

GLASGOW COLLEGE UESTC

Exam

Engineering Project Management & Finance (UESTC 3031)

**Date: June 21st 2023
Time: 09:30-11:30AM**

Attempt all PARTS. Total 100 marks

Use one answer sheet for each of the questions in this exam.

Show all work on the answer sheet.

For Multiple Choice Questions, use the dedicated answer sheet provided.

Make sure that your University of Glasgow and UESTC Student Identification Numbers are on all answer sheets.

An electronic calculator may be used provided that it does not allow text storage or display, or graphical display.

All graphs should be clearly labelled and sufficiently large so that all elements are easy to read.

The numbers in square brackets in the right-hand margin indicate the marks allotted to the part of the question against which the mark is shown. These marks are for guidance only.

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Section A: Multiple Choice Questions

Q1 Multiple Choice Questions (MCQs): There are 12 MCQs. You are provided with five options to each question (A, B, C, D, or E). ONLY one of the five is the correct answer for each question.

(1.1) Why do companies use project management? Choose the correct combination of statements. [2]

- 1 - To define the project and agree with the customer
- 2 - To estimate project cost and make proposals
- 3 - To assess risk and failure points and make back up plans
- 4 - To allocate the right resource at the right time
- 5 - To track the schedule only once the plan is made

A – 1 + 2 + 3 + 5

B – 1 + 2 + 4 + 5

C – 2 + 3 + 4 + 5

D – 1 + 3 + 4 + 5

E – 1 + 2 + 3 + 4

(1.2) In a Profit and Loss (Income) statement, Earnings before Interest, Tax, Depreciation, and Amortisation (EBITA) is equal to: [2]

A – Total Sales minus Cost of Sales

B – Total Expenses minus Net Profit

C – Total Sales minus (Salaries + Rent)

D – Gross Profit minus all company operating expenses (salaries and rent etc.)

E – Full production costs minus Net Profit

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- (1.3) If a company has an organisational structure as shown below in Figure Q1(1.3), it is called: [2]

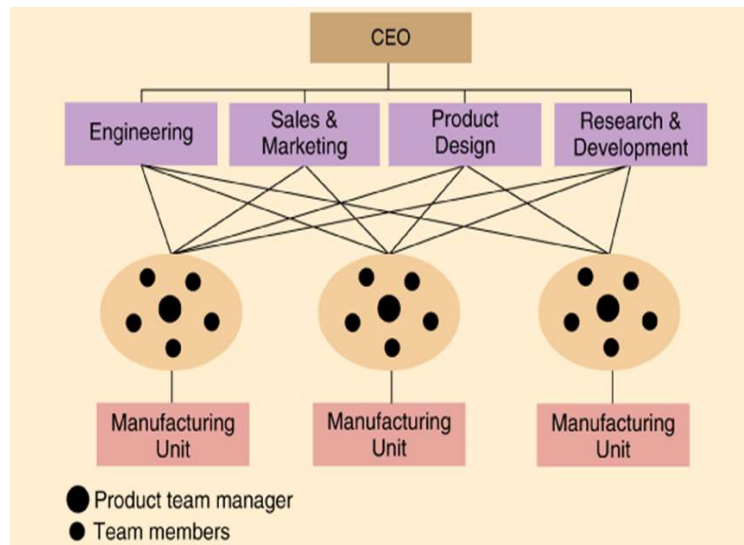


Figure Q1(1.3)

- A – A Team-Based Structure
- B – A Matrix Structure
- C – A Divisional Structure
- D – A Simple Startup Structure
- E – A Military Command Structure

- (1.4) A Sole Trader Company is: [2]

- A – A business you run as an individual. You can keep all your business' profits after you have paid tax on them. You are personally responsible for any losses your business makes.
- B – A business in which you and your business partner (or partners) personally share responsibility for your business. You can share all your business's profits between the partners. Each partner pays tax on their share of the profits.
- C – A company whose shares can be freely traded on the stock market.
- D – An organisation you can set up to avoid paying tax or having any responsibility as a director.

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E – An organisation you can set up to run your business- it is responsible for everything it does, and its finances are separate from your personal finances. Any profit it makes is owned by the company after it pays Corporation Tax. The company can then share its profits amongst its shareholders.

- (1.5) In a simple Lease-or-Buy calculation, you require a radar equipment for a project. The cost to buy the equipment is 30,000 RMB plus an additional 500 RMB per day. You are able to lease the equipment from a local company at a cost of 2000 RMB per day. What is the maximum length of time you can lease the equipment before it is cheaper to buy the equipment? [2]

A – 3 days

B – 10 days

C – 20 days

D – 30 days

E – 16.333 days

- (1.6) If **TC** = Total Cost, **F** = Fixed Costs, **VC** = Variable Cost, **SP** = Selling Price, **R** = Revenue, and **Q** = Quantity of products sold, then the breakeven point of a project is defined as: [2]

A – When $F - (VC) * Q = (SP) * Q$

B – When $TC = R$

C – When $(R) * Q = SP - VC$

D – When $TC = F + (VC) * Q$

E – When $R = (SP) * Q$

- (1.7) What is a Profit & Loss (Income) statement? [2]

A – It only summarises all the sales revenues for the financial year

B – It only summarises all the payments or expenses for the financial year

C – It is only used when the company makes a loss

D – It summarises the sales revenues, payments, and expenses for the financial year

E – It is only used when the company makes a profit

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(1.8) In a Profit and Loss (Income) statement, the Gross Profit is equal to: [2]

A – Total Expenses minus Net Profit

B – Sales minus Expenses

C – Total Sales minus Cost of Sales

D – Total Sales minus (Salaries + Rent)

E – Full production costs minus Net Profit

(1.9) If a company is described as having a ‘Defender (i.e. market leader or stable market)’ Strategic Posture, it displays the following characteristics: [2]

	Emphasis	Market Focus	Structure and Process	Technology
A -	Pioneering changes and innovation	Aggressively explore and exploit new market opportunities	Organic: informal, decentralised, and flexible	Contingent, multiple, prototypical technologies; low degree of routinisation and mechanisation
B -	Stability and efficiency	Maintain a small niche	Mechanistic: hierarchical, centralised, and control	One core highly cost-efficient technology
C -	Balanced: minimised risks and maximise profits	Defend core business while cautiously exploit proven new markets by imitating Prospectors	Matrix organisation – coalition between core functions	Dual core with emphasis on applied research
D -	Reluctant to act due to instability and uncertainty	Unsure	Maintain whatever structure is in place; often a weak link with strategy, which is unclear	Unsure

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E -	Stability and efficiency	Aggressively explore and exploit new market opportunities	Organic: informal, decentralised, and flexible	Dual core with emphasis on applied research
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(1.10) Design for Manufacturing (DFM) is an important part of any product development cycle (e.g., initial design, final design, fabrication, production, and product launch). Which item below is correct: [2]

- A – The DFM is more effective to be applied in the production stage because of the higher impact and lower cost of changes due to the product being manufactured and can be changed promptly.
- B – The DFM is more effective to be applied during product launch because of the highest impact and lowest cost of changes.
- C – The DFM is more effective to be applied to the initial design because of the highest impact and lowest cost of changes.
- D – The DFM is more effective to be applied after the initial design and before production when the final design is being finalized and can effectively implement required changes according to customer requirements.
- E – The DFM is more effective to be applied in all stages after design because we are sure that the customer requirements are recognized completely and any changes in the future do not impose higher costs of changes.

(1.11) There is a variety of actionable sustainable design principles that can be implemented to create better designs. Some of them are below except: [2]

- A – Dematerialization.
- B – Migration to product-service systems.
- C – Limit or eliminate long-distance outsourcing.
- D – Design for a shorter period of usage.
- E – Invest in simulation.

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(1.12) When analyzing broad causes by looking at the specific parts, the Pareto chart is one of the applicable tools for the control of quality. Which of the following statements about a Pareto chart is true? [2]

A – It is a bar graph that displays the relative frequency or size of problems in descending order of importance.

B – It is a line graph that shows the cumulative percentage of problems plotted against the total number of occurrences.

C – It is a scatter plot that indicates the correlation between two variables.

D – It is a pie chart that breaks down the total number of problems into categories.

E – None of the above statements.

Section B: Long Questions

- Q2 You are a project manager working on China's high speed railway. You need to install a major new piece of electrical equipment into a new station that is being built at Chengdu's new airport. The only way to install the new equipment is to hire a tower crane to lift it into position. As the project manager, you have collected all the information and tasks required to build a tower crane on the station site and recorded the tasks in Table Q2(a).

Table Q2(a): Tower Crane tasks and durations.

Task Number	Task Description	Duration (days)	Predecessors
0	Project Start (Milestone)	0	
1	Specify Crane	3	0
2	Survey Site	4	1
3	Survey Power Supply	3	1
4	Select Site	1	2
5	Order Tower Crane	2	3,4
6	Arrange Transport	4	5
7	Order Mobile Erector Crane	3	5
8	Install Concrete Plinth	5	5
9	Confirm Site Access	1	6,7,8
10	Get Mobile Erector Crane on Site	4	9
11	Crane Parts on Site	5	9
12	Install Crane Base	2	10,11
13	Install Tower & Crane Head	1	12
14	Assemble Jib	2	10,11
15	Install Jib	1	12,13
16	Install counterweight	1	15
17	Apply Crane Power	1	16
18	Test Crane	1	17
19	Project end	0	18

- (a) Show the above information on a Network diagram showing each task duration and the interdependencies of each task. [8]
- (b) Using the Network diagram:
- (i) List the critical path tasks in the order they occur. [3]
- (ii) Calculate the project's overall duration (show your working). [2]
- (c) Develop a Gantt chart for this project showing all tasks, interdependencies, slack time, and critical path. [7]

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- (d) If Task 8 (Install Concrete Plinth) cannot be started until the 'Mobile Erector Crane' has been ordered (Task 7) has been completed:
- (i) Calculate the new project duration and describe how this change impacts the critical path. [2]
 - (ii) Comment on the usefulness of a Gantt chart to a project manager when changes occur. [3]

Q.3

- (a) Design For Manufacturing (DFM) consists of some main principles such as Simplicity, Standardization, Tolerance, Material Selection, Automation, and Process Integration.
- Describe briefly any two of these DFM principles. [4]
 - The 4Rs in particular are very effective tools in building a circular economy for sustainable products. It includes four principles that can be applied by almost every individual and have an exponential effect. List any two of these principles. [2]
- (b) Quality control (QC) is a procedure or set of procedures intended to ensure that a manufactured product or performed service adheres to a defined set of quality criteria or meets the requirements of the client or customer.
- By using seven basic tools of quality, we can manage the quality of our product or process effectively. Known around the world as the seven-quality control (7-QC) tools. List any four of these tools. [4]
 - Let's say you are a manufacturer of printed circuit boards (PCBs) for electronic devices. You want to monitor the defect rate of your PCBs to ensure that they meet the required quality standards. You decide to monitor the defect rate of your PCBs. After collecting data for a period of time, you plot the data and check the trend of the defect rate over time. Which quality tool is used? [1]
 - In the schematic quality tool that you used in above (ii), what exactly do you see if noticed that the process is unstable? [2]
- (c) Robust Design is an engineering methodology for improving productivity during research and development so that high-quality products can be produced quickly and at a low cost.
- The four different versions of the quadratic loss function are plotted in Figure Q3 based on the Taguchi overview. List the name of any two of these loss functions. [2]

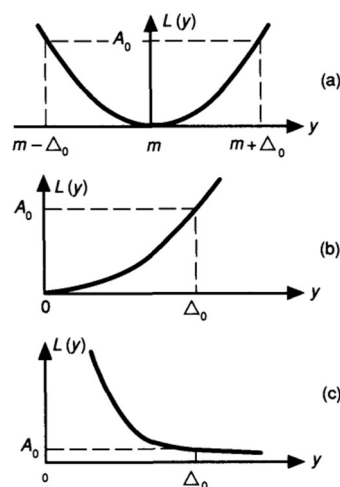


Figure Q3

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- (ii) In robust design terminology, the performance of a product as measured by the quality characteristic varies in the field due to a variety of causes. We call all such causes noise factors, and they can be generally classified into three types. Explain any two types of noise factors. [4]
- (d) Six-sigma is a statistical concept that measures a process in terms of defects – at the six sigma level, there are 3.4 defects per million opportunities:
- (i) List any of the five main phases in 6-Sigma. [2]
- (ii) There are five key roles for Six Sigma in manufacturing including Executive Leadership, Champions, Master Black Belts, Black Belts, and Green Belts. Explain briefly any two of these roles. [4]

Q4

- (a) Derive the theoretical break-even revenue relationship in terms of fixed costs, variable costs, and selling price. [3]

You work for XYZ, a company that requires 17,500 optical transceivers annually to manufacture its optical wireless communication (OWC) systems. These optical transceivers are supplied by an external supplier to your company for 57 RMB each. Moreover, your company has some vacant production facilities that adds to the total annual costs with Fixed Overhead Cost of 568,750 RMB. Currently, the vacant production facilities are rented out for 225,000 RMB per year but your manager has informed you that the rental agreement is nearing an end soon.

- (b) Draw a table comparing the equivalent cost of purchasing a transceiver from the external supplier while the vacant production facilities are rented out with the scenario when the rental agreement has expired. [5]
- (c) Your manager now tells you he wants to utilise the vacant production facilities and manufacture the transceivers within the company. In addition to the Fixed Overhead Cost, the production cost breakdown for a transceiver is shown in Table Q4(b) below.

Table Q4(c): Cost breakdown for a transceiver

Cost Category	Cost per Transceiver (RMB)
Direct Materials	22.50
Direct Labour	12.50
Variable Overhead	2.50

Given this new information, prepare a new cost table showing the annual impact of manufacturing the transceivers within the production facilities available in the company. Should your company continue purchasing the transceivers from the external supplier or start manufacturing their own transceivers? [5]

- (d) Using the information provided in **Table Q4(c)**, if your company can sell the optical transceivers for 78.125 RMB each, draw a table showing the production costs and sales revenue of manufacturing and selling transceiver quantities from 3,500 → 17,500 transceivers in 3,500 transceiver increments. [5]
- (e) If the factory is running at full capacity of 17,500 transceivers per year with an assumed price of 78.125 RMB per transceiver, what is the profit made by the company? What is the safety margin for this scenario? [3]
- (f) Draw a Breakeven graph showing Total Cost (TC), Variable cost (VC), Fixed Cost (FC), and Revenue (REV) against production quantity (Q). Calculate the Breakeven Point and indicate this on the graph. [5]

End of question paper