12	24
	<b>Total</b>	<b>45</b>	<b>100</b>

## Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	20	25	25	0

Where R:Remember; U:Understanding; A:Application, N:Analyze and E:Evaluate C:Create(as per Revised Bloom's Taxonomy)



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## References/Suggested Learning Resources:

### (a) Books:

1. Statistics for Environmental Engineers by Paul Mac Berthouex, Linfield C Brown, Lewis publications
2. Introduction to Probability and Statistics, by S. Lipschutz and J. Schiller, Tata McGraw- Hill, 2017.
3. Applied Statistics and Probability for Engineers by D. C. Montgomery and G. C. Runger, WileyIndia, 2008.
4. Statistical Techniques, Design of Experiments and Stochastic Modeling by A. Ghosh, B. Saha and P. Mal, CRC Press, 2021.
5. Miller and Freund's Probability and Statistics for Engineers by R. A. Johnson and C. B. Gupta, Pearson Education, 2009.
6. Statistical concepts and methods by G. K. Bhattacharya and R. A. Johnson, John Wiley, New Delhi, 2002

### (b) Open sources of software and website:

1. <http://nptel.iitm.ac.in>, World Wide Web, Google Search Engine etc.

## Tutorial Exercise:

1. Calculate Mean, Median, and Mode using Environment Laboratory data.
2. Calculate Range, Mean Range and Percentage Mean Range using Environment Laboratory data.
3. Calculate Mean Deviation, Percentage Mean Deviation of material / Processes.
4. Numerical based on Standard Deviation, Coefficient of Variation, Variance
5. Determination of Number of sample test for assessment of any industrial raw material or its product.
6. Find Normal Distribution, Binomial Distribution etc. of Environment Laboratory data.
7. Numerical based on probability of Environment Laboratory data.

## • List of suggested activities for Problem Based Learning:

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Laboratory Visit- pollution parameters analysis laboratory of State Government/Central Government/Gujarat Pollution Control Board/Water Supply Board	Visit = 5hrs, Report preparation = 3hrs Total = 8hrs	Based on the report submitted. The report should contain observations and calculations of laboratory data.
2.	Technical Video based learning related to subjects offered during semester	Duration of video : 5hrs Report preparation : 5hrs Total = 10hrs	Multiple choice questions based Assessment
3.	Explore applications of Water GeM, Sewer GeM, EPANET Software	Duration=5 hrs	Based on report preparation using Software input data.
4.	Secondary data compilation and its analysis related to	Duration=5 hrs	Technical Presentation of data using statistical



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	pollution/environment attributes from relevant International/Central/State Government Websites		methods in form of report/presentation
5.	Preparation of working/Nonworking model for flow measuring devices	Duration=10 hrs	Based on project display considering technical aspects
6.	Poster presentation on laboratory practices, firefighting systems, water supply systems, sewerage systems	Duration=5 hrs	Based on poster/chart preparation and presentation skills
7	Survey related to water demand of residential area/ institutional area/commercial area/hospitals, survey on water distribution system	Duration=5 hrs Report preparation = 5hrs Total=10 hrs	Based on data collection and its report presentation
8	Mock-drill for chemistry laboratory safety using Institute firefighting facilities	Duration=5 hrs	Based on Active participation student
9	Participation in Workshop/seminar related to environmental engineering	Duration = 6 hrs	Based on participation certificate
10	Preparation of technical report from reference book on given topic	Duration=5 hrs	Based on Report preparation
11	Assignments/numericals related to subject	Duration=10 hrs	Based on submission of given assignments
12	Self-learning through online courses related to subjects	Duration=10 hrs	Multiple choice questions-based Assessment

Note:

- All the suggested activities should be related to the subject.
- The number of hours is suggestive. Faculty can sub-divide the number of hours based on the activity.
- Rubrics for the evaluation can be prepared by the faculty.
- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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