**Program Learning Outcomes:**

1. **Engineering Knowledge:** An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** An ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/Development of Solutions:** An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
4. **Investigation:** An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.
5. **Modern Tool Usage:** An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.
6. **The Engineer and Society:** An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.
7. **Environment and Sustainability:** An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. **Individual and Team Work:** An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.
10. **Communication:** An ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management:** An ability to demonstrate management skills and apply engineering principles to one’s own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.
12. **Lifelong Learning:** An ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments.

**Course Information Sheet**

**A – Basic Information**

|  |  |  |
| --- | --- | --- |
| **Title: Probability Methods in Engineering** | | **Code:** MS-222 |
| **Program:** Bachelor of Electrical Engineering | **Semester:** IV | **Credit Hours: 3+0**  **Lecture: 48**  **Practical:** 0 |
| **Knowledge Area** (as per HEC curriculum template) | Computing/ Electrical Engg. Foundation/ Electrical Engg. Breadth/Electrical Engg. Depth / Inter-Disciplinary | |

**B – Professional Information**

1. **Course Objectives:**

This course covers the role of statistics in engineering which includes, probability distributions, random sampling and data description, point estimation of parameters, statistical intervals for a single sample, and tests of hypotheses for a single sample

1. **Course Learning Outcomes (CLOs):**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CLO No.** | **CLO Description** | **Domain and Taxonomy level** | **PLO mapped**  **(i to xii)** | **Level of emphasis of the PLO**  **(1=High; 2=Medium; 3=Low)** |
| 1. | Data representation and Measure of central tendency. | C2 | ( I ) | 2 |
| 2. | Basic principles of probability, sample spaces, Discrete and Continuous distributions. | C3 | ( IV ) | 2 |
| 3. | Correlation, Statistical Inference and Testing of Hypothesis. | C3 | ( V ) | 2 |

***\*Note:***

* *C 🡪 Cognitive, P 🡪 Psychomotor, A 🡪 Affective domains and ‘n’ is the taxonomy level.*
* *It is strongly suggested that one CLO should be mapped to one PLO and one domain only.*

1. **Syllabus and Books:**

|  |
| --- |
| **Statistics:** Introduction, Types of data & variables, presentation to data, object, classifications, Tabulation, Frequency distribution, Graphical representation, Simple & Multiple Bar diagrams, Sartorial& Pie-Diagram, Histogram, Frequency, Polygon, Frequency Curves & their types.  **Measures of Central Tendency and Dispersion:** Statistics Averages, Median Mode, Quartiles, Range, Moments, Skew ness & Kurtosis, Quartile Deviation, Mean Deviation, Standard Deviation, Variance & its coefficient, Practical Significance in related problems. |
| **Curve Fitting:** Fitting of a first and Second degree curve, fitting of exponential and logarithmic curves, related problems. Principle of least squares, second order Statistics & Time series not in bit detail. Simple Regression and Correlation Scatter diagrams, Correlation & its Coefficient, Regression lines, Rank Correlation & its Coefficient, Probable Error (P.E), related problems.  **Sampling and Sampling Distributions:** Population, Parameter & Statistic, Objects of sampling, Sampling distribution of Mean, Standard errors, Sampling & Non- Sampling Errors, Random Sampling, Samplingwith & without replacement, Sequential Sampling, Central limit theorem with practical significance in related problems.  **Statistical Inference and Testing of Hypothesis**: Estimation, Types of Estimates, Confidence interval, Tests of hypothesis, Chai square one tails & two tails tests. Application in related problems.  **Probability:** Basic concepts, Permutation & Combination, Definitions of probability, Laws of Probability. Conditional probability, Bayes’ Rule. Related problems in practical significance.  **Random Variables:** Discrete & Continuous random variables, Random Sequences and transformations. Probability distribution, Probability density function, Distribution function, Mathematical expectations, Moment Generating Function (MGF), Markov random walks chain/ related problems.  **Probability Distributions:** Discrete probability distributions, Binomial Poisson, Hyper geometric & Negative binomial distributions, Continuous probability distribution, Uniform, Exponential & Normal distributions & their practical significance. |
| **Text Book(s)**  Walpole, Myers, Myers and Ye, “Probability & Statistics for Engineers and Scientists” 8th. |

1. **Percentage of theoretical background, problems analysis and solution design**

|  |  |
| --- | --- |
| **Elements covered in the course** | **Percentage of full course coverage** |
| Theoretical background | 30 |
| Problem analysis | 35 |
| Solution design | 35 |

1. **Teaching and learning methods:**

**(You may add/delete as suitable for the course)**

* 1. Lecture
  2. Class discussion
  3. Presentation
  4. Assignment

1. **Student assessment methods:**

**(You may add/delete as suitable for the course)**

* 1. Quiz
  2. Assignment
  3. Exams (Theory)
  4. Presentation

1. **Assessment schedule:**
   1. Quiz throughout the semester
   2. Assignment throughout the semester
   3. Presentation After midterm
   4. Exams

midterm exam Week 9

final theory exam Week 18

1. **Weighting of assessments:**

**Theory:**

1. Quizzes 10
2. Assignments 10
3. Midterm examination 20
4. Final term examination 60
5. Total 100

1. **Facilities required for teaching and learning**
2. Computer Usage, Multimedia
3. Software (MS Excel, Minitab)
4. Books from library