

## KNOXVILLE, TENNESSEE

Knoxville was established in 1792 and was named after Henry Knox, President Washington's War Secretary. It is headquarters of The Tennessee Valley Authority. The Sunsphere was built for the 1982 World's Fair.

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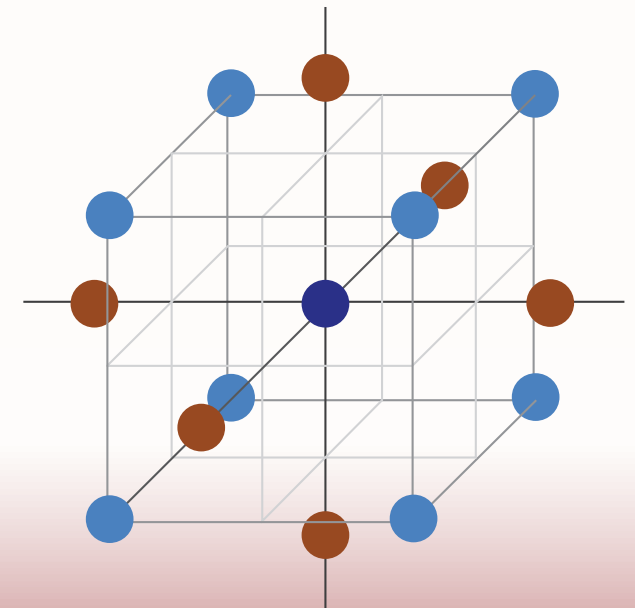
### CONTACT INFORMATION

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University of Tennessee  
Center for Renewable Carbon

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# DESIGN OF EXPERIMENTS FOR RAPID INNOVATION

MARCH 29-31, 2022

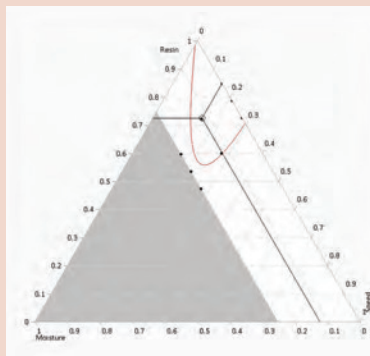
THE UNIVERSITY of  
**TENNESSEE**   
INSTITUTE of  
AGRICULTURE  
 AgResearch

## DESIGN OF EXPERIMENTS

Design of Experiments (DOE) refers to a process of planning an experiment so that appropriate data can be analyzed using statistical methods resulting in valid and objective conclusions. A designed experiment is a series of tests in which purposeful changes are made to input variables of a process or lab system so that we may observe and identify the objective reasons for changes in an output response. DOE facilitates the development of innovative robust products and/or processes. The fundamental principles of replication, randomization, and blocking are taught. Emphasis is given to minimizing the influence of “nuisance” factors during individual experimentation. The split-plot and nested designs for restrictions on randomization are important concepts for DOE in manufacturing settings.



## DESIGNING ROBUST PRODUCTS



A key challenge for businesses is to develop and sustain competitiveness by providing innovative and robust products. DOE provides a highly accepted set of statistical methods and experimentation protocols to enhance

scientific inference, improve decision making, and minimize business risk. DOE allows for the study of interaction effects of input factors which is not possible using the OFAT method or “one variable at time” experimentation. OFAT provides less information and results in more experimental runs or cost. Key methods taught for designing innovative and robust products are: split-plot and nested designs when randomization is restricted; response surface designs with and without blocking; mixture designs; and Taguchi robust product design.

## INSTRUCTOR



**Timothy M. Young, PhD**  
Professor | Graduate Director  
PhD NR (Statistics) The University of Tennessee  
MS Statistics, (Oper. Res.) The University of Tennessee  
MS Forest Economics (Statistics), University of Wisconsin  
BS Forestry, University of Wisconsin

### Memberships & Honors:

American Statistical Association  
American Society of Quality  
Forest Product Society (Past-President)  
Fulbright Scholar (Austria 2013-2014)  
Fulbright Specialist – Agricultural Statistics (Austria 2016)

Tim has 20 years of experience in the bio-based products industries with four years of experience with private sector in MDF manufacture. The Design of Experiments (DOE) course has been taught successfully since 2009. More than 20 companies have participated graduating more than 130 successful candidates through the course. The course has been taught off-site, privately for four companies.

## KEY CONCEPTS TAUGHT

MODERN DESIGN CONCEPTS INCLUDING KEY PRINCIPLES AND ASSUMPTIONS

ANOVA AND THE GLM

FULL FACTORIAL DESIGNS

ANCOVA

2K SCREENING DESIGNS

SAMPLE SIZE AND POWER

FRACTIONAL FACTORIALS AND PRINCIPLE OF ORTHOGONALITY

RANDOMIZED COMPLETED BLOCK DESIGN

SPLIT-PLOT AND NESTED DESIGNS

BLOCKING AND CONFOUNDING WITH FRACTIONAL FACTORIALS

RESPONSE SURFACE DESIGNS

CENTRAL COMPOSITE DESIGN (CCD)

BOX-BEHNKEN DESIGN

MIXTURE DESIGNS AND EXTREME VERTICES DESIGNS

SIMPLEX LATTICE

AUGMENTED AND UNAUGMENTED

## COURSE DESCRIPTION

The Center for Renewable Carbon (CRC) at The University of Tennessee holds training course which provides a comprehensive overview of the principles of designed experimentation for modern applications in R&D experiments, product innovation; with applications for the technical lab progressing to the manufacturing plant floor. Designing robust products is a key learning outcome of the course. Candidates participate in hands on activities and work on PC-based exercises using real world process data ( JMP 16 and Minitab 20 Software).

The course has easy to understand text which helps ensure a comfortable pace and fun learning experience benefiting the participants.

Session I will be held on March 29-31, 2022. The dates for Session II are agreed upon by participants at the end of Session I. The course is limited to cover candidates. The fee of \$3,350 covers lodging, food, registration, and local transportation for both sessions. Division of The University of Tennessee, Division of Outreach & Continuing Education will award 4.0 CEU' completes to each participant, who successfully completed both session of the course.

### DESIGNED FOR

- Technical Directors
- R&D Managers
- Quality Control Managers
- Product Innovation Engineers
- Continuous Improvement Specialists and Engineers