

SULIT



Second Semester Examination
2024/2025 Academic Session

July/August 2025

EBB 442/3–Quality Control and Management
[Kawalan dan Pengurusan Mutu]

Duration :3 hours
[Masa :3 jam]

Please ensure that this examination paper contains THIRTEEN (13) printed pages before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi TIGA BELAS (13) muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instruction: Answer **FIVE(5)** questions. PART A is **COMPULSORY**. Answer **TWO(2)** questions from PART B and **TWO(2)** questions from PART C. All questions carry the same marks.

[Arahan: Jawab **LIMA(5)** soalan. BAHAGIAN A **WAJIB** dijawab. Jawab **DUA(2)** soalan dari BAHAGIAN B dan **DUA(2)** soalan dari BAHAGIAN C. Semua soalan membawa jumlah markah yang sama.]

In the event of any discrepancies in the examination questions, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunakan.]

Should any candidate be caught cheating or in possession of materials not authorised to be brought into the Examination Hall during the examination, appropriate disciplinary action will be taken against the candidate concerned. In the event a candidate is found guilty of cheating, he/she can be expelled from the University.

[Sekiranya seseorang calon didapati meniru/menipu ataupun mempunyai bahan-bahan yang tidak dibenarkan dibawa ke dalam Dewan Peperiksaan semasa peperiksaan diadakan, tindakan disiplin yang sewajarnya akan dikenakan terhadap calon berkenaan. Jika seseorang calon didapati bersalah meniru/menipu beliau boleh disingkir dari Universiti.]

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PART A / BAHAGIAN A

- (1). (a). Explain the relationship of quality, cost of quality, and profitability.

Terangkan perhubungan di antara kualiti, kos kualiti dan keuntungan.

(10 marks/markah)

- (b). Differentiate between product quality in manufacturing industries and service quality in the service sector. Provide a relevant real-world example to support your explanation.

Bezakan antara kualiti produk dalam industri pembuatan dan kualiti perkhidmatan dalam sektor perkhidmatan. Sertakan contoh dunia sebenar untuk menyokong penjelasan anda.

(10 marks/markah)

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PART B / BAHAGIAN B

- (2). (a). Suppose that a supplier ships components lots in size of 5000. A single-sampling plan with sample size (n) = 50 and acceptance number (c) = 2 is being used for receiving inspection. Rejected lots are screened, and all defective items are reworked and returned to the lot.

Katakan bahawa pembekal menghantar komponen dalam lot bersaiz 5000. Pelan pensampelan tunggal dengan saiz sampel (n) = 50 dan nombor penerimaan (c) = 2 sedang digunakan untuk menerima pemeriksaan. Lot yang ditolak disaring, dan semua item yang rosak dikerjakan semula dan dikembalikan ke lot.

- (i). Draw the operating characteristic (OC) curve for this plan.

Lukis lengkung cirian operasi (OC) untuk pelan ini.

(5 marks/markah)

- (ii). Define the terms: Producer's risk and consumer's risk

Tentukan istilah: Risiko pengeluaran dan risiko pengguna

(2 marks/markah)

- (iii). Calculate the producer's risk when the acceptance quality limit is 2.5%

Kira risiko pengeluaran apabila had kualiti penerimaan ialah 2.5%

(3 marks/markah)

- (iv). If the consumer's risk is 10%, calculate the limiting quality.

Sekiranya risiko pengguna adalah 10%, hitung kualiti yang terhad.

(3 marks/markah)

- (b). As a Director of Quality for a company that produces medical parts, multiple rejections of the products shipped to a major customer have been encountered within two months. You have instructed a team of engineers to resolve this concern immediately. Explain the approaches that your team can use to address and resolve this issue permanently and regain the customer's satisfaction.

Sebagai Pengarah Kualiti untuk syarikat yang menghasilkan alat ganti perubatan, pelbagai penolakan produk yang dihantar kepada pelanggan utama telah dihadapi dalam tempoh dua bulan. Anda telah mengarahkan pasukan jurutera untuk menyelesaikan kebimbangan ini dengan segera. Terangkan pendekatan yang boleh digunakan oleh pasukan anda untuk menangani dan menyelesaikan isu ini secara kekal dan mendapatkan semula kepuasan pelanggan.

(7 marks/markah)

- (3). The following budget was proposed for a factory that produces electronic components.

Item / Perkara	Budget (RM) / Belanjawan (RM)
Training / Latihan	12,000
Recall / pemulangan	10,000
Inspection / Pemeriksaan	5,000
Rework / Kerja Semula	15,000
Process Improvement / Penambahbaikan Proses	8,000
Testing / Ujian	10,000
Warranty Claims / Tuntutan Waranti	20,000
Scrap / Sekerap	10,000

- (i) Explain the importance of cost of quality in the operation of the factory.
Terangkan kepentingan kos kualiti dalam operasi kilang.

(3 marks/markah)

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- (ii). Analyze the budget based on the category of quality cost

Analisis belanjawan berdasarkan kategori kos kualiti.

(8 marks/markah)

- (iii). Based on the budget, argue with strong justifications one can conclude and suggest any improvement plan, if needed.

Berdasarkan belanjawan, hujahkan dengan justifikasi yang kukuh bagi seseorang boleh membuat kesimpulan dan mencadangkan sebarang pelan penambahbaikan jika perlu.

(3 marks/markah)

- (iv). The company receives a lot of 2,000 units of IC substrate from a supplier. To determine if the lot meets quality standards, an acceptance sampling plan is conducted based on ANSI/ASQ Z1.4 with the information given: Inspection Level = General Inspection, Acceptance Quality Limit = 1.5%, and Inspection Type = Single Sampling Plan. Using the standard, determine: The acceptance number and rejection number.

Syarikat menerima banyak 2,000 unit substrat IC daripada pembekal. Untuk menentukan sama ada lot memenuhi piawaian kualiti, pelan pensampelan penerimaan dijalankan berdasarkan ANSI/ASQ Z1.4 dengan maklumat yang diberikan: Tahap Pemeriksaan = Pemeriksaan Am, Had Kualiti Penerimaan = 1.5%, dan Jenis Pemeriksaan = Pelan Persampelan Tunggal. Menggunakan piawaian, tentukan: Nombor penerimaan dan nombor penolakan.

(3 marks/markah)

- (v). Based on the information given in (iv), after inspection of the incoming IC substrate, a total of 2 units are non-conforming. Since the detection of some substrates that are out of specification, the decision of rejecting the whole lot has been made. Justify the decision in which the lot was sentenced.

Berdasarkan maklumat yang diberikan dalam (iv), selepas pemeriksaan substrat IC yang masuk, sejumlah 2 unit tidak mematuhi. Terdapat beberapa substrat yang tidak mengikut spesifikasi, keputusan untuk menolak keseluruhan lot telah dibuat. Wajarkan keputusan di mana lot itu dijatuhkan hukuman.

(3 marks/markah)

- (4). (a). An engineer is evaluating an acceptance sampling plan for a lot of 10,000 transistors. The sampling plan follows a single sampling plan of Sample Size = 250, Acceptance Number = 5, Probability of Lot Acceptance = 0.85, and Incoming Non-conforming (p) = 2% (0.02).

Seorang jurutera sedang menilai pelan pensampelan penerimaan untuk 10,000 lot transistor. Pelan persampelan mengikut pelan persampelan tunggal dengan Saiz Sampel = 250, Nombor Penerimaan = 5, Kebarangkalian Penerimaan Lot = 0.85, dan Tidak Mematuhi Masuk (p) = 2% (0.02).

- (i). Define Average Outgoing Quality (AOQ).

Tentukan Kualiti Keluar Purata (AOQ).

(1 mark/markah)

- (ii). Explain its significance in acceptance sampling.

Terangkan kepentingannya dalam persampelan penerimaan.

(2 marks/markah)

- (iii). Calculate the AOQ for this sampling plan.

Kira AOQ untuk pelan pensampelan ini.

(5 marks/markah)

- (iv). Explain the effect of lot size on AOQ.

Terangkan kesan saiz lot pada AOQ.

(4 marks/markah)

- (b). Differentiate between mean time between failure and mean time to failure.

Bezakan antara masa purata antara kegagalan dan masa purata untuk kegagalan.

(2 marks/markah)

- (c). A manufacturer produces batteries for electric vehicle. The products must meet high-standards in terms of quality, reliability, durability, and robustness. Differentiate the four terms by providing appropriate examples.

Pengilang mengeluarkan bateri untuk kenderaan elektrik. Produk mesti memenuhi piawaian tinggi dari segi kualiti, kebolehpercayaan, ketahanan dan keteguhan. Bezakan empat istilah ini dengan memberikan contoh yang sesuai.

(6 marks/markah)

PART C / BAHAGIAN C

- (5). Table 1 presents the deviation values from the nominal diameter for drilled holes in a carbon fiber composite used in aerospace applications. All measurements are in ten-thousandths of an inch.

Jadual 1 membentangkan nilai sisihan daripada diameter nominal untuk lubang gerudi dalam komposit gentian karbon yang digunakan dalam aplikasi aeroangkasa. Semua ukuran adalah dalam sepuluh ribu inci.

Table 1 / Jadual 1

Sample Number/ Nombor Sampel	x1	x2	x3	x4	x5
1	-30	+50	-20	+10	+30
2	0	+50	-60	-20	+30
3	-50	+10	+20	+30	+20
4	-10	-10	+30	-20	+50
5	+20	-40	+50	+20	+10
6	0	0	+40	-40	+20
7	0	0	+20	-20	-10
8	+70	-30	+30	-10	0
9	0	0	+20	-20	+10
10	+10	+20	+30	+10	+50
11	+40	0	+20	0	+20
12	+30	+20	+30	+10	+40
13	+30	-30	0	+10	+10
14	+30	-10	+50	-10	-30
15	+10	-10	+50	+40	0
16	0	0	+30	-10	0
17	+20	+20	+30	+30	-20
18	+10	-20	+50	+30	+10
19	+50	-10	+40	+20	0
20	+50	0	0	+30	+10

- (a). Construct the $\bar{X}$ and R control charts using the provided data. Assess whether the process is statistically controlled.

Bina carta kawalan $\bar{X}$ dan R berdasarkan data yang diberi. Tentukan sama ada proses tersebut berada dalam kawalan statistik atau tidak.

(10 marks/markah)

- (b). Using the range method, calculate the estimated standard deviation of the process.

Gunakan kaedah julat untuk menganggarkan sisihan piawai bagi proses tersebut.

(5 marks/markah)

- (c). If the allowable specification is ± 100 units from the nominal value, evaluate the process capability and compute the Cp index.

Jika spesifikasi dibenarkan adalah ± 100 unit dari nilai nominal, nilaikan keupayaan proses dan kira indeks Cp.

(5 marks/markah)

- (6). Refer to Table 2, which lists the inspection results of personal computers over a 10-day period.

Rujuk Jadual 2 yang menunjukkan hasil pemeriksaan komputer peribadi selama 10 hari.

Table 2 / Jadual 2

Day/ Hari	Units Inspected/ <i>Unit Diperiksa</i>	Nonconforming Units/ <i>Unit Tidak Sesuai</i>	Fraction Nonconforming/ <i>Pecahan Tidak Sesuai</i>
1	80	4	0.050
2	110	7	0.064
3	90	5	0.056
4	75	8	0.107
5	130	6	0.046
6	120	6	0.050
7	70	4	0.057
8	125	5	0.040
9	105	8	0.076
10	95	7	0.074

- (a). Analyze the data to determine if the process is within statistical control.
Analisis data dan tentukan sama ada proses berada dalam kawalan statistik.

(10 marks/markah)

- (b). List and explain THREE (3) benefits of using attribute (p) control charts in quality control.

Senaraikan dan terangkan TIGA (3) kelebihan menggunakan carta kawalan atribut (p) dalam kawalan kualiti.

(5 marks/markah)

- (c). Define the concept of Statistical Process Control (SPC). Describe three essential elements of SPC when applied in a production setting.

Takrifkan konsep Kawalan Proses Statistik (SPC). Terangkan tiga elemen penting dalam SPC apabila digunakan dalam persekitaran pengeluaran.

(5 marks/markah)

- (7). A paper production facility monitored product quality over 20 days by tracking imperfections in each paper roll.

Sebuah kilang kertas memantau kualiti produk selama 20 hari dengan menjejaki ketidaksempurnaan dalam setiap gulungan kertas.

- (a). Use the data from Table 3 to develop a control chart for the number of nonconformities per roll.

Gunakan data dalam Jadual 3 untuk membina carta kawalan bagi bilangan ketidaksesuaian setiap gulungan.

(10 marks/markah)

Table 3 / *Jadual 3*

Day	Number of Rolls Produced	Total Number of Imperfections
1	18	12
2	18	14
3	24	20
4	22	18
5	22	15
6	22	12
7	20	11
8	20	15
9	20	12
10	20	10
11	18	18
12	18	14
13	18	9
14	20	10
15	20	14
16	20	13
17	24	16
18	24	18
19	22	20
20	21	17

- (b). Using Table 4 data on defective batteries, compute the 3σ upper and lower control limits and centerline for the proportion of defects. With a sample size of $n = 1000$, draw the control chart and determine the control status of the process.

Gunakan data Jadual 4 mengenai bateri rosak, kira had kawalan atas dan bawah 3σ serta garisan tengah untuk pecahan kecacatan. Dengan saiz sampel $n = 1000$, lukiskan carta kawalan dan tentukan status kawalan proses.

(10 marks/markah)

Table 4/ *Jadual 4*

Week	Defective Units
1	17
2	14
3	9
4	3
5	20
6	6
7	6
8	4
9	17
10	2
11	10
12	2
13	5
14	18
15	1
Total	134
Average	8.93

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