UNIVERSITI MALAYSIA PERLIS

Peperiksaan Akhir Semester Pertama
Sidang Akademik 2025/2026

Januari - Februari 2026

EMK31303 – Engineering Technology Management
[Pengurusan Teknologi Kejuruteraan]

Masa: 2 Jam

Please make sure that this question paper has **NINE (9)** printed pages including the front page.
*[Sila pastikan kertas soalan ini mengandungi **SEMBILAN (9)** muka surat yang bercetak termasuk muka surat hadapan.]*

This question paper has **FOUR (4)** questions. Answer **ALL** questions. Each question contributes **25 marks.**
*[Kertas soalan ini mengandungi **EMPAT (4)** soalan. Jawab **SEMUA** soalan. Setiap soalan menyumbang **25 markah.**]*

Dicetak oleh Unit Peperiksaan & Pengijazahan, Bahagian Pengurusan Akademik, Pusat Pengurusan Akademik UniMAP

Question 1
[Soalan 1]

SolarMax Energy Solutions has been awarded a contract to install a micro-hydro hybrid renewable energy system in a remote village in Sabah. The project aims to provide reliable and sustainable electricity to reduce dependence on diesel generators. The list of activities involved in the project is shown in **Table 1**.
*[SolarMax Energy Solutions telah dianugerahkan kontrak untuk memasang sistem tenaga boleh baharu hibrid mikro-hidro di sebuah kampung terpencil di Sabah. Projek ini bertujuan untuk menyediakan bekalan elektrik yang boleh dipercayai dan mampan bagi mengurangkan pergantungan kepada penjana diesel. Senarai aktiviti yang terlibat dalam projek ini ditunjukkan dalam **Jadual 1.**]*

(a) Draw and identify the critical path of the project network diagram.
[Lukis dan kenal pasti laluan kritikal gambarajah rangkaian projek.]

(10 Marks/ *Markah*)

(b) Evaluate the probability of the project completion in 18 weeks and 14 weeks. Assume the expected time of individual activity and the cumulative expected time have the probability of 0.5. Use the table of standard normal (Z) as shown in **APPENDIX A.**
*[Nilaikan kebarangkalian projek siap dalam 18 minggu dan 14 minggu. Andaikan jangkaan masa aktiviti individu dan masa jangkaan kumulatif mempunyai kebarangkalian 0.5. Gunakan jadual normal piawai (Z) seperti ditunjukkan dalam **LAMPIRAN A.**]*

(15 Marks/ *Markah*)

Table 1
[Jadual 1]

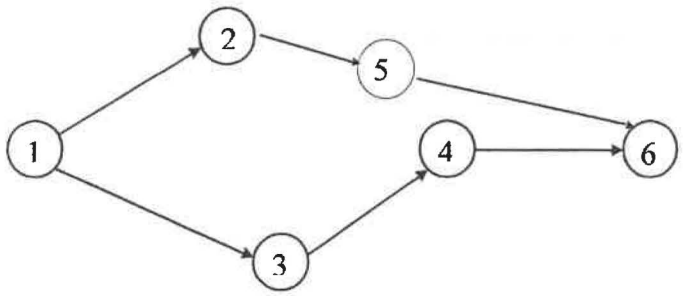
Activity *[Aktiviti]*	**Event** *[Peristiwa]*	**Expected time, t_e (week)** *[Jangka masa, t_e (minggu)]*	**Activity standard deviation, σ** *[Sisihan piawai aktiviti, σ]*
A	1-2	4	1.2
B	1-3	6	2
C	2-4	5	1.8
D	3-4	4	1.5
E	3-5	7	2.3
F	4-6	6	3.0
G	5-6	5	2.5

Question 2
[Soalan 2]

GreenTech Hydro Sdn. Bhd. has been awarded a contract to install a small hydroelectric water-pumping system for an agricultural community in Cameron Highlands. The preliminary project schedule shows that the project would take 10 weeks to complete, based on the network diagram shown in **Figure 1**. However, the client has requested for an earlier completion date. After a technical meeting, the project manager, Ms. Farah, developed the time–cost trade-off (crashing) data for each activity as shown in **Table 2**. The indirect cost for the project is RM 2,000 per week.
*[GreenTech Hydro Sdn. Bhd. telah dianugerahkan kontrak untuk memasang sistem pam air hidroelektrik berskala kecil bagi sebuah komuniti pertanian di Cameron Highlands. Jadual awal projek menunjukkan bahawa projek tersebut akan mengambil masa 10 minggu untuk disiapkan, berdasarkan rangkaian projek yang ditunjukkan dalam **Rajah 1**. Namun begitu, pihak pelanggan telah meminta agar tarikh penyiapan dipercepatkan. Selepas mesyuarat teknikal, pengurus projek, Pn. Farah, telah membangunkan data pertukaran masa–kos (crashing) bagi setiap aktiviti seperti yang ditunjukkan dalam **Jadual 2**. Kos tidak langsung bagi projek ini ialah RM 2,000 setiap minggu.]*

(a) Analyze the total cost of the project.
[Analisa jumlah kos projek tersebut.] (6 Marks/ *Markah*)

(b) Calculate the time duration and the corresponding cost that should be optimized by Ms. Farah to complete the project.
[Nilaikan tempoh masa dan kos yang sepadan yang perlu dioptimumkan oleh Ms. Farah untuk menyiapkan projek tersebut.]



(19 Marks/ *Markah*)

Figure 1
[Rajah 1]

Table 2
[Jadual 2]

Activity *[Aktiviti]*	**Time (day)** *[Masa (hari)]*		**Cost (RM)** *[Kos (RM)]*	
	Normal *[Biasa]*	**Crash** *[Runtuh]*	**Normal** *[Biasa]*	**Crash** *[Runtuh]*
1-2	3	2	8,000	10,000
1-3	4	3	9,000	12,000
2-5	5	3	14,000	20,000
3-4	3	1	6,000	10,000
4-6	4	2	7,000	11,000
5-6	2	1	5,000	6,000

...4/-

Question 3
[Soalan 3]

TechNova Manufacturing Sdn. Bhd. is evaluating whether to invest in a new laser cutting machine to improve production efficiency. The company must invest RM 20,000, and expects to generate cash flows for 5 years. Two alternative machines, Machine X and Machine Y, have different projected after-tax cash flows as shown in **Table 3**. Both machines have a moderate risk profile. The required rate of return (interest rate) is 9% annually.
*[TechNova Manufacturing Sdn. Bhd. sedang menilai sama ada untuk melabur dalam sebuah mesin pemotong laser baharu bagi meningkatkan kecekapan pengeluaran. Syarikat perlu melabur sebanyak RM 20,000 dan menjangka akan menghasilkan aliran tunai selama 5 tahun. Terdapat dua mesin alternatif, iaitu Mesin X dan Mesin Y, yang mempunyai unjuran aliran tunai selepas cukai yang berbeza seperti yang ditunjukkan dalam **Jadual 3**. Kedua-dua mesin mempunyai profil risiko yang sederhana. Kadar pulangan yang diperlukan (kadar faedah) ialah 9% setahun.]*

(a) Analysed the NPV of each project for the company to choose the best project.
[Analisa NPV setiap projek bagi membolehkan syarikat memilih projek yang terbaik.]

(12 Marks/ *Markah*)

(b) Determine the amount of depreciation that must be issued each year for the laser cutting machine if the machine can be sold for RM 4,000 at the end of Year 5. Use the straight-line depreciation method to find the annual depreciation amount and illustrate the graph of depreciation.
[Tentukan jumlah susut nilai yang perlu direkodkan setiap tahun untuk mesin pemotong laser jika mesin tersebut boleh dijual pada harga RM 4,000 pada akhir tahun ke-5. Gunakan kaedah susut nilai garis lurus untuk mencari jumlah susut nilai tahunan dan ilustrasikan graf susut nilai.]

(13 Marks/ *Markah*)

Table 3
[Jadual 3]

Year *[Tahun]*	**Expected income after-tax (RM)** *[Jangkaan pendapatan selepas-cukai (RM)]*	
	Machine X *[Mesin X]*	**Machine Y** *[Mesin Y]*
1	3,000	4,500
2	4,000	5,000
3	4,500	5,500
4	5,000	6,000
5	5,500	6,500

Question 4
[Soalan 4]

Mrs. Aisyah plans to take a bank loan at an interest rate of 4% per year to support her expanding business operations. In the 2nd year, she requires RM 30,000,000 to purchase new equipment. She intends to fully settle the loan by the end of the 6th year. Due to an increase in business revenue, Mrs. Aisyah decides to make a partial repayment of RM 25,000,000 at the end of the 4th year. At the end of the 6th year, she is only able to pay RM 90,000,000.
[Puan Aisyah merancang untuk membuat pinjaman bank pada kadar faedah 4% setahun bagi menyokong pengembangan operasi perniagaannya. Pada akhir tahun ke-2, beliau memerlukan sebanyak RM 30,000,000 untuk membeli peralatan baharu. Beliau bercadang untuk menyelesaikan sepenuhnya pinjaman tersebut pada akhir tahun ke-6. Disebabkan peningkatan pendapatan perniagaan, Puan Aisyah membuat bayaran sebahagian sebanyak RM 25,000,000 pada akhir tahun ke-4. Pada akhir tahun ke-6, beliau hanya mampu membayar sebanyak RM 90,000,000.]

(a) Create the cash flow diagram for the problem.
[Buatkan rajah aliran tunai untuk masalah ini.]

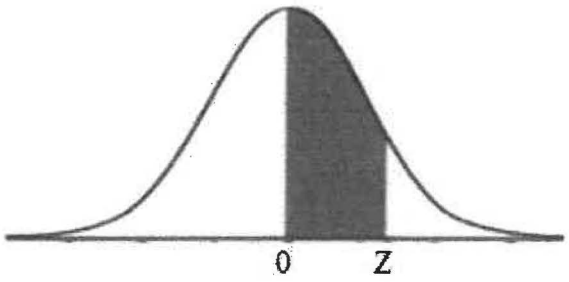
(10 Marks/ *Markah*)

(b) Decide how much money could she borrow now based on Mrs.Aisyah's financial ability?
[Tentukan berapakah jumlah wang yang boleh dipinjam oleh Puan Aisyah sekarang jika itu adalah satu-satunya kemampuan kewangannya?]

(15 Marks/ *Markah*)

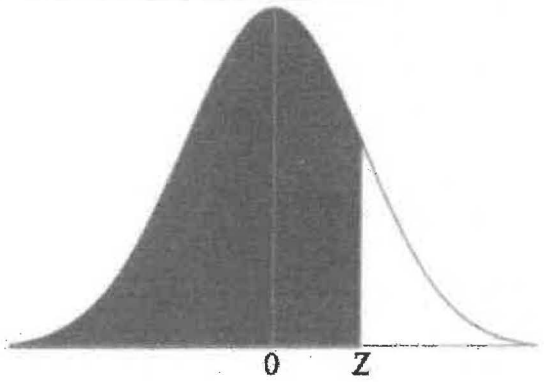
...6/-

LAMPIRAN A
[APPENDIX A]



	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4886	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4927	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964

LAMPIRAN B
[APPENDIX B]



	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9405	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964

LAMPIRAN C
[APPENDIX C]

Formula *[Formula]*	
Time estimate *[Anggaran masa]*	$t_e = \frac{t_o + 4t_m + t_p}{6}$
Event standard deviation *[sisihan piawai peristiwa]*	$\sigma TE = \sqrt{\sum_{j}^{i=0} \sigma_{i-j} \; ; i,j = 1}$
Value *[Nilai]*	$Z = \frac{TS - TE}{(\sigma)TE}$
Investment per annual tonne capacity *[Pelaburan bagi setiap kapasiti tan tahunan]*	$\frac{I_2}{I_1} = \frac{C_2}{C_1}$
Turnover and capacity ratio *[Nisbah perolehan dan kapasiti]*	$I = C \times S$
Sixth-tenth factor *[Faktor keenam kesepuluh]*	$I_2 = I_1 \left(\frac{C_2}{C_1}\right)^{0.6}$
Standard deviation, SD *[Sisihan piawai, SD]*	$\sqrt{\sum_{i=1}^{n} \{Probability \times (EC - EV)\}}$
Coefficient of variation *[Pekali variasi]*	$\frac{SD}{EV}$
Cost variance *[Varians kos]*	$CV = BCWP - AC$
Schedule variance *[Jadual varians]*	$SV = BCWP - BCWS$
Cost performance index *[Indeks prestasi kos]*	$CPI = \frac{BCWP}{AC}$
Schedule performance index *[Indeks prestasi jadual]*	$SPI = \frac{BCWP}{BCWS}$
Estimated cost performance index *[Indeks prestasi anggaran kos]*	$ESPI = \frac{BAC}{AC + Add}$
Total cost *[Kos jumlah]*	$TC = \sum C_N + (TE \times C_i)$
	$TC = TFC + TVC$
Time-cost ratio (slope) *[Nisbah kos-masa (cerun)]*	$\frac{C_C - C_N}{T_N - T_C}$
Total revenue *[Jumlah pendapatan]*	$TR = P \times Q$
Break event point *[Titik rehat peristiwa]*	$BEPC = \frac{TFC}{P - TVC}$

Formula *[Formula]*	
Future value *[Nilai masa depan]*	$F = \sum P(1+i)^n$ $F = A\left\{\frac{(1+i)^n - 1}{i}\right\}$
Net present value *[Nilai semasa bersih]*	$NPV = PWB - PWC$
Depreciation *[Susut nilai]*	$d_i = \frac{B-S}{N}$ $d_i = \frac{N-i+1}{SoYD}(B-S)\,;SoYD = \frac{N(N+1)}{2}$
Book value *[Nilai tempahan]*	$BV = B - \sum d_i$

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