

## Everyone's Smart University

### Project (Spring 2021)

|              |                        |               |
|--------------|------------------------|---------------|
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Section

Course

Code

Thursday

Date

Master

(PMG506)

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## Advanced project Management

### Instructions:

- آخر موعد للتسليم هو يوم الخميس 2021-05-20 في تمام الساعة 9 مساءً.
- الإجابة متاحة باللغة الإنجليزية أو اللغة العربية مع مراعاة أن تكون المصطلحات العلمية باللغة الإنجليزية.
- مع الالتزام نموذج الجامعة ولن تقبل أي مستندات أخرى.pdf يتم تسليم المشروع في صيغة ملف .
- طريقة البحث Literature Review ، دراسات علمية سابقة Introduction يجب مراعاة أقسام البحث الرئيسية (مقدمة ، وان كان هناك ملحقات References ، وأخيراً المراجع Results and Discussion ، النتائج والمناقشة Methodology Appendices يتم إضافتها)
- موحد كما يلي: Theme: يجب الالتزام بـ
- حجم الخط 12.
- نوع الخط Arial.
- لون الخط أسود.
- line spacing 1.5 المسافة بين الأسطر

- عدد صفحات البحث (لا يقل عن ثلاث صفحات ولا يزيد عن ست صفحات).

Instructor's Name: ~~Eng. Amaal Aburumman~~ **Eng. Dr. Akram M. S. Ali**

### Project:

You are required to document your role in administering a project. The project may be set in a business, social, sporting, or family environment but must be of a significant size and scale. If you do not have an actual project to write about you may complete the project hypothetically. **This report will be between three to six pages in length.** This is a significant research project.

Your report must address ~~each~~ **ONE** of the following issues:

1. Identify and describe the purpose, scope, and objectives of the project. **Display this information using an appropriate tool.**
2. Describe how the team is given an outline of the project.
3. Describe the strategies that are going to be set up to maintain communication with the team members.
4. Describe the tools that are going to be used to monitor the goals, time frames or milestones.
5. Identify project milestones and activities. **Display this information using an appropriate tool.**
6. Create a budget and link the costs to the key milestones for a project.
7. Describe how you are going to divide tasks and resources amongst a project team. **Display this information using an appropriate tool.**
8. Briefly describe how the progress will be monitored.
9. How are current project records maintained? Who has responsibility for this? provide some recommendations on how this process could be improved.
10. Describe the current procedure for finalizing projects. Create your own procedure and identify how you will evaluate the success of the project.
11. Legislation that may affect the project including health and safety, and anti-discrimination legislation.

**Best of luck...**

## المشروع:

مطلوب منك توثيق دورك في إدارة مشروع. قد يتم تعيين المشروع في بيئة تجارية أو اجتماعية أو رياضية أو عائلية ولكن يجب أن يكون بحجم مناسب. إذا لم يكن لديك مشروع فعلي لتكتب عنه ، فيمكنك إكمال المشروع افتراضياً. ستكون هذا التقرير من ثلاث إلى ست صفحات

يجب أن يعالج تقريرك ~~كل~~ **احد** القضايا التالية:

1. تحديد ووصف الغرض والنطاق والأهداف من المشروع. اعرض هذه المعلومات باستخدام أداة مناسبة.
2. صف كيف يتم إعطاء الفريق مخططاً تفصيلياً للمشروع.
3. وصف الاستراتيجيات التي سيتم وضعها للحفاظ على التواصل مع أعضاء الفريق.
4. صف الأدوات التي سيتم استخدامها لرصد الأهداف أو الأطر الزمنية أو المعالم.
5. تحديد معالم المشروع والأنشطة. اعرض هذه المعلومات باستخدام أداة مناسبة.
6. إنشاء موازنة وربط التكاليف بالمعالم الرئيسية للمشروع.
7. صف كيف ستقوم بتقسيم المهام والموارد بين فريق المشروع. اعرض هذه المعلومات باستخدام أداة مناسبة.
8. صف بإيجاز كيف سيتم رصد التقدم.
9. كيف يتم الاحتفاظ بسجلات المشروع الحالية؟ من المسؤول عن هذا؟ تقديم بعض التوصيات حول كيفية تحسين هذه العملية.
10. وصف الإجراء الحالي لإنهاء المشاريع. قم بإنشاء الإجراء الخاص بك وحدد كيفية تقييم نجاح المشروع.
11. التشريعات التي قد تؤثر على المشروع بما في ذلك الصحة والسلامة ، وتشريعات مكافحة التمييز.

مع تمنياتي بالتوفيق..

## **Project Management for SOFTWARE PACKAGE FOR THERMAL DESIGN OF HEAT EXCHANGER**

### **1. INTRODUCTION**

Heat exchanger is one of devices that is convenient in industrial and household application. These include power production, chemical industries, food industries, electronics, environmental engineering, manufacturing industry, and many others. It comes in many types and function according to its uses.

A software is important for design a heat exchanger and it has many benefits for industries and Academy facilities Renowned for its high accuracy and efficiency when students can use this software to learn the basics of heat exchanger.

This project is mainly producing a new software package to be utilized to carry out thermal design for heat exchanger and condenser for real life engineering situations. Some of the variables are the length of the unit, the surface area, the number of tubes, and tube passes; tube layout; the bundle type types, baffle type and geometry; and stream allocation.

At the beginning of the project, I was responsible for collecting data related to the equations and variables used in arithmetic problems. Upon implementation, I was responsible for arithmetic and hypothetical problems, applying equations in the software applied to it, and verifying whether they match.

In this research I chose most points requirements in for this course assignment I will show our tools and technique were we use it to manage this work. The benefits of Project Management Tools and Techniques Improve quality of projects such as: [1]

- ❖ Meet or exceed customer requirements
- ❖ Reduce project planning time
- ❖ Reduce costs of projects
- ❖ Reduce duplication of work and effort
- ❖ Improve the quality of communication among stakeholders

## **2. Literature Review**

### **2.1 Year 1998:**

K. C. LEONG and K. C. TOH and Y. C. LEONG A software for the thermal and hydraulic design of shell and tube heat exchangers with flow induced vibration checks has been developed in a Windows-based Delphi programming environment. Its user-friendly input format and excellent color graphics features make it an excellent tool for the teaching, learning and preliminary design of shell and tube heat exchangers. Design methodology is based on the open literature Delaware method while flow-induced vibration calculations adhere closely to the methodology prescribed by the latest TEMA standards for industry practice. It is hoped that the software will bridge the gap between the teaching of engineering fundamentals and the existing industry practice of shell and tube heat exchanger design.[2]

### **2.2 Year 2011:**

El-Harbawi, M., Acellam, D. and Yin, C-Y from Murdoch University they designed a Tube and Shell Heat Exchanger software. This software can be customized to apply any of three methods which are the Bell-Delaware, Kern and stream analysis methods. Therefore, the user is given an option to select the most appropriate method for his design. The development of this software was based on Kern and Bell-Delaware methods, both used for the thermo-hydraulic design analysis. Their mechanical design is based on TEMA standard. For the heat exchanger analysis, they used Log Mean Temperature Difference (LMTD) method and Visual Basic software as a programming language.[3]

## **3. Methodology**

After we make our literature review we found that most of the backed work on heat exchanger software design depend on the visual basic program as language program and used LMTD method in heat exchanger analysis. Most of the heat exchanger software design was based on the LMTD method because it's easy to use in software. There is some little heat exchanger software design based on

HYSYS program. Also, we didn't find any heat exchanger software design based on NTU method.

So, based on this background our software will design by using Aspen Tech program and we will use the LMTD method in the heat exchanger analysis.

## **4. Project Management**

### **4.1 Revise Problem Statement:**

Design a new software package to be utilized to carry out thermal design for heat exchanger and condenser.

### **4.2 Project Charter:**

#### **4.2.1 Project and Product Overview**

Design a new software package to be utilized to carry out thermal design for heat exchangers. We will use Hysys aspen program to design the software package. Our project start at September of 2014 and will end at the May of 2015, the estimated project duration is 8 months and the estimated project budget is 1200 S.R.

#### **4.2.2 Justification**

##### **4.2.2.1 Business need:**

About the business need for the project, we need to money to get the Hysys aspen program to design our software.

##### **4.2.2.2 Impact:**

We can divide the impact of our project to two side, for designer and for customer. For customer if there is an problem and he need to buy a heat exchanger he can know what is the type of the heat exchanger that is he need to, just by using our software he put the necessary data in the program and he will know the proper type

of heat exchanger just in short time and accurately. For designer, he will sell a lot of copies of his products because the program is very important for customers who deal with heat exchangers.

### **4.2.3 Scope**

#### **4.2.3.1 Objectives of the project:**

The objective of this project is to produce a new software package to be utilized to carry out thermal design for heat exchanger and condenser for real life engineering situations. Some of the variables are the length of the unit, the dirt factor, the surface area, the number of tubes, and tube passes; tube layout; the bundle type types, baffle type and geometry; and stream allocation. One method is to be used, namely the LMTD.

#### **4.2.3.2 Major deliverables:**

- 1- Design a software in applicable time around 8 months.
- 2- The budget of the project will not exceed 1200 S.R.
- 3- Design a software that can be developed with time.

### **4.2.4 Duration**

The project is to be realized by the end of the second semester of the year 2015. A progress report is due by the end of the first semester.

### **4.2.5 High-level alternatives analysis**

When we did our literature review we found that there are two programs that we can use to design our project which are Hysys aspen and visual basic programs. We choose the Hysys aspen program because there are a lot of programs that have been designed by visual basic, so we choose the Hysys aspen. But there is a problem that we encountered which is that we have to learn how to use Hysys aspen to design our software.

#### **4.2.6 Summary budget and project organization**

There is budget is 1200 S.R. provided for this project. Students dedicate 4 to 6 hours weekly to working on the project. The chemical engineering department also provides any technical support the students may need.

#### **4.2.7 Goals**

##### **4.2.7.1 Client's Goal:**

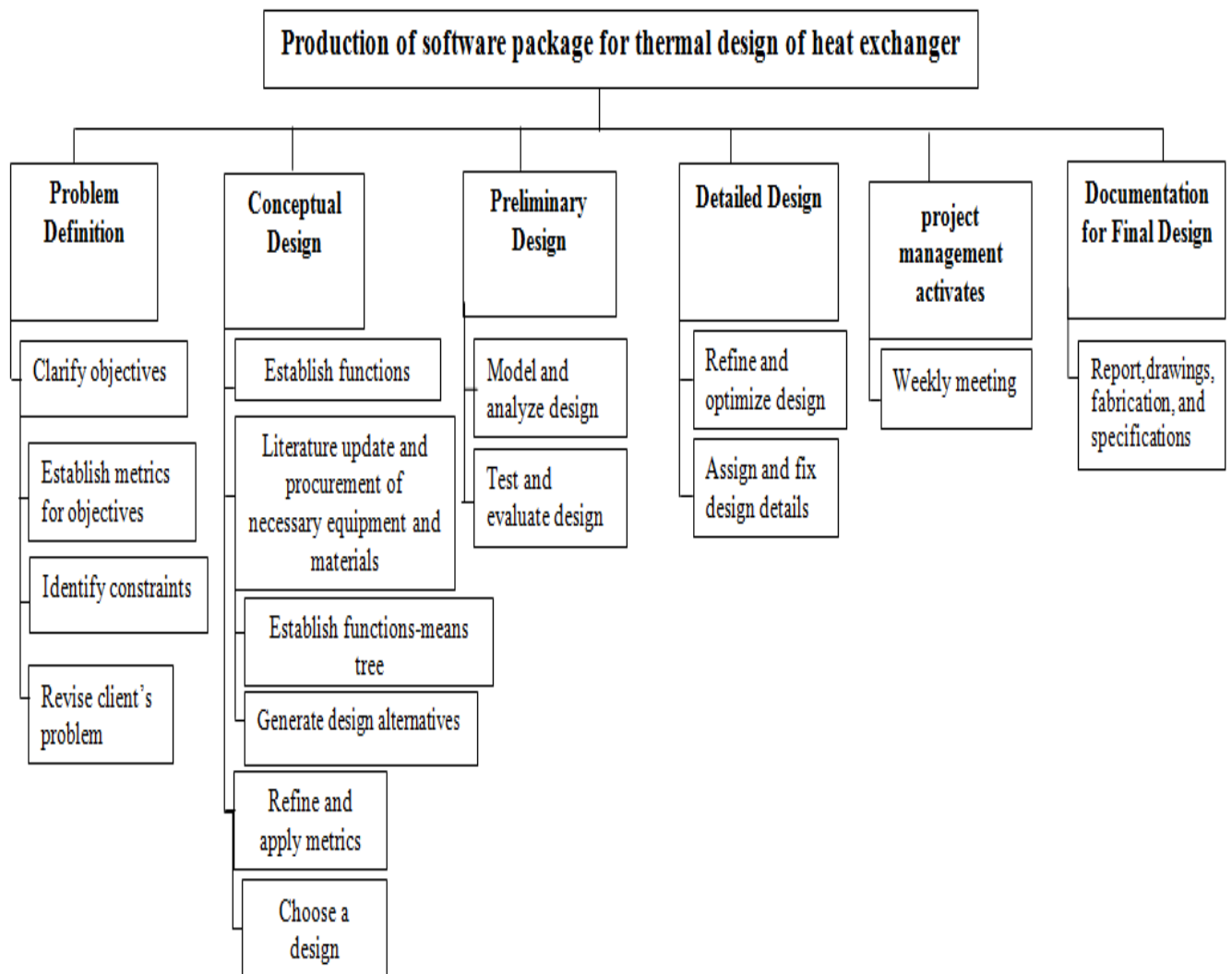
The client desires to have the technical team design and design a new software package to be utilized to carry out thermal design for heat exchangers. The client's duties are to provide structure and guidelines regarding project management techniques.

##### **4.2.7.2 Project Supervisor's Goal:**

The supervisor is to provide support regarding preliminary design, detailed design and set guidelines for the technical report write-up.

#### **4.3 Work Breakdown Structure (WBS):**

The Work Breakdown Structure (WBS) is a method used to divide the project into simple and concise tasks. It helps organize the work and give a clear view of what the tasks are simply by graphical representation. The WBS is illustrated in **Figure 4.1**.



### Work Breakdown Structure (WBS)

#### 4.4 Linear Responsibility Chart (LRC):

After WBS we are going to show the responsibilities of each team member in terms of the tasks and subtasks to be completed. This step can help us to manage our project and every member should know what his task is. We will list our tasks that we made by WBS by using linear responsibility chart (LRC). So, in LRC we will divide the roles between members in each task to manage our work. LRC shown in **Table 4.1.**

**Table 1.1: Linear Responsibility Chart (LRC)**

| <b>Liner Responsibility Chart</b>                                                 | <b>M1</b> | <b>M2</b> | <b>M3</b> | <b>M4</b> | <b>Director of design</b> |
|-----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|---------------------------|
| Clarify objectives                                                                | 2         | 2         | 3         | 1         | 4                         |
| Establish metrics for objectives                                                  | 3         | 4         | 1         | 2         |                           |
| Identify constraints                                                              | 2         | 1         | 4         | 3         |                           |
| Revise client's problem statement                                                 | 1         | 3         | 2         | 4         |                           |
| Establish function                                                                | 3         | 4         | 2         | 1         |                           |
| Literature update and procurement of necessary equipment and materials            | 3         | 1         | 4         | 2         |                           |
| Establish means for functions and functions-means tree                            | 2         | 3         | 1         | 2         | 4                         |
| Generate design alternatives                                                      | 1         | 4         | 2         | 3         |                           |
| Refine and apply metrics to design alternatives                                   | 2         | 1         | 3         | 4         |                           |
| Choose a design                                                                   | 3         | 2         | 1         | 4         |                           |
| Model and analyze chosen design                                                   | 1         | 3         | 4         | 2         |                           |
| Test and evaluate chosen design                                                   | 4         | 1         | 2         | 2         | 3                         |
| Refine and optimize chosen design                                                 | 1         | 2         | 3         | 4         |                           |
| Assign and fix design details                                                     | 1         | 2         | 4         | 3         |                           |
| Weekly meeting                                                                    | 4         | 3         | 1         | 2         |                           |
| Report, drawings, fabrication, and specifications                                 | 2         | 1         | 3         | 4         |                           |
| <b>Key: 1: Main Responsibility, 2: Support/work, 3: Review, 4: Final Approval</b> |           |           |           |           |                           |

#### **4.5 Gantt Chart:**

Gantt chart is a time technique that we use to make our project tracking clear for us to know how much achievement we made along the project. It shows the tasks on the left hand side and the weeks in the top as shown in **Table 4.2**.

**Table 2.2: Gantt chart**

| Task/Week                                                              | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Clarify objectives                                                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Establish metrics for objectives                                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Identify constraints                                                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Revise clients problem statement                                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Establish functions                                                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Literature update and procurement of necessary equipment and materials |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Establish means for functions and functions-means tree                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Generate design alternatives                                           |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Refine and apply metrics to design alternatives                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Choose a design                                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Model and analyze chosen design                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Test and evaluate chosen design                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Refine and optimize chosen design                                      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Assign and fix design details                                          |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Weekly meetings                                                        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Report, drawings, fabrication, and specifications                      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |

#### 4.6 Percent Complete Matrix:

This technique is called the Percent Complete Matrix (PCM). The PCM is used to determine the overall status of the project by using the work breakdown structure. The planned duration of each task is predetermined in days. The status of each task is displayed in the matrix, as well. See the PCM in **Table 4.3**

**Table 3.3: Percent Complete Matrix**

| Task                                                                   | Planned Duration (days) | Percent of Total | Status (see keys) | Credit (Days) |
|------------------------------------------------------------------------|-------------------------|------------------|-------------------|---------------|
| Clarify objectives                                                     | 2                       | 1.3%             | 2                 | 2             |
| Establish metrics for objectives                                       | 4                       | 3%               | 2                 | 4             |
| Identify constraints                                                   | 3                       | 2%               | 2                 | 3             |
| Revise client's problem statement                                      | 2                       | 1.3%             | 2                 | 2             |
| Establish functions                                                    | 2                       | 1.3%             | 2                 | 2             |
| Literature update and procurement of necessary equipment and materials | 30                      | 20%              | 1                 | 20            |
| Establish means for functions and functions-means tree                 | 6                       | 4%               | 2                 | 6             |
| Generate design alternatives                                           | 4                       | 3%               | 2                 | 4             |
| Refine and apply metrics to design alternatives                        | 5                       | 3.3%             | 2                 | 5             |
| Choose a design                                                        | 2                       | 1.3%             | 2                 | 2             |
| Model and analyze chosen design                                        | 20                      | 13.4%            | 1                 | 15            |
| Test and evaluate chosen design                                        | 4                       | 3%               | 1                 | 2             |
| Refine and optimize chosen design                                      | 8                       | 5.3%             | 0                 | 0             |
| Assign and fix design details                                          | 12                      | 8%               | 1                 | 3             |
| Weekly meeting                                                         | 30                      | 20%              | 1                 | 20            |
| Report, drawings, fabrication, and specifications                      | 15                      | 10%              | 1                 | 8             |
| <b>Total</b>                                                           | <b>149</b>              | <b>100%</b>      |                   | <b>65.77%</b> |
| <b>Key: 0= Has not started, 1= In progress, 2= Completed.</b>          |                         |                  |                   |               |

## 5. Result

This project has been the design of shell and tube heat exchanger by use Aspen programs. The first task completed in Hysys was the analysis of the two streams in the process that needed to be heated and cooled. A sensitivity run was utilized to determine the enthalpy of each system over the appropriate temperature range. Then we go to design another problem more complex but Hysys doesn't allow for deep design .That was a big reason to use another aspen program more successful in design than Hysys it's Aspen Exchanger Design & Rating (Aspen EDR) to solve a problem with same material (water -water ) and second problem with different material ( water - oil ).

Project management tools have been used to compare and evaluate various alternatives and we using Aspen programs.

Cost estimation From the results obtained, the software can be calculate cost of the design. Lastly the most suitable and economical heat exchanger is decided. Also, there are three parameters involved in computing the total cost of a software development project:

1. Hardware and software costs including maintenance
2. Travel and training costs
3. Effort costs (the costs of paying software engineers).

For the future work Thermal design for heat exchanger is a hot topic of research. It is useful if someone try to make a package for using aspen tech software to design a heat exchanger by using the NTU method. Also, we think it will be more useful if someone using aspen tech software to see which method is more useful in design heat exchangers LMTD or NTU method.

## 6. References:

- 1- <https://www.pmi.org/learning/library/project-management-tools-techniques-impact-success-8349>
- 2- K. C. LEONG and K. C. TOH. **(1998)**. Shell and Tube Heat Exchanger Design Software for Educational Applications. School of Mechanical and Production Engineering, Nanyang Technological University, 14(3), pp.217-224. Retrieved October 26, 2014, from  
<http://www.ijee.ie/articles/Vol14-3/ijee1015.pdf>
- 3- El-Harbawi, M., Acellam, D. and Yin, C-Y. (2011). Development of educational software for designing shell-and-tube heat exchangers. International Journal of Mechanical Engineering Education, 39 (4), pp. 291-296. Retrieved November 3, 2014, from  
<http://researchrepository.murdoch.edu.au/10536/>