MIE 373 Simulation and Facility Layout

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Sept 5 Laboratory #1: Introduction to Course ........................................... Chapter 1

- Course Overview: Lectures(simulation); Lab(Factory project)  
- Today Simulation and Factory Project overview
  - What is Simulation?  
  - Why is it Important?  
  - Systems and Models
    - Model Building  
    - Simulation Costs and Risks  
    - Danaher Tool Case Study
- Handouts for project, general discussion
- Laboratory Orientation; account numbers, computers, etc.
- Project team formulation (mechanical system is best; mix of mtrls.; decomposable to weigh):
  - push lawn mower
  - portable heater
  - staplers(big hand)
  - tire pumps
  - swiss army knife
  - master brake cylinder
  - pencil sharpener
  - desk fan
  - weigh scale
  - hair dryer
  - popcorn popper
  - many other possibilities

Sept 7 F Lecture #1: Basics of Discrete Event Simulation(DES)......................... Chapter 2

- Basic Queue  
- Sample Path Hand Simulation  
- Basic Performance Measures

Sept 10 M Lecture #2 Sample Paths with Hwk#1: Hand Simulation Example........ Chapter 2

- Detailed Analysis  
- Statistics  
- Replications  
- First Homework handed out due next week in class Sept. 17

Sept 12 W Laboratory #II: .................................................Product Decomposition and Drawings

- Teams present their product and begin disassembly  
- Product Drawings on Pro Model or AutoCad  
- Parts List done in lab.  
- Slides from Chapter II  
- Lab Assignment is Parts List in ARENA drawing commands  
- Give out checklist for Section I.

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Sept 14 Fri Lecture #3: Quick Peek at ARENA ........................................ Ch. 3.1,3.2,3.3
  • Windows tour
  • Running the small example

Sept 17 Mon Lecture #4: Simple Queue Arena Model ..................................... Ch. 3.4-3.5
  • 1st homework is due
  • Create Arena program flow chart with modules
  • Running arena models

Sept 19 Wed Laboratory #III .................................................................Product Analysis
  • Bill-of-Materials (BOM) (review)
  • Operations Process Charts
  • Section I requirements and presentation guidelines
  • Lab Assignment is Assembly Charts, done in Arena is best

Sept 21 Fri Lecture #5 Modelling Basic Operations ......................................Chapter 4
  • Electronic Assembly and Test problem Model 4.1
  • 4.1.2 is construction of model
  • 4.1.3 Running model
  • Homework #2 handed out and is due on October 5th

Sept 24 Mon Lecture #6 Basic Operations and Inputs .....................................Chapter 4.2
  • Enhanced Electronics manufacturing example (Model 4.2)
  • Schedules and States
  • Resource Pictures

Sept 26 Wed Laboratory #IV Section I due ..................................................Section II Introduction
  • 10-15 minute presentations by each team of:
    • Production Drawings
    • Assembly drawing
    • Parts List
    • Assembly flow charts
  • Section II Overview of Process Planning
  • Operations Process Chart Route Sheets discussion second half of lab
  • Textbook discussion on Route Sheets
  • Lab Assignment is Operations Process Charts (sketched out)

Sept 28 Fri Lecture #7 .............................................................................ARENA Section 4.3
  • Enhancing the animation (Model 4.3)
  • Queues
  • Entity pictures
  • Variables and Plots

Oct 1 Mon Lecture #8 Model 4.4 EAS with Part Transfers ..................................... Ch. 4.4
Oct 3 Wed  Laboratory V: Manufacturing Analysis  
  - Cycle Times Laboratory  
  - Use of DSS for machining times.  
  - DSS Methodology handout.  
  - Lab Assignment is OP Chart + at least 1 Route Sheets  
  - OP Chart in Arena

Oct 5 Fri  Lecture #9 Manufacturing Processes  
  - Homework #2 is due  
  - Manufacturing Processes Overview  
  - Injection molding  
  - Stamping  
  - Other processes (see textbook)

Oct 9 TuesWed  Lecture #10 Input Analysis/Data Collection  
  - Data Collection and Input Analyzer software  
  - Data Analysis and Fitting Distributions  
  - Modelling Time Series Data

Oct 10 Wed  Laboratory VI: Process Planning  
  - MHS design  
  - Work on Factory projects; give out checklist for Section II(due next week).  
    - Route Sheets  
    - Material Costs  
    - Machine Tables  
    - Machine Drawings

Oct 12 Fri  Lecture #11 Probability Review  
  - Introduction  
  - Random Variables  
  - Distribution Functions  
  - Expectation  
  - Moments  
  - Correlations

Oct 15 Mon  Lecture #12 Data Analysis  
  - Goodness of Fit Tests  
  - Chi-Square Test  
  - K-S Test  
  - Homework #3 handed out and due Oct. 29

Oct 17 W  Laboratory VII  
  - Section II is due.  
  - Section III overview: Layout Planning Charts  
  - Chapter 7 of Textbook on MHS design  
  - Lab Assignment is Flow Process Charts; Layout Planning Charts  
  - Conveyors  
  - Industrial Trucks  
  - Cranes and Lifts  
  - DSS model runs

Oct 19 F  Lecture #13 Random Number Generation  
  - Appendices C&D
- Variate and Process Generation
- Inverse Transform Method
- Stochastic Process Generation

Oct 22 Mon Lecture #14 ARENA Modelling .......... Manufacturing System/Chapter 7.1 and 7.2
- This is a key Chapter to link the factory project and Arena modelling.
- Sequences implement the process plan.

Oct 24 Wed Laboratory VIII ................................................................. MHS design
- Section III overview: Initial Layout
- Chapter 4 & 7 of Textbook on MHS design
- Lab Assignment is Initial Layout using FLAP/GMAFLAD

Oct 26 Fri Lecture #15 ARENA Modelling ............................................ Chapter 7 Logic Modules
- Continued the development of the cell layout Section 7.3.
- Run model.

Oct 29 Mon Lecture #16 ................................................................. Chapter 7 Cell Animation 7.4
- Do the full animation process.
- Homework #3 is due

Oct 31 Wed Laboratory IX ................................................................. MHS Design
- Use the machine area templates and size of aisles to create a schematic layout of the machine areas and perhaps even the assembly areas.
- Also show the mhs decision support tool.
- Find pictures of material handling equipment.
- Costs of material handling equipment should be available from web.
- Lab assignment is mtrl. handling cost table and pictures of mtrl. handling items

Nov 2 Fri Lecture #17 ................................................................. Chapter 7 Steady State Simulation 7.5
- Steady state model of cell layout with WIP variables.
- Output Analysis

Nov 5 Mon Midterm (in-class)

Nov 7 Wed Laboratory X Section III continues .................................................................
- Begun final layout process with FLAP/MAFLAD & AutoCad.
- Should refine layout model and finish Layout Planning Charts.
- Finish Section III. (Chapter 7 in textbook)

Nov 9 Fri Lecture #18 (Transporters) MHS Design ............................................ Chapter 8.1
- Transporter lecture. (Chapter 8 in textbook)
- Couple with cell layout

Nov 12 Mon Veteran’s Day class canceled

Nov 14 Wed Laboratory XI Section III due ................................................................. Site Planning
- Section III is due (Chapter 7 in textbook)
- Site Planning (Chapter 10 in textbook)
- Site Plan process begun using block diagram of facility and
- Site Plan and Simulation of Site Plan
• Section IV & V overview: Personnel Planning, Corporate Structure, Unit Cost
• Office Layout
• Lab Assignment is Preliminary Site Plan

Nov 16 Fri Lecture #19: Chapter 8 MHS Design
• Transporters 8.2 MHS Design (Chapter 8 in textbook)
• Homework #4 Parts Simulation/Sequences

Nov 19 Mon Lecture #20: Chapter 8.3
• Finish the transporters animation lecture.

Nov 21 Wed Optional Laboratory- Thanksgiving recess (no class)
• No class? Want to refine the layout and include office, warehouse etc.
• Teams work on Section IV & V

Nov 26 Mon Lecture #21: Chapter 8 Conveyors model
• Accumulating and Non-Accumulating conveyors

Nov 28 Wed Laboratory XII Office Planning Laboratory XII: Section IV & V
• Office Planning Overview (Chapter 11 in textbook)
• Gave detailed handouts on the final cost, unit cost calculations, etc.
  – Corporate Structure
  – Unit Costs
  – Office Layout
  – Final Plant Layout
• Office Planning Laboratory

Nov 30 Fri Lecture #22: Verification Process
• Assembly and Painting tandem queue study with model verification process.
• This model is very good and is used in the Pan and Opt presentations.
• Homework #4 due

Dec 3 Mon Lecture #23: Batch and Assembly

Dec 5 Wed Laboratory XIII: Section VI
• Section IV and V due (Chapter 11 in textbook)
• Section VI and Final Plant Layout Development discussion. (Chapter 12 in textbook)
• Final project checklist.

Dec 7 Fri Lecture #24: Process Analyzer (PAN)
• Importance of Experimental Design

Dec 10 Mon Lecture #25 Optimization: PAN and OPT

Dec 12 Wed Laboratory XIV Section VI due: Final Development of Sections (I-VI)
• Presentation Requirements handed out.

Dec 14 Fri Last Class Final Plant Layout Refinement & Development.