

GLASGOW COLLEGE UESTC

Main

Engineering Project Management & Finance (UESTC 3031)

Date: June 23rd 2024

Time: 14:30-16:30

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.

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.

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) Which item below is correct regarding Design for Manufacturing (DFM): [2]
- A. As a general rule, DFM can't be started at the initial stages of product design before fabrication.
 - B. It is usually accepted (demonstrated) that 70 to 80% of production costs are determined by design decisions.
 - C. DFM is a design method to reduce the overall cost of production by increasing the complexity of manufacturing operations.
 - D. The DFM may impose higher manufacturing costs, but instead, it can benefit from higher customer satisfaction because of improved product quality.
 - E. While manufacturers were facing strong competition from other manufacturers (rivals), at the time, they were under pressure to increase production efficiency while increasing costs of production.
- (1.2) Which statement accurately describes a cause-effect diagram? [2]
- A. A cause-effect diagram is primarily used to illustrate the effects of a specific problem without identifying its root causes.
 - B. Cause-effect diagrams, also known as fishbone or Ishikawa diagrams, are visual tools used to focus on the sole cause of a given problem.
 - C. A cause-effect diagram called the fishbone or Ishikawa diagram is designed to indicate the relationships between various effects easily with no need for visual tools.
 - D. A cause-effect diagram is a visual tool used to logically organize possible causes for a specific problem or effect by graphically displaying them in increasing detail, suggesting causal relationships among theories.
 - E. Cause-effect diagrams called fishbone or Ishikawa diagrams are visual tools exclusively used to identify effects, without the need for organizing possible causes or establishing causal relationships.

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(1.3) Which of the following statements best describes the three pillars of sustainability? [2]

- A. Sustainability involves meeting the current generation's needs without consideration for future generations, emphasizing economic growth, environmental care, and social well-being.
- B. Sustainability entails achieving economic growth, environmental care, and social well-being simultaneously, fulfilling the needs of current generations without compromising the needs of future generations.
- C. Sustainability primarily focuses on economic growth, with minimal consideration for environmental and social aspects, to fulfill the needs of the current generation.
- D. Sustainability prioritizes environmental care over economic growth and social well-being, neglecting the importance of balancing all three pillars.
- E. Sustainability emphasizes social well-being as the sole pillar, with economic growth and environmental care being secondary considerations in fulfilling the needs of current and future generations.

(1.4) Which of the following is not a project? [2]

- A. Programming regular software updates for an electronic control system in a manufacturing plant.
- B. Developing and implementing a software algorithm for real-time data processing in an electronic control system
- C. Developing a prototype for a next-generation smartphone.
- D. Implementing a recycling program in an office building.
- E. Designing and building a printed circuit board (PCB) for a new electronic device.

(1.5) Which of the following is not true about the initial phase of a project? [2]

- A. The cost associated at the beginning of the project is highest.
- B. Stakeholders have the maximum influence during this phase.
- C. The highest uncertainty is at this stage of the project.
- D. The initial scope is defined, and initial financial resources are committed.
- E. All the above statements are correct.

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(1.6) Which of the following statements about the WBS is most correct in the project management context? [2]

- A. WBS stands for Work Breakdown Statement.
- B. The WBS includes 100 percent of the work of the project.
- C. Any work not included in the WBS is out of scope.
- D. WBS can decompose through project work packages and cannot by phases of a project.
- E. B & C

(1.7) Consider the structure of a start-up company run by an entrepreneur. Find the correct pair of true statements. [2]

- 1 Maximum standardisation and formalisation
- 2 Few layers: Limited middle-line managerial levels
- 3 Decentralised and indirect supervision
- 4 Wide span of control (around the entrepreneur)

A – 1 and 2

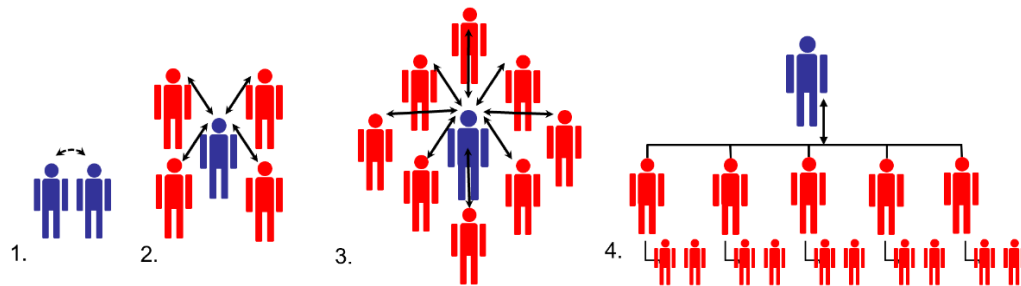
B – 3 and 4

C – 2 and 3

D – 2 and 4

E – 1 and 3

(1.8) The following organisational structures should be labelled as: [2]



A – 1. Start-up; 2. Expansion; 3. Growth; 4. Formal Organisation

B – 1. Expansion; 2. Start-up; 3. Formal Organisation; 4. Growth

C – 1. Start-up; 2. Growth; 3. Expansion; 4. Formal Organisation

D – 1. Expansion; 2. Start-up; 3. Growth; 4. Formal Organisation

E – 1. Growth; 2. Start-up; 3. Formal Organisation; 4. Expansion

(1.9) It costs 1000 RMB for hand tools and 1.50 RMB labour per unit to manufacture a product. An alternative is to manufacture the product with automated machinery costing 15,000 RMB, with a 0.50 RMB per-unit cost. With an annual production rate of 5000 units, how long will it take to reach the production cost cross-over point? [2]

A – 2.0 yr

B – Never

C – 3.6 yr

D – 2.8 yr

E – 0.9 yr

(1.10) A company has been in business for approximately 12 months and has prepared financial projections to present to an investor. Over the last 12 months the company has sold **300,000 CNY** of their existing products which cost them **150,000 CNY** to manufacture. In addition, the company has been working on a new product design which cost **100,000 CNY** to develop and has been valued at **200,000 CNY**. The new product will replace the existing product so all existing product designs are valued at **0 CNY**. What is the present valuation of the company? [2]

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A – 250,000 CNY

B – 150,000 CNY

C – 500,000 CNY

D – 50,000 CNY

E – 350,000 CNY

(1.11) Project risk management is best described as: [2]

A – Managing responses to threats

B – Identifying and acknowledging threats and opportunities

C – Planning responses to threats

D – Minimising threats and maximising opportunities

E – Implementing responses to threats

(1.12) Risk response planning consists of four main strategies. Which of the following does not fall under the main strategies of risk response planning? [2]

A – Avoidance

B – Acceptance

C – Transference

D – Mitigation

E – Identification

Section B: Long Questions

Q2 As a young entrepreneur you would like to guarantee a healthy total cost of ownership via evaluating net present value of your young company while utilising discounted cash flow analysis.

- (a) Consider your company is designing a new product that will take your company three years to design, fabricate, and build. For this product, your company's expenses are 1,000,000 RMB per year, which will increase with inflation rate of 5% annually. How much must your company quote your customer (for delivery in three years time) if your company would like to cover their expenses and earn a net profit (in today's equivalent currency) of 100,000 RMB? [3]
- (b) Consider your company would like to purchase a new machine that has a purchase price of 10 Million (M) RMB with a lifetime of five years. The machine will require annual maintenance costs of 1 M RMB associated with annual power costs of 0.5 M RMB. All costs are fixed with inflation of 10% applied to power only after year 1.
 - (i) Demonstrate the total projected costs over the lifetime of this new machine. [3]
 - (ii) Analyse the total cost of ownership over the lifetime of this new machine. [4]
- (c) Consider you have decided that your company will make a significant investment into expanding its presence in China by setting up a large assembly facility in Chengdu. Your company has estimated its initial set up costs to be in the region of 6,398 M RMB. Net income from this new assembly facility is forecasted as follows:

Year (Y) 1: 1,400 M RMB
Y2: 1,450 M RMB
Y3: 1,550 M RMB
Y4: 1,625 M RMB
Y5: 1,480 M RMB
 - (i) Calculate the projected payback time for this new assembly facility to the nearest month. [5]
 - (ii) Calculate the net present value of this new assembly facility based on a discounting factor of 5%. [5]
 - (iii) Comment on the attractiveness of this new assembly facility. [3]
- (d) Consider a part of cash-flow with 30 days net payment terms for cash-in and cash-out given in Table Q2 below. Determine the cumulative cash towards the

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end of each month (M). The currency utilised for transactions in this cash-flow is RMB. [3]

Table Q2: Cash-Flow Table

	M0	M1	M2	M3	M4	M5
Sales Bookings	10	12	8	20	100	0
Shipments	0	10	12	8	20	100
Components Order	5	6	4	10	50	0

Q.3

- (a) DFM is the process of designing components for ease of manufacturing high-quality products at a lower cost.
- (i) The product development cycle in general consists of the initial design, final design, fabrication, production, and product launch. Draw a plot while showing the effectiveness of the DFM application versus the product development cycles (aforementioned) based on both the impact and cost of changes. [4]
 - (ii) Sustainability can make a balance between three main pillars. List any two of these pillars. [2]
- (b) The goal of Quality control (QC) is to identify any defects after a product is developed, but before it's released to production. 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:
- (i) Which 7-QC tool looks at a bar chart that is sorted in descending order from the highest frequency to the lowest frequency to from left to right, while the height of the bars reflects the frequency or the impact of the problems? [1]
 - (ii) Which of the 7-QC tools is a graph used to study how a process changes over time? [1]
 - (iii) Assume fifteen sample points are collected for yield rate over time in a specific process, see Table Q3(b). Utilizing the tool mentioned in (ii), create a plot

Sample Number	Yield Rate (%)
1	98.50
2	97.80
3	98.30
4	99.10
5	99.30
6	94.32
7	98.40
8	98.60
9	98.80
10	99.00
11	99.10
12	98.80
13	98.90
14	99.10
15	98.20

Table Q3(b)

demonstrating an uncontrolled variation, indicative of an unstable process. Provide a visual representation by including a central line, upper and lower control limits, and notes highlighting the instability of the process. [6]

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- (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.
- (i) Consider a power supply circuit used in a stereo system for which the target output voltage is 110 volts. If the output voltage falls outside 110 ± 20 volts, then the stereo fails in half the situations and must be repaired. Suppose it costs \$100 to repair the stereo. Using the Taguchi quadratic loss function, compute the average loss associated with a particular output voltage of 100 volts. [3]
 - (ii) How robust design can increase the quality of a process/product (hint: the main idea behind the robust design)? [2]
- (d) In an electronic manufacturing process, a new component is designed with a parameter range of 20 ± 1 mm. The process, characterized by a mean value of 19.8 mm and a standard deviation of 0.2 mm, is assessed for its capability to meet the specifications. Answer the following questions:
- (i) Calculate the process capability index C_{pk} for the given parameter range. [4]
 - (ii) Discuss your assessment over the obtained C_{pk} value in term of the risk associated with this manufacturing process. [2]

Q4

(a) Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. Answer the following questions.

(i) Project A has a BCR of 1.4. What can we infer from this? [2]

(ii) During one of the standup meetings, a team member asked you the difference between standard and regulation. How would you respond? [2]

(iii) Compare the main elements involved in “Sample Basic Sender / Receiver” with Interactive” communication models in a project. [4]

(b) Project schedule management includes the processes required to manage the timely completion of the project. One of the common techniques used is CPM (critical path method). The critical path is the sequence of activities that represents the longest path through a project, which determines the minimum possible project duration. Consider a project (assume date 0 for project starting) with the details shown in Table Q4(b), and answer the following questions.

Activity	Duration	Predecessor(s)
A	2	-
B	1	-
C	4	-
D	1	A
E	2	B,C,D
F	7	C

Table Q4(b)

(i) Plot a CPM network diagram for the above project (hint: show activity on nodes and concerning their relevant dependencies). [4]

(ii) Perform the forward pass analysis through the schedule network and compute Early Start and Early Finish dates for all activities. [4]

(iii) Perform the backward pass analysis through the schedule network and compute Late Start and Late Finish dates for all activities. [4]

(iv) Calculate the total float (slack) for all activities. [2]

(v) Define the Critical Path (sequence of activities that are located on the critical path). [1]

(vi) Assume the activity “C” is completed with 1 day delay. Discuss how the consequence of this delay can affect the project. [2]

End of question paper