Programme	B.Sc. (Engg.) Energy Engineering	Course Code	NS 113	Credit Hours	3 + 0 = 3
Course Title	**Linear Algebra and Applied Statistics**				

Course Introduction

Linear Algebra and Applied Statistics (NS 113) is a foundational course designed to equip students with essential mathematical tools and techniques. This course covers key concepts in linear algebra, including matrix theory, vector spaces, and the application of matrices in solving engineering problems. Additionally, it introduces fundamental statistical methods, emphasizing their practical application in data analysis and problem-solving. By the end of the course, students will be proficient in recognizing, explaining, and solving computational problems related to linear algebra and statistics, preparing them for advanced studies and practical challenges in their respective fields.

Mapped SDGs	SDG-4: Quality Education

Learning Outcomes

1. **Recognize** basic concepts of linear algebra and applied statistics. (C2)
2. **Explain** Matrix theory and the use of matrices in solving engineering problems. (C2)
3. **Solve** computational problems of linear algebra and applied statistics. (C3)

Course Content		Assignments/Readings
Week 1	**Unit-I Vectors** 1.1 Introduction of linear algebra and its application 1.2 Matrices, Determinants, & Cofactor	The teacher may assign home assignments/problem-based learning/reading materials/learning activity etc.
Week 2	**Unit-I Vectors** 1.3 Inverse, Rank of matrices 1.4 Linear Independence	
Week 3	**Unit-I Vectors** 1.5 Solution of system of Linear systems 1.6 Linear dependence, linear independence, spanning set, basis	
Week 4	**Unit-I Vectors** 1.7 Linear Transformations	
Week 5	**Unit-I Vectors** 1.8 Operations on matrices, Eigenvalue & Eigenvectors	
Week 6	**Unit-II Meaning of Descriptive and Inferential Statistics** 2.1 Population and Sample. Types of variables, Measurement Scales, Sources of Statistical data in Pakistan.	

Week 7	**Unit-II Meaning of Descriptive and Inferential Statistics** 2.2 Description of data by frequency tables and graphs 2.3 Stem and Leaf Display and Box plots. Measures of Central Tendency: A.M. H.M. G.M.	
Week 8	**Unit-II Meaning of Descriptive and Inferential Statistics** 2.4 Mode, Median, Quantiles. Properties of Mean with proofs Weighted Arithmetic Mean 2.5 Empirical Relation between Mean, Median and Mode	
Week 9	**Unit-II Meaning of Descriptive and Inferential Statistics** 2.6 Empirical Relation between Mean, Median and Mode 2.7 Relative Merits and Demerits of various averages	
Week 10	**Unit-II Meaning of Descriptive and Inferential Statistics** 2.8 Measures of Dispersion: Absolute and Relative Measures, Range. Semi Inter-Quartile Range 2.9 Mean Deviation, Variance, Standard Deviation. Coefficient of Variation	
Week 11		
Week 12	**Unit-II Meaning of Descriptive and Inferential Statistics** 2.10 Coefficient of Mean Deviation, Coefficient of Quartile Deviation	
Week 13	**Unit-II Meaning of Descriptive and Inferential Statistics** 2.11 Properties of Variance and Standard Deviation., Moments, Moment Ratios, Kurtosis and Skewness	
Week 14	**Unit-III Probability Theory** 3.1 Introduction to classical Probability theory: 3.1.1 Events 3.1.2 Multiplication rule 3.1.3Permutation 3.1.4Additive rule	

Week 15	**Unit-III Probability Theory** 3.2 Probability distribution: 3.2.1 Discrete distribution (Hypergeometric, Poisson, Binomial) 3.2.2. Continuous distribution (Normal)	
Week 16	**Unit-III Probability Theory** 3.3 Correlation and Regression analysis 3.3.1. Correlation 3.3.2. Simple regression 3.3.3. Multiple regression	

Textbooks and Reading Material

1. Textbooks.

1. Zill, D. G. (2020). Advanced engineering mathematics. Jones & Bartlett Learning.
2. Stewart, J., Clegg, D. K., & Watson, S. (2020). Calculus: early transcendentals. Cengage Learning.
3. Chatelin, F. (Ed.). (2012). Eigenvalues of Matrices: Revised Edition. Society for Industrial and Applied Mathematics.
4. Kristály, A., Rădulescu, V. D., & Varga, C. (2010). Variational principles in mathematical physics, geometry, and economics: Qualitative analysis of nonlinear equations and unilateral problems (Vol. 136). Cambridge University Press.
5. Faigle, U., Kern, W., & Still, G. (2013). Algorithmic principles of mathematical programming (Vol. 24). Springer Science & Business Media.

2. Suggested Readings

1. Lang, S. (2012). A first course in calculus. Springer Science & Business Media.
2. Kulkarni, S., & Harman, G. (2011). An elementary introduction to statistical learning theory (Vol. 853). John Wiley & Sons

Teaching Learning Strategies

1. Multimodal **Instruction**: Utilize lectures with multimedia, white/blackboard
2. **Interactive and Collaborative Learning**: Engage students through group discussions, project-based learning, and presentations to develop critical thinking and communication skills.
3. **Assignments and Assessments**: Assign individual and group tasks, reading and writing assignments to assess comprehension and encourage independent study.
4. **Practical Application**: Integrate real-world projects and case studies to bridge theory and practice, enhancing problem-solving and practical skills.

Assignments: Types and Number with Calendar

Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Activity	-	-	Quiz 1	-	Assignment 1	-	-	-

Week	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Activity	-	-	Assignment 2	-	-	Quiz 2	-	-

The abovementioned schedule of assignments/quizzes/presentations is tentative. The schedule will be provided to the students at the start of semester.

Assessment			
Sr. No.	**Elements**	**Weightage**	**Details**
1.	Midterm Assessment	35%	Written assessment at the mid-point of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work, report writing, and viva-voce examination, etc.
2.	Sessional Assessment	25%	This assessment may include classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written assessment at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work, report writing, and viva-voce examination, etc.