Università degli Studi della Basilicata
Scuola di Ingegneria

COURSE: System reliability and statistical quality control				
TEACHER: Elvira Di Nardo				
e-mail: elvira.dinardo@unibas.it		website: http://oldwww.unibas.it/utenti/dinardo/home.html		
Language: italian				
ECTS: 6	n. of hours: 54	Academic year: 2015/16	Campus: Potenza	Semester: I

TOPICS

Reliability of stochastic systems. Statistical quality control (on line and off line).

TEACHING METHODS (please tick one or more options)
X Theoretical lessons
X Tutorials in classroom
X Tutorials in laboratory
□ Project works
□ Technical visits
Other activities (please specify) _____

TEXTBOOKS
[1] Citti P., Arcidiacono G., Campatelli G. Fondamenti di Affidabilità. McGraw-Hill (2003)
[2] Spiegel M. R., Statistica 2/ed, Collana Schaum
[3] Montgomery D. C., Controllo statistico della qualità McGraw-Hill (2005).

ON-LINE EDUCATIONAL MATERIAL
web address: http://oldwww.unibas.it/utenti/dinardo/aff1314.html

LEARNING OUTCOMES
The course is designed for preparing students on how to set up an experimental design and for checking if the design parameters are within the tolerance limits by using statistical tools. Stochastic models are introduced in order to assess the reliability of a system in a project design.

REQUIREMENTS
Calculus: numerical series, limits, derivatives, integrals.

EVALUATION METHODS (please tick one or more options)
□ Intermediate verifications
X Written examination
□ Discussion of a project work
□ Practical test
X Oral examination
Other methods (please specify) _____

DETAILED CONTENT

Elements of probability theory and random variables.

Descriptive statistics: random sample, population. Qualitative and quantitative variables. Graphical tools aiming to describe populations. Indices of positions, symmetry and dispersion. Outliers. The employment of R as computational statistical software for analysis and inference.

Sampling distributions: random vectors. Joint distributions. Convolutions. Functions of random vectors: application to statistics. Sampling distribution of the mean when the variance is known. Sampling

distribution of the mean when the variance is unknown. Sampling distribution of the variance when the population is gaussian.

Confidence intervals: Reliability of stochastic systems: Life time of a system, types of failures, reliability function, failure function, failure density. Residual time life. Failure rate and cumulative failure rate. Comparisons among reliabilities of systems. Exponential models. Law of Weibull and Raylegh. Lognormal models. Conditioned reliability. Failure mean time. Residual life mean time. Mean time between two consecutive failures. Analysis of data on life times of a system. Probability plotting papers. How to estimate a failure function. Censored samples. Kolmogorov-Smirnov test, test on the mean with known variance and test on the mean with unknown variance. Sign test. Reliability of systems in series and in parallels. Conditioned reliability. Life exchange rate matrix. k-out-of n systems.

Statistical quality control: Statistical process control. Design of control charts. Rational subgroups. Analysis of patterns and control charts. Excursion and mean charts. Control charts for individual measurements. Process capability. Attribute control charts: for proportions, for defects, for units. Performances of a control chart. Cumulative sum control chart. Exponentially weigthed moving averange chart. Scatter diagrams. Covariance and correlations. Linear regression. Residual analysis.

Design of Experiments: Factorial experiments. ANOVA (analysis of variance) with one factor. Notched box-plots. ANOVA with fixed and random effects. ANOVA with two factors one observation per cell and more than one observation per cell. Interactions among factors. 2^k factorial design. Fractional design. Orthogonal design. Robust design. Loss function. Signal to noise function.

EXAMINATION SESSIONS (FORECAST)
9/10/2015 18/10/2015 29/01/2016 26/02/2016 22/04/2016 24/06/2016 22/07/2015

SEMINARS BY EXTERNAL EXPERTS YES □ NO X

FURTHER INFORMATION

The primary purpose of the course is to enable students to formalize problems involving modeling stochastic systems and synthesis and analysis of data, coming from engineering environments, in order to formulate proposals and solutions for their understanding.