Statistics Course Final Redefinition: III/2K

Day One:

Morning Session:
Module One: **Introduction**. overview of IITRI and AMPTIAC, of course objectives and outline; motivation: materials engineering and statistics (Ch. 1); discussion of data quality and pedigree, data collection and its statistical characteristics (Ch. 2).
Half Hour Break
Module Two: **Random Variables and Distributions**: Distributions, Parameters, meaning, interpretation and uses; outliers and probabilities of rare events; distributions as patterns of outcomes; discrete: Discrete Uniform, Bernoulli, Binomial, Geometric; continuous: Normal, Exponential, Lognormal and Weibull. Examples.

Lunch: one hour (from noon to 1 PM)

Afternoon Session:
Module Three: **Confidence Intervals**. Central Limit Theorem and examples; derivation of large and small sample c.i.. for the mean of one population; determination of sample size. Interpretation of confidence and tolerance limits and bounds. Numerical examples.
Half Hour Break
Module Four: **Hypothesis Testing**. Reasons, meaning and implementation: z and t tests. The case of testing for the mean of large and small samples of a single population. One and two sided tests. Student t distribution: table and uses. Numerical examples.

Day Two

Morning Session:
Module Five: **Goodness of Fit and Other Tests**. Testing two means with large and small samples. GoF: need and uses. Fit tests for large samples (Chi-Square) and for small samples (Anderson-Darling). The MNR test for outliers. Numerical examples.
Half Hour Break
Module Six: **Assessment of Bivariate Data.** Meaning, types and applications of variable association. Assessment of qualitative bivariate data: contingency tables. Assessment of quantitative bivariate data: covariance and (Pearson and Spearman) correlation. The Chi Square distribution and table. Analysis and interpretation of contingency tables.

Lunch: one hour

Afternoon Session:
Module Seven: **Linear Regression**. First model with detailed development; point and interval estimation and tests of hypotheses for model parameters; forecasting a mean value; forecasting variance. Numerical examples (in 5.4).
Half Hour Break
Module Eight: **Assumptions and Residual Analysis.** Verification of regression model assumptions via residual analysis. Non-linear regression; comparison of models. Data transformations and regression. Numerical examples (in 7.3.1).

Day Three

Morning Session

Module Nine: **Analysis of Variance** (ANOVA). Detailed implementation and uses of the one-way model. Point and interval estimations, hypotheses tests for model parameters. Contrast and comparison of treatment differences. Numerical examples (in 5.5).

Half Hour Break

Module Ten: **Data Analysis with ANOVA**. Minitab examples of residual data analysis. Verification of assumptions. Derivation of c.i. for treatment differences (Tuckey's). Non-parametric alternatives to ANOVA: Kruskal-Wallis and the K-Sample Anderson-Darling tests. Numerical examples (in 5.6 and 6.2).

Lunch: one hour

Afternoon Session

Module Eleven: **Case Studies in ANOVA**. Estimating (A and B basis) allowables via the Handbook flowchart. Detailed development of case study examples in Ch. 6: Hanson Koopmans and large sample non parametric methods; Weibull, Lognormal and Normal methods of estimating A and B basis allowables. Numerical examples.

Half hour Break

Module Twelve: **Case studies in Regression**. Discuss the Handbook flowchart (Ch. 7) through case study of regression examples. Levine's test for homogeneity of variances. Comparison of models and selection of the best. Numerical examples. The future.