

**SOUTHERN ILLINOIS UNIVERSITY**

**TECHNOLOGY DESIGN**

**IT 395 -- SYLLABUS**

I. COURSE NUMBER AND TITLE: IT 395, Technology Design

II. CREDIT HOURS: 3 credit hours

III. PREREQUISITE:

While there are no formal prerequisites for this course, the student is expected to know how to apply the principles found in the Technical Sketching, Manufacturing Processes, First-Line Supervision, Computer, Materials Handling & Plant Layout, Quality Control, Production & Inventory Control, Cost Estimating, and Industrial Safety courses. If you have not had these courses, then you need to discuss this deficiency with the instructor before attempting the course.

IV. DESCRIPTION OF COURSE:

Depending on your own personal situation and preferences, you are to choose from one of the following three options:

- Option 1 – Complete an individual project at your workplace.
- Option 2 – Complete a group project assigned by the instructor.
- Option 3 – Complete an individual project assigned by the instructor.

Each of these options are explained in this syllabus.

V. TEXTBOOK:

There is no formal textbook is used for this course. Instead, all Industrial Technology texts, in conjunction with library and field research, become the “text”.

VI. COURSE OBJECTIVES:

Upon completion of the course the student will be able to:

- 1) Design a system, its operational components, and to develop appropriate system cost.
- 2) Demonstrate understanding of system operation.

VII. INSTRUCTIONAL FORMAT:

This is a non-weekend formatted course or Independent Study consisting of written deadlines and general written guidelines as to what is expected of the student. The instructor will provide assistance and guidance as required.

## VIII. PROJECT SELECTION & EVALUATION:

All persons enrolled in this course will be expected to work together in one large group OR complete an individual project. See specifics later in the syllabus.

### GRADING STANDARD:

|   |            |   |          |
|---|------------|---|----------|
| A | 90 - 100 % | D | 60 - 69% |
| B | 80-89%     | F | < 60%    |
| C | 70-79%     |   |          |

## IX. STUDENT RESPONSIBILITIES:

- A. The due date for the completed report is six days prior to the end of the semester. A one-letter grade deduction will be made for each week it is late.
- B. For Options 1 and 3, individual projects, exceptions to this will be for TDY, emergency leave (vacation), etc.. Upon return from TDY, emergency leave, etc., the student has one week to complete the late work before the late penalty kicks in. Late work must be submitted with orders or other supporting documentation attached to them in order for the penalty to be waived. Late work submitted without documentation will be considered late -- no exceptions.
- C. For Option 2, given that this is a group project, there is no exception policy for late work. The group as a whole is expected to cover for missing members. It is suggested that you carefully and diligently police your fellow team members. If the members of the group feel that a member of the group is not pulling their weight, they may, with the consent of a two - thirds majority, remove members of the group for non - performance. This is an extreme measure, and it's expected that groups will first make every attempt to encourage renegade members to do their share of work. Any member removed from the group must complete an individual project (Option 1 or 3). This is non-negotiable.

## X. INCOMPLETES:

- A. For Options 1 and 3, individual projects, it is the policy of the professor not to give Incomplete grades. Occasionally, one realizes that events do occur which may merit the awarding of an Incomplete. In accordance with written university policy, an Incomplete grade will not be granted for any reason in a case where the student would not pass the course if all unfinished assignments were converted to zero points. Effectively this means that you have to have completed around 75% of the course to even be considered for an Incomplete. In the event that the student feels an incomplete is applicable in their case, it is their responsibility to document the reason in writing to the professor and it must be approved. If you fail to complete this step, an Incomplete will not be granted. Talking to the instructor on the phone or in the hallway does not constitute "in writing". In order to be granted an incomplete grade, you will be required to prove you have completed 75% of the course. The burden of proof is upon you.
- B. For Option 2, the group project, the incomplete policy is that incompletes will be granted in only the most unusual of circumstances (for example, the outbreak of war requiring immediate redeployment). The group is expected to police itself internally to resolve TDY conflicts, etc..

XI. INSTRUCTOR:

Dennis Lithgow  
(903) 751-4631 (Home)  
(501) 988-1391 (LRAFB - Tues 10:00 - 3:00)  
e-mail: denbeclithgow@juno.com (home)

XII. INSTRUCTOR AVAILABILITY:

The best way to communicate with the instructor is by e-mail. This is typically checked a minimum of once per day. Your instructor is also available by phone for conference and/or assistance at Little Rock AFB nearly every Tuesday at the above times. You may also feel free to call me at home to discuss problems. Students are encouraged to discuss problems as they arise, before they become major problems out of control. The instructor is also periodically at the base so that if you want to meet face-to-face, that is an option. Contact the Program Coordinator at the SIU base office to schedule a meeting time.

XIII. PLAGIARISM:

A reminder concerning plagiarism -- it's a serious offense. It is the presentation of another author's words or ideas as if they were your own. Follow proper documentation and crediting procedures and you won't go wrong.

Plagiarism occurs when one uses the exact language of someone else without putting the quoted material in quotation marks and giving its source. Plagiarism also occurs when the student presents on his own, the sequence of ideas, the arrangement of the material, or the pattern of thought of someone else, even though he expresses it as his own words. Plagiarism occurs when a sequence of ideas is transferred from a source to a paper without the process of digestion, integration, and reordering in the writer's mind and without the acknowledgement in the paper.

If you paraphrase a source, you must give credit to the author by indicating the source. If you take a quotation word-for-word, you must use quotation marks to indicate that the wording is the original author's.

The penalty for plagiarism in this course is: (1) zero credit for all work where plagiarized material exists; and (2) reporting of the matter to the Dean of Students.

#### XIV. REPORT FORMAT

- A) Use a Technical Report. The technical report format is to be used under all three options. Technical reports must be presented in a matter-of-fact manner, clear and concise, accurate, objective, restraint (i.e. emotion is not used for persuasion in technical writing), and have a specific format. Technical writing is utilitarian -- normally intended for readers who already have a special interest in the subject matter. Good technical reports are not measured by their volume in pages, but by their clarity and conciseness. Long reports, similar to long letters, are often not read by anyone in business or industry.
- B) Report Elements: The following elements / sections are required in the order listed.
- 1) Cover: Used to protect the report, the cover should have a short title, author, and organization (source of the report).
  - 2) Cover / Title Page: Normally indicates:
    - a) Subject of the report.
    - b) Person to whom report is made.
    - c) Person(s) making the report.
    - d) Date of the report.
    - e) IT 395, Technology Design.
  - 3) Letter of Transmittal: A letter from you to me. States why the report was prepared. Presents the minimum of facts necessary to orient the reader to the report. No prescribed length. Usually can be contained in one page.
  - 4) Table of Contents: Lists all the headings used and indicates the page on which the heading starts. Functions as a topical outline of the report. Includes appendixes and references.
  - 5) Executive Summary: Independent element of the report, placed early in the report. Should give the same impression that readers would get from reading the entire report. Should contain a statement of the problem, scope of the investigation, research methods used, key ideas used in the report, conclusion, and recommendations. Normally uses the language of management (money). Presents, in highly condensed form, the most important information that the report contains.
  - 6) Body / Narrative: Subdivide into the following sections:
    - a) Introduction: Describes the main purpose and scope of the report, identification of the problem, and the objectives of the report.
    - b) Discussion: Includes the analysis of the problem, alternative courses of action, and an evaluation of each course of action
    - c) Conclusion: A summary of what your report was about.
    - d) Recommendations: Recommend what the optimum solution is and why it was selected.

- 7) Appendix: A place to put material without placing it in the main part of the report. Tables, figures, calculations, lists, layouts, floor plans, maps, etc. should be located in the appendices.
- 8) Bibliography: Contains sources of material used in the report.
- C) Page Numbering: Number all pages except the title page and letter of transmittal.
- D) Paragraph Numbering: Use the decimal system for numbering headings and paragraphs.
- 1 First Section Heading
  - 1.1 First Paragraph
  - 1.1.1 First Subparagraph
  - 1.1.2 Second Subparagraph
  - 1.2 Second Paragraph
  - 1.2.1 First Subparagraph
  - 1.2.2 Second Su paragraph
  - 1.2.2.1 First sub-item
  - 1.2.2.2 Second sub-item
  - 2 Second Section Heading
- E) The completed report will be retained by the instructor. If you want a copy, make a copy before submitting the report.

## OPTION 1

### WORK RELATED INDIVIDUAL PROJECT

#### A Problem Solving Project

- I. Assignment: The student will evaluate a workplace (either their own or in a business concern that would welcome professional work) to identify a problem(s) that can be solved by the application of scientific principles and use of three Industrial Technology courses in the SIUC-IT degree program. Historically, these projects have been either very good, or very bad, with little in between. To do well you will need to **aggressively** apply what you have learned in this program to the problem at hand.
  
- II. Types of Projects: (Others are possible, but need approval by the instructor).
  - A) Facility layout improvement
  - B) Work methods improvement
  - C) Control of costs
  - D) Material handling equipment study and improvement
  - E) Analysis of inventory control system and improvement
  - F) Quality control program and improvement
  - G) Analysis of a major safety problem and improvement
  
- III. Project Specifics:
  - A) This is a “real world” individual project of your choosing.
  - B) Project Approval. Written Presentation Schedule. & Other Comments:
    - 1) Project Submission & Approval: Due not later than ten days after the beginning of the semester.
      - A) What to Look for in the Work Environment:
        - 1) Poor utilization of facilities
        - 2) Poor utilization of manpower
        - 3) Ineffective process layout
        - 4) High accident frequency
        - 5) Poor product and service quality
      - B) Once you have identified a problem(s), write a plan of action detailing the problem solving process as it applies to the specific problem and submit it for approval. See the following forms. These must be completed and returned to the instructor for approval.
    - 2) Written Document: Due not later than six days prior to the end of the semester. A formal, technical, written report format should be used. Be complete in your written analysis and specific with information and logic. The more complete, detailed, accurate, and professional your work, the better your project will be. As a minimum, three quantitative techniques must be used. The following are suggested techniques, but others may be used:

- A) Flow charting
  - B) Process charting
  - C) Statistical process control charts
  - D) Time and motion study
  - E) PERT and critical path diagrams
  - F) Production and inventory control models
  - G) Return on investment analysis
- 3) All work submitted for a grade becomes the property of Southern Illinois University. If you wish to retain a copy, it should be made before handing in the written document.
- 4) This is a self-study project, therefore there is no in-class lecture time. Any student needing clarification, special direction, or assistance with any aspect of the project should contact the instructor.
- 5) It is critically important to get approval for the project from high up within the company in writing. There have been instances in the past where students have spent nearly the entire semester working on a project to have the company decide at the end that the information is proprietary. The instructor is willing to sign any non-disclosure forms the company requires and to return the original of the report after grading if the company requests it in writing.

IV. Grading: Total of 1000 points possible.

| <u>Grading Breakdown:</u> |  | <u>Points</u> |
|---------------------------|--|---------------|
| A)                        | Problem difficulty and merit   | 200           |
| B)                        | Problem solution   | 600           |
| C)                        | Technical Report Format. Includes:   | 200           |
|                           | 1) Calculation correctness and accuracy  |               |
|                           | 2) Demonstrated application of scientific techniques and management practices from at least <u>three</u> Industrial Technology courses |               |
|                           | 3) Presentation form to include organization, neatness, grammar, punctuation, and syntax.  |               |

**Option 1      WORK RELATED INDIVIDUAL PROJECT**

**FORM TO BE COMPLETED BY THE STUDENT FOR INDIVIDUAL PROJECT**

STUDENT NAME: \_\_\_\_\_

For your problem(s), complete the following questions and return this form to the instructor. The questions will assist you and me in determining the significance, scope, relevance, and work required to solve or complete this proposed project.

1.     Problem Recognition: What symptoms or facts do you recognize that suggest a problem exists?
  
2.     Clearly Define the Central Problem:
  
3.     Objective or Goal: Write a statement of your objective or goal when solving this problem.
  
4.     Evaluation Criteria: Write a statement detailing the criteria you believe appropriate for evaluating the possible solutions generated.
  
5.     Analysis of the Central Problem: What factors, facts, or data would need to be generated and analyzed before solutions could be generated ?
  
6.     Generate Possible Solutions to the Problem: Do some brainstorming to generate several possible solutions. List as many plausible and implement able solutions as you can at this time with limited information.

**FORM TO BE COMPLETED BY THE COMPANY OR ORGANIZATION FOR INDIVIDUAL PROJECT**

1. Organization & Location:  
Company Name or Organization \_\_\_\_\_  
Street Address \_\_\_\_\_  
City, State, ZIP \_\_\_\_\_
  
2. The Project: Please briefly detail the problem or project the student will be working on in your organization and the benefit your organization will receive from its solution.
  
  
  
  
  
  
  
  
  
  
3. Work Required: What is your best estimate of the labor hours required to actually do this project?
  
  
  
  
  
  
  
  
  
  
4. Project Duration: What is your best estimate of the number of days required in your facility by the student in order to complete this project ?
  
  
  
  
  
  
  
  
  
  
5. Project Coordinator: Please provide the following information for the individual in your organization that will be the project coordinator.  
Coordinator Name \_\_\_\_\_  
Position or Title \_\_\_\_\_  
Work Phone Number \_\_\_\_\_  
Office Hours \_\_\_\_\_
  
  
  
  
  
  
  
  
  
  
6. Project Review: Please provide the following information for the individual in your organization who will review the completed project.  
Name \_\_\_\_\_  
Position or Title \_\_\_\_\_  
Work Phone Number \_\_\_\_\_  
Office Hours \_\_\_\_\_

THANK YOU FOR YOUR PARTICIPATION WITH THIS INFORMATION AND PROJECT.  
PLEASE RETURN THE COMPLETED FORM TO THE STUDENT.

**OPTION 1**

**WORK RELATED INDIVIDUAL PROJECT**

**(Point value possible in parenthesis)**

|                            |         |       |
|----------------------------|---------|-------|
| Problem Difficulty & Merit | 150 pts | _____ |
| Problem Solution           | 600 pts | _____ |
| Technical Report Format    | 250 pts | _____ |

- (50) Calculation correctness & accuracy
- (50) Demonstrated application (3 course minimum)

**Presentation form**

- (5) Cover (short title, authors, organization)
- (5) Title Page
- (5) Letter of Transmittal
- (5) Table of Contents
- (5) Executive Summary
- (105) Body
  - Introduction
  - Discussion
    - Analysis
    - Alternative courses of action
    - Evaluation of each alternative
- (5) Appendix
- (5) Bibliography
- (5) Page numbering (all except Title Pg & Ltr of T)
- (5) Paragraph numbering

## OPTION 2

### INSTRUCTOR ASSIGNED GROUP PROJECT

- I. Assignment: Using the document that accompanies this project, you are to plan for the launch of the product described below using the tools and techniques presented in the Industrial Technology curriculum. You are to assume this will be a new company and that the product is their only product.
- II. Product : The product you will build is a benchtop bandsaw. Detailed drawings along with the process used in building the prototype are available from the SIU Coordinator. (Based on higher production volumes, *it is expected your process will vary dramatically from the one laid out for the prototypes.*) You are to take the base document supplied to you and improve upon it so as to enhance the probability of successfully launch for this product.
- III. Business Plan & Product Demand: Your business plan should develop in detail your plans for production in order to meet the demand projected later in this document.
- IV. Project Specifics:
  - A) Group Size & Organization:
    - 1) This is a group project. While a “group” can be 2 or more persons, 4 – 5 persons is a more practical number if you expect to complete the project on time.
    - 2) Group members are to select one member of the team to be the Project Team Leader. It is recommended that this person be elected by secret ballot.
  - B) Project Approval. Written Presentation Schedule. and Other Commitments:
    - 1) Project Submission & Approval: Due not later than fourteen days following the beginning of the semester. You are to submit in writing to the instructor's office the name of the Project Team Leader, the initial projections of how the work is to be broken up among the members of the group, and an estimated timetable for completion of the project. The Project Team Leader should be prepared to discuss any concerns of the instructor.
    - 2) Written Document: Due not later than six days prior to the end of the semester. A formal, technical, written report format should be used. Be complete in your written analysis and specific with explanations. All decisions made should include assumptions, calculations, and all pertinent information and logic. The more complete, detailed, accurate, and professional your work, the better your project will be.
    - 3) All work submitted for a grade becomes the property of Southern Illinois University. **If you wish to retain a copy, it should be made before handing the project in.**
    - 4) This is a self-study project, therefore there is no in-class lecture time. Any student needing clarification, special direction, or assistance with any aspect of the project should contact the instructor.

C) Project Information: The project (and as applicable, the proposal) should include as a minimum the following:

1) Facilities Planning:

A) Equipment Required:

- 1) Number of machines at each level of production
- 2) Scrap rate for each operation
- 3) Machine efficiency (other than 100%)

B) Detailed Plant Layout:

- 1) Space calculations & justification
- 2) Process flow chart
- 3) Activity Relationship Chart
- 4) Activity Relationship Diagram

Facilities Plans may be need to accommodate varying levels of production over time. The most economical plant in year one is not the one needed in year ten. Plan accordingly.

2) Operational Planning:

A) Manpower Plan

- 1) Staffing for direct and indirect manpower
- 2) Organization chart

B) Product / Process Description

- 1) Detailed orthographic drawings of all tooling required
- 2) Material selection.
- 3) Operation process chart for product.
- 4) Assembly chart for product
- 5) Parts list and bill-of-material for product.
- 6) Workstation layout for each operation.
- 7) A process plan detailing the steps to be accomplished with short written descriptions and a listing of tooling required for that step. (The first three columns of Table 7.5 in Cost Estimating, 3rd Edn. by Ostwald are a good example).

C) Labor Estimation

- 1) Time study or Predetermined Time System estimate (MOST - Maynard Operation Sequence Technique) for each process step.
- 2) MOST estimate will give a time for the 150th unit. Adjust this time using learning curve theory to come up with adjusted time estimates for the full ten year life of the study.
- 3) PF&D Allowances estimate and justification.
- 4) Summary of standard times per product by operation step.

D) Sales, Production, and Inventory Schedules.

- 1) Equipment required and an **expansion plan** using the product demand estimates given later in this document.
  - 2) Quantitative production / inventory plan as to how inventory levels will be established (using EOQ formulas, ect.).
- 3) Product Costing & Profitability Analysis: Any cost not known may be estimated as long as it is reasonable and documented. No blind guessing allowed. The costs in item 3 c may be used **if you are not able to find actual costs**. The first ten year sales schedule for the products is listed in item 3 d that follows. Assume that material costs drop to 95% of their previous cost with each jump in annual production of 100 units / year.

A) Cost Estimates for all Items:

- |  |                      |
|--|----------------------|
| 1) Equipment   | 2) Tools and tooling |
| 3) Insurance   | 4) Buildings         |
| 5) Supplies  |                      |
| 6) Salaries for indirect labor   | 7) Utilities         |
| 8) Labor grades and pay scales for direct labor. Work incentive system, if used. |                      |

B) Products to be Costed Using Standard Cost Methodology: Product standard cost should be computed for each product for each year.

- 1) Direct material cost product.
- 2) Direct labor cost product
- 3) Overhead cost product

C) Representative Cost Information:

| ITEM  | COST (\$)     |
|---|---------------|
| 1) Forklift                                     | 18,000        |
| 2) Small press                                  | 50,000        |
| 3) Progressive die press                        | 300,000       |
| 4) Overhead conveyor with motor                 | 100 / ft      |
| 5) Assembly line floor conveyor w/ motor        | 100 / ft      |
| 6) Roller / gravity conveyor<br>(non-motorized) | 20 / ft       |
| 7) Plant building space                         | 100 / sq ft   |
| 8) Industrial zoned land                        | 10,000 / acre |
| 9) Milling machine (large)                      | 40,000        |
| 10) CNC Milling machine (large)                 | 100,000       |
| 11) CNC Machining center (large)                | 400,000       |
| 12) Milling machine (small)                     | 6,000         |
| 13) CNC Milling machine (small)                 | 20,000        |
| 14) CNC Machining center (small)                | 40,000        |
| 15) Radial Drill Press                          | 5,000         |
| 16) Sensitive Drill Press                       | 1,200         |
| 17) Lathe (large)                               | 50,000        |
| 18) CNC Lathe (large)                           | 200,000       |

- 19) Lathe (small) 5,000
- 20) CNC Lathe (small) 20,000
- 21) Industrial Air Compressor 50,000
- 22) Assembly Line Air Tools 500 each
- 23) Plating Line (complete) 750,000
- 24) Conveyor Oven (large) 75,000
- 25) Oven, non-conveyor, small 20,000
- 26) Vapor degreaser 10,000
- 27) Injection Molding Machine 150,000  
with 18 x 18 inch die
- 28) Injection Molding Machine 100,000  
with 12 x 12 inch die
- 29) Loading Dock (per lineal foot) 4,000
- 30) Cold rolled steel sheet 1 / lb
- 31) Stainless steel 3 / lb
- 32) Plastic 0.50 / lb
- 33) Administrative furnishings, modular 2000  
(per workstation)
- 34) Storage racks, non-automated 5 / cubic foot

D) Product Sales Forecast in Units:

|           | Yr. 1 | Yr. 2 | Yr. 3 | Yr. 4 | Yr. 5 | Yr. 6 | Yr. 7 | Yr. 8 | Yr. 9 | Yr. 10 |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| January   | 100   | 140   | 420   | 1150  | 1590  | 1640  | 2660  | 6580  | 7070  | 6820   |
| February  | 100   | 170   | 710   | 1220  | 1560  | 1780  | 2840  | 6660  | 6840  | 7810   |
| March     | 100   | 220   | 860   | 1380  | 1730  | 2290  | 3390  | 6820  | 8210  | 6800   |
| April     | 110   | 260   | 1040  | 1350  | 1750  | 2530  | 3580  | 7750  | 7800  | 6860   |
| May       | 110   | 410   | 1380  | 1430  | 2570  | 2850  | 4200  | 7580  | 7890  | 7900   |
| June      | 110   | 550   | 1340  | 1550  | 2720  | 3060  | 5250  | 8400  | 7880  | 6900   |
| July      | 210   | 640   | 1390  | 1720  | 2910  | 3130  | 6100  | 8640  | 79600 | 6990   |
| August    | 310   | 480   | 1210  | 1590  | 2560  | 2840  | 6100  | 8870  | 6870  | 7880   |
| September | 110   | 390   | 1000  | 1060  | 1990  | 2610  | 6330  | 8750  | 7820  | 8830   |
| October   | 110   | 270   | 980   | 1130  | 1770  | 2520  | 6560  | 8420  | 6800  | 5810   |
| November  | 110   | 250   | 1040  | 1110  | 1560  | 2410  | 6480  | 8460  | 7900  | 6800   |
| December  | 110   | 380   | 1070  | 1210  | 1740  | 2610  | 6590  | 8320  | 7840  | 7850   |
|           |       |       |       |       |       |       |       |       |       |        |

E) Process Information

- 1) Injection molding machine: Molding cycle time — 1 minute/cycle
- 2) Press operations: 3 seconds/cycle for one part per cycle
- 3) Small metal parts up to 6 inches in length or width:
  - A) Bending or forming: 4 seconds/cycle
  - B) Machining using CNC lathe: 10 seconds / square inch

4. Financial & Management Analysis:

- A) Calculate total amount of capital needed for initial startup. Three months of expenses will be required before any income is generated. The labor during that period will be used to develop all tooling and produce a prototype to be subjected to intense engineering review ("drive the pants off it") and will be used for review by "the press". To the greatest extent possible, all expansion is to be financed from internal cash flow. Calculate any additional cash infusions required in years 2 - 9. All capital requirements are to be summarized in one place in the report for the ten year period. Assume a tax rate of 35% on all "profits".
- B) Devise a sales and marketing plan. This plan should include a comparison of your operation to competitors. Also include a "racing campaign" as a means of advertising your product. Be sure to look at the cost of promotional material, press review of your product, etc.
- C) Customers are required to place their deposits (see attachments) and payments into an impound account. The monies from this account are freed to the firm on the day the product is shipped. All accounts due suppliers are net 30 days.
- D) Compute a break-even analysis for the product for each of the first three years. Break-even is found by plotting sales (income) vs. volume and expenses vs. volume (number of units manufactured).

V. Grading: Total of 1000 points possible. This is a group project and a grade will be assigned initially for the entire group. This grade will then be pro-rated based on the "Group Member Contribution" score sheets to be filled in by all group members. If the group determines that one participant isn't carrying their part of the work, then the group should discipline that member as appropriate on their own.

| <u>Grade Breakdown:</u>   | <u>Points</u> |
|---|---------------|
| A) Facilities Plan  | 200           |
| B) Operational Plan   | 325           |
| C) Product Costing & Profitability Analysis   | 125           |
| D) Financial & Management Analysis  | 100           |
| E) Technical Report Format. To include:   | 250           |
| 1) Calculation correctness and accuracy   |               |
| 2) Demonstrated application of scientific techniques and management practices from at least <u>three</u> Industrial Technology courses. |               |
| 3) Presentation form to include organization, neatness, grammar, punctuation, spelling, and syntax.                                     |               |

In order that you might have a better understanding of what the instructor is looking for in grading, the following worksheet is provided.

## IT 395 GRADE SHEET

### Option 2 Instructor Assigned Group Project

(Point value possible in parenthesis):

#### Facilities Plan

200 pts

\_\_\_\_\_

##### Equipment Required

- (30) No. of machines
- (10) Scrap rate per operation
- (10) Machine efficiency

##### Detailed Plant Layout

- (60) Space calculations and justification
- (20) Process flow chart
- (20) Activity Relationship chart
- (20) Activity Relationship diagram
- (30) Detailed Plant Layout drawing

#### Operational Plan

325 pts

\_\_\_\_\_

##### Manpower Plan

- (20) Staffing for direct/indirect labor by year
- (10) Organization chart by year

##### Product / Process Description

- (45) Detailed Orthographic tooling drawings of all required fixtures, gages, etc.
- (10) Material selection
- (20) Operation process chart (per product)
- (20) Assembly chart (per product)
- (10) Parts list & BOM (per product)
- (30) Detailed, drawn to scale, Workstation layout for each operation

##### Labor Estimation

- (75) Time Study / Predetermined Time System (MTM or MOST)
- (10) PF&D and justification
- (10) Summary of standard times

##### Sales, Production, and Inventory Schedules

- (15) Equipment required & 10-yr expansion plan
- (50) Quantitative production / inventory plan - how inventory levels will be set. (JIT, etc.)

**Product Costing & Profitability Analysis**

125 pts

\_\_\_\_\_

Cost Estimates for:

- (5) Equipment, tools, & tooling
- (5) Facilities
- (5) Labor grades & pay scales (or work incentive)
- (5) Salaries
- (5) Utilities & Insurance

Products Costed using Standard Cost Methodology:

- (20) Direct material per unit
- (30) Direct labor per unit
- (40) Overhead per unit
- (10) Cost summary table per unit

**Financial & Management Analysis**

100 pts

\_\_\_\_\_

- (65) Cash Needs Summary by year
- (25) Regulatory Requirements Summary
- (10) Break-even analysis for each of the first three years

**Technical Report Format**

250 pts

\_\_\_\_\_

- (50) Calculation correctness & accuracy
- (50) Demonstrated IT application (3 course minimum)

Presentation form

- (5) Cover (short title, authors, organization)
- (5) Title Page
- (5) Letter of Transmittal
- (5) Table of Contents
- (5) Executive Summary
- (105) Body
  - Introduction
  - Discussion
    - Analysis
    - Alternative courses of action
    - Evaluation of each alternative
- (5) Appendix
- (5) Bibliography
- (5) Page numbering (all except Title Pg & Ltr of T)
- (5) Paragraph numbering



## OPTION 2

### INSTRUCTOR ASSIGNED INDIVIDUAL PROJECT

- I. Assignment: Using the document that accompanies this project, you are to plan for the launch of the product described below using the tools and techniques presented in the Industrial Technology curriculum. You are to assume this will be a new company and that the product is their only product.
- II. Product: The product you will build is a tool holder for a lathe. The drawings needed to produce this product are contained in a handout available from the Program Coordinator along with a description of the process used to produce a prototype of the product. (Based on higher production volumes, *it is expected your process will vary dramatically from the one laid out for the prototypes.*) You are to take the base document supplied to you and improve upon it so as to enhance the probability of successfully launch for this product.
- III. Business Plan & Product Demand: Your business plan should develop in detail your plans for production in order to meet the demand projected later in this document.
- IV. Project Specifics:
  - A) Project Approval. Written Presentation Schedule. and Other Commitments:
    - 1) Written Document: Due not later than six days prior to the end of the semester. A formal, technical, written report format should be used. Be complete in your written analysis and specific with explanations. All decisions made should include assumptions, calculations, and all pertinent information and logic. The more complete, detailed, accurate, and professional your work, the better your project will be.
    - 3) All work submitted for a grade becomes the property of Southern Illinois University. **If you wish to retain a copy, it should be made before handing the project in.**
    - 4) This is a self-study project, therefore there is no in-class lecture time. Any student needing clarification, special direction, or assistance with any aspect of the project should contact the instructor.
  - B) Project Information: The project should include as a minimum the following:
    - 1) Facilities Planning:
      - A) Equipment Required:
        - 1) Number of machines at each level of production
        - 2) Scrap rate for each operation
        - 3) Machine efficiency (other than 100%)
      - B) Detailed Plant Layout:

- 1) Space calculations & justification
- 2) Process flow chart
- 3) Activity Relationship Chart
- 4) Activity Relationship Diagram

Facilities Plans may be need to accommodate varying levels of production over time. The most economical plant in year one is not the one needed in year ten. Plan accordingly.

2) Operational Planning:

A) Manpower Plan

- 1) Staffing for direct and indirect manpower
- 2) Organization chart

B) Product / Process Description

- 1) Detailed orthographic drawings of all tooling required
- 2) Material selection.
- 3) Operation process chart for product.
- 4) Assembly chart for product
- 5) Parts list and bill-of-material for product.
- 6) Workstation layout for each operation.
- 7) A process plan detailing the steps to be accomplished with short written descriptions and a listing of tooling required for that step. (The first three columns of Table 7.5 in Cost Estimating, 3rd Edn. by Ostwald are a good example).

C) Labor Estimation

- 1) Time study or Predetermined Time System estimate (MOST - Maynard Operation Sequence Technique) for each process step.
- 2) PF&D Allowances estimate and justification.
- 3) Summary of standard times per product by operation step.

D) Sales, Production, and Inventory Schedules.

- 1) Equipment required and an **expansion plan** using the product demand estimates given later in this document.
- 2) Quantitative production / inventory plan as to how inventory levels will be established (using EOQ formulas, ect.).

- 3) Product Costing & Profitability Analysis: Any cost not known may be estimated as long as it is reasonable and documented. No blind guessing allowed. The costs in item 3 c may be used **if you are not able to find actual costs**. The first ten year sales schedule for the products is listed in item 3 d that follows. Assume that material costs drop to 95% of their previous cost with each jump in annual production of 100 units / year.

A) Cost Estimates for all Items:

- |  |                      |
|--|----------------------|
| 1) Equipment   | 2) Tools and tooling |
| 3) Insurance   | 4) Buildings         |
| 5) Supplies  |                      |
| 6) Salaries for indirect labor   | 7) Utilities         |
| 8) Labor grades and pay scales for direct labor. Work incentive system, if used. |                      |

B) Products to be Costed Using Standard Cost Methodology: Product standard cost should be computed for each product for each year.

- 1) Direct material cost product.
- 2) Direct labor cost product
- 3) Overhead cost product

C) Representative Cost Information:

| ITEM  | COST (\$)     |
|---|---------------|
| 1) Forklift                                     | 18,000        |
| 2) Small press                                  | 50,000        |
| 3) Progressive die press                        | 300,000       |
| 4) Overhead conveyor with motor                 | 100 / ft      |
| 5) Assembly line floor conveyor w/ motor        | 100 / ft      |
| 6) Roller / gravity conveyor<br>(non-motorized) | 20 / ft       |
| 7) Plant building space                         | 100 / sq ft   |
| 8) Industrial zoned land                        | 10,000 / acre |
| 9) Milling machine (large)                      | 40,000        |
| 10) CNC Milling machine (large)                 | 100,000       |
| 11) CNC Machining center (large)                | 400,000       |
| 12) Milling machine (small)                     | 6,000         |
| 13) CNC Milling machine (small)                 | 20,000        |
| 14) CNC Machining center (small)                | 40,000        |
| 15) Radial Drill Press                          | 5,000         |
| 16) Sensitive Drill Press                       | 1,200         |
| 17) Lathe (large)                               | 50,000        |
| 18) CNC Lathe (large)                           | 200,000       |
| 19) Lathe (small)                               | 5,000         |
| 20) CNC Lathe (small)                           | 20,000        |
| 21) Industrial Air Compressor                   | 50,000        |
| 22) Assembly Line Air Tools                     | 500 each      |
| 23) Plating Line (complete)                     | 750,000       |

- 24) Conveyor Oven (large) 75,000
- 25) Oven, non-conveyor, small 20,000
- 26) Vapor degreaser 10,000
- 27) Injection Molding Machine 150,000  
with 18 x 18 inch die
- 28) Injection Molding Machine 100,000  
with 12 x 12 inch die
- 29) Loading Dock (per lineal foot) 4,000
- 30) Cold rolled steel sheet 1 / lb
- 31) Stainless steel 3 / lb
- 32) Plastic 0.50 / lb
- 33) Administrative furnishings, modular 2000  
(per workstation)
- 34) Storage racks, non-automated 5 / cubic foot

D) Product Sales Forecast in Units:

|           | Yr. 1 | Yr. 2 | Yr. 3 | Yr. 4 | Yr. 5 | Yr. 6 | Yr. 7 | Yr. 8 | Yr. 9 | Yr. 10 |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| January   | 100   | 112   | 405   | 1102  | 1587  | 1688  | 2600  | 6500  | 6897  | 6789   |
| February  | 100   | 145   | 700   | 1200  | 1555  | 1734  | 2844  | 6625  | 7209  | 6987   |
| March     | 120   | 208   | 840   | 1386  | 1700  | 2223  | 3309  | 6813  | 8800  | 7234   |
| April     | 125   | 220   | 1000  | 1310  | 1799  | 2512  | 3523  | 7700  | 8123  | 7900   |
| May       | 113   | 400   | 1031  | 1402  | 2500  | 2800  | 4200  | 7509  | 7765  | 7654   |
| June      | 113   | 513   | 1308  | 1588  | 2715  | 3001  | 5288  | 845   | 7999  | 8200   |
| July      | 200   | 608   | 1325  | 170   | 2900  | 3169  | 6109  | 8641  | 8578  | 8790   |
| August    | 312   | 475   | 1298  | 1598  | 2582  | 2896  | 6156  | 8859  | 8678  | 8700   |
| September | 119   | 312   | 1099  | 1066  | 1901  | 2600  | 6300  | 8700  | 8567  | 8600   |
| October   | 198   | 266   | 954   | 1102  | 1700  | 2500  | 654   | 8478  | 8234  | 8300   |
| November  | 154   | 245   | 1000  | 1105  | 1500  | 2408  | 6423  | 8498  | 8567  | 8600   |
| December  | 175   | 312   | 1000  | 1200  | 1700  | 262   | 6500  | 8365  | 8467  | 850    |
|           |       |       |       |       |       |       |       |       |       |        |

E) Process Information

- 1) Injection molding machine: Molding cycle time — 1 minute/cycle
- 2) Press operations: 3 seconds/cycle for one part per cycle
- 3) Small metal parts up to 6 inches in length or width:
  - A) Bending or forming: 4 seconds/cycle
  - B) Machining using CNC lathe: 10 seconds / square inch

4. Financial & Management Analysis:

- A) Calculate total amount of capital needed for initial startup. Three months of expenses will be required before any income is generated. The labor during that period will be used to develop all tooling and produce a prototype to be subjected to intense engineering review ("drive the pants off it") and will be used for review by "the press". To the greatest extent possible, all expansion is to be financed from internal cash flow. Calculate any additional cash infusions required in years 2 - 9. All capital requirements are to be summarized in one place in the report for the ten year period. Assume a tax rate of 35% on all "profits".
- B) Compute a break-even analysis for the product for each of the first three years. Break-even is found by plotting sales (income) vs. volume and expenses vs. volume (number of units manufactured).

V. Grading: A total of 1000 points possible, broken down as shown here.

| <u>Grade Breakdown:</u>   | <u>Points</u> |
|---|---------------|
| A) Facilities Plan  | 200           |
| B) Operational Plan   | 325           |
| C) Product Costing & Profitability Analysis   | 125           |
| D) Financial & Management Analysis  | 100           |
| E) Technical Report Format. To include:   | 250           |
| 1) Calculation correctness and accuracy   |               |
| 2) Demonstrated application of scientific techniques and management practices from at least <u>three</u> Industrial Technology courses. |               |
| 3) Presentation form to include organization, neatness, grammar, punctuation, spelling, and syntax.                                     |               |

In order that you might have a better understanding of what the instructor is looking for in grading, the following worksheet is provided.

## IT 395 GRADE SHEET

### Option 3 Instructor Assigned Individual Project

(Point value possible in parenthesis):

#### Facilities Plan

200 pts \_\_\_\_\_

##### Equipment Required

- (30) No. of machines
- (10) Scrap rate per operation
- (10) Machine efficiency

##### Detailed Plant Layout

- (60) Space calculations and justification
- (20) Process flow chart
- (20) Activity Relationship chart
- (20) Activity Relationship diagram
- (30) Detailed Plant Layout drawing

#### Operational Plan

325 pts \_\_\_\_\_

##### Manpower Plan

- (20) Staffing for direct/indirect labor by year
- (10) Organization chart by year

##### Product / Process Description

- (45) Detailed Orthographic tooling drawings of all required fixtures, gages, etc.
- (10) Material selection
- (20) Operation process chart (per product)
- (20) Assembly chart (per product)
- (10) Parts list & BOM (per product)
- (30) Detailed, drawn to scale, Workstation layout for each operation

##### Labor Estimation

- (75) Time Study / Predetermined Time System (MTM or MOST)
- (10) PF&D and justification
- (10) Summary of standard times

##### Sales, Production, and Inventory Schedules

- (15) Equipment required & 10-yr expansion plan
- (50) Quantitative production / inventory plan - how inventory levels will be set. (JIT, etc.)

**Product Costing & Profitability Analysis**

125 pts

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Cost Estimates for:

- (5) Equipment, tools, & tooling
- (5) Facilities
- (5) Labor grades & pay scales (or work incentive)
- (5) Salaries
- (5) Utilities & Insurance

Products Costed using Standard Cost Methodology:

- (20) Direct material per unit
- (30) Direct labor per unit
- (40) Overhead per unit
- (10) Cost summary table per unit

**Financial & Management Analysis**

100 pts

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- (65) Cash Needs Summary by year
- (25) Regulatory Requirements Summary
- (10) Break-even analysis for each of the first three years

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