UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Kedua
Sidang Akademik 2006/2007

April 2007

EPM 322E/3 – Kejuruteraan Industri

Masa : 3 jam

ARAHAN KEPADA CALON :

Sila pastikan bahawa kertas soalan ini mengandungi **LAPAN (8)** mukasurat dan **TUJUH (7)** soalan serta **DUA (2) lampiran** yang bercetak sebelum anda memulakan peperiksaan.

Jawab **LIMA (5)** soalan sahaja.

Soalan **SATU** adalah **WAJIB.**

Jawab **DUA (2)** soalan dari **BAHAGIAN A**.
Jawab **DUA (2)** soalan dari **BAHAGIAN B**.

LAMPIRAN :

LAMPIRAN 1 : Cumulative Probabilities of the Standard Normal Distribution [1 mukasurat]
LAMPIRAN 2 : Percentage Points of the Distribution [1 mukasurat]

Calon dibenarkan menjawab semua soalan dalam **Bahasa Inggeris** ATAU **Bahasa Malaysia** ATAU kombinasi kedua-duanya.

Setiap soalan mestilah dimulakan pada mukasurat yang baru.

SOALAN WAJIB

Q1. [a] State THREE (3) advantages and THREE (3) disadvantages of work sampling.

Nyatakan TIGA (3) kebaikan dan TIGA (3) kelemahan kaedah pengsampelan kerja.

(24 markah)

[b] Provide THREE reasons for time standard in a job. Explain briefly one of them.

Berikan TIGA sebab perlunya masa piawai dalam sesuatu kerja. Terangkan secara ringkas salah satu sebab tersebut.

(32 markah)

[c] The readings shown in Table Q1[c] were obtained from a work sampling study at PPKM office.

Data yang ditunjukkan dalam Jadual S1[c] diperolehi dari kajian pengsampelan kerja yang dilakukan di pejabat PPKM.

Table Q1[c]
Jadual S1[c]

	STAFF				
ACTIVITY	**WAN**	**LIA**	**FARAH**	**SYAM**	**HAZREE**
X	256	246	245	278	208
Y	34	29	42	52	48
Z	52	71	49	18	58
Idle	18	14	24	12	46

(i) Calculate the percentage of idle time for each staff.

Kira peratusan masa lewa bagi setiap orang staf.

(22 markah)

(ii) Calculate the confidence index for each activity at 95% statistically confidence level

Kira indeks keyakinan bagi setiap aktiviti pada paras keyakinan statistik 95%.

(22 markah)

BAHAGIAN A

Q2. [a] List FOUR (4) principle objectives in method study.

Senaraikan EMPAT (4) objektif utama dalam kajian kaedah.

(20 markah)

[b] Provide SIX (6) applicable and appropriate principles of motion economy to be employed in designing sedentary precision work (eg. assembling 3-pin plug.

Nyatakan ENAM (6) prinsip ekonomi pegerakan yang boleh digunapakai sesuai dalam merekabentuk kerja jitu dalam keadaan duduk (eg. memasang palam 3 pin).

(30 markah)

[c] You are required to study the assembly of 3-pin plug (excluding wire assembly).

(i) List the components of the plug.
(ii) Sketch plan view layout of the components on the work table.
(iii) Use a two-handed process chart to record the assembly method of the plug.

Anda di kehendaki untuk mengkaji kerja pemasangan palam 3-pin (tidak termasuk pemasangan dawai).

(i) Senaraikan komponen palam tersebut
(ii) Lakarkan susunatur komponen di meja kerja dari perspektif atas.
(iii) Gunakan carta proses dua tangan untuk merakamkan kaedah pemasangan palam tersebut

(50 markah)

Q3. [a] State THREE (3) weaknesses of work design that are based on scientific approach.

Nyatakan TIGA (3) kelemahan merekabentuk kerja menurut pendekatan saintifik.

(15 markah)

[b] i) Explain briefly TWO (2) common methods in motivational approach
ii) Provide ONE (1) advantage of each method stated.
iii) Discuss ONE (1) drawback of motivational methods compared to specialization approach

i) Terangkan secara ringkas DUA (2) cara rekabentuk kerja menurut pendekatan motivasi

ii) Nyatakan SATU (1) kebaikan bagi setiap kaedah yang telah diberi.

iii) Bincang SATU (1) kelemahan pendekatan motivasi berbanding pendekatan pengkhususan

(40 markah)

[c] New operators are required to work-at an assembly line. Prior to employment, they were tested by assembling 3-pin plugs. Management assumed that steady state nominal time is reached after assembling of 1000 plugs. Regular operators are performing the task within 4 minutes.

(i) Should you hire any applicant assembling the first plug in 10 minutes and the second plug in 9 minutes? Justify your decision.

(ii) Calculate the expected time for a job the applicant should take to finish the 10^{th} plug unit.

(iii) State one significant limitation of this analysis

Pekerja baru di perlukan untuk jawatan operator pemasangan. Mereka diuji dengan pemasangan palam 3-pin. Pengurusan menganggarkan masa nominal mampu di capai setelah operator memasang palam ke 1000. Operator biasa mampu melakukannya lebih kurang 4 minit.

(i) Patutkah anda menerima pemohon kerja yang memasang palam yang pertama dalam masa 10 minit dan palam kedua pula dalam masa 9 minit.? Buktikan keputusan anda.

(ii) Kira masa jangkaan bagi pemasangan palam ke 10 yang sepatutnya dilakukan pemohon kerja

(iii) Nyatakan satu kekangan yang signifikan bagi analisis ini.

(45 markah)

Q4. [a] State the other THREE (3) components of productivity cycle other than productivity measurement. Explain briefly on the types of productivity measurement.

Nyatakan TIGA (3) komponen kitaran produktiviti selain pengukuran produktiviti. Terangkan secara ringkas jenis pengukuran produktiviti.

(25 markah)

[b] Technology based improvements is a very common approach to increase productivity. Use flowcharts to explain briefly how computerization improves productivity in

(i) Product Design

(ii) Manufacturing process

Penambahbaikan berasas teknologi merupakan pendekatan lazim bagi meningkatkan produktiviti. Dengan mengunakan carta alir, terangkan secara ringkas bagaimana pengkomputeran meningkatan produktiviti dalam

(i) Rekabentuk produk
(ii) Proses pembuatan

(30 markah)

[c] Table Q4[c] shows the financial performance of Synergy Drive Industries Bhd. The company is cash-rich, therefore no capital borrowing is done.

(i) Calculate the sales figure for year 2001, 2002 and 2003 (Asume year 2000 is the base year)

(ii) Calculate the productivity index for the year 2001, 2002 and 2003

(iii) Calculate the productivity index if inflation is taken into account

Jadual S4[c] memaparkan prestasi kewangan bagi Synergy Drives industries Bhd. Syarikat tersebut tidak memerlukan pinjaman kapital kerana ia kaya tunai.

(i) Kira jualan bagi tahun 2001, 2002 dan 2003 (andai tahun 2000 sebagai tahun dasar).

(ii) Kira indeks produktiviti bagi tahun 2001, 2002 dan 2003

(iii) Kira indeks produktiviti jika inflasi di ambilkira

(45 markah)

Table Q4[c]
Jadual S4[c]

YEAR/*TAHUN*	2000	2001	2002	2003
	x 100,000	x 100,000	x 100,000	x 100,000
Keuntungan sebelum cukai **Pre tax profit**	RM200.00	RM220.20	RM233.80	RM237.00
Kos tenaga manusia **Man power cost**	RM300	RM315	RM310	RM315
Kos bahan **Material cost**	RM 600	RM650	RM 670	RM 690
Kos lain berkaitan pengeluaran **Other production related cost**	RM60	RM65	RM 67	RM 69
Kadar faedah *Interest rates*	40.0%	4.25%	4.50%	4.25%

BAHAGIAN B

Q5. [a] **Define the term Standard Time, and explain why is it usually more convenient to express standards in time per hundred pieces rather than time per piece.**

Nyatakan definasi bagi Masa Piawai, dan jelaskan kenapa selalunya lebih mudah menyatakan masa piawai dalam sebutan masa per seratus unit daripada masa per unit.

(15 markah)

[b] **The following data are based on the observation from a production industry.**

Cycle time (average measured time)	**: 1.40 minutes**
Base rate	**: RM 8.80 per hour**
Machine time (power feed)	**: 0.55 minutes per cycle**
Pieces per cycle	**: 4**
Element 1 average time	**: 0.09 minutes**
MTM time for element 1	**: 132 TMU(1 TMU = 0.00001 hour)**
Allowances	**: 17 % on effort time and 12 % on power feed time**

The plant uses synthetic performance rating

Determine :

i) Performance factor
ii) Allowed machine time per piece
iii) Allowed cycle time per piece
iv) Money rate per hundred

Data berikut adalah berdasarkan kepada pemerhatian daripada industri pengeluaran:

Masa kitar (masa pengukuran purata)	*: 1.40 minit*
Kadar asas	*: RM 8.80 se jam*
Masa mesin (suapan kuasa)	*: 0.55 minit se kitar*
Cebisan se kitar	*: 4*
Unsur 1 masa purata	*: 0.09 minit*
Masa MTM bagi unsur 1	*: 132 TMU (1 TMU= 0.00001 jam)*
Basi	*: 17% bagi masa usaha, dan 12% bagi masa suapan kuasa*

Kilang menggunakan kadaran prestasi sintesis

Tentukan :

i) Faktor prestasi
ii) Masa mesin seunit terizin
iii) Masa kitar seunit terizin
iv) Kadar wang per seratus

(45 markah)

[c] **A group of analysts have to review 20 film loops. Each analyst then compute their individual record which suppose to fall within ± 5 points of the known rating. Her supervisor check her average difference as - 4.08 points on 20 films. The standard deviation was 6.4. Calculate:**

i) **What percentage of this analyst's rating was contained within the desired rating?**
ii) **State an assumption required on the sample values.**

Sekumpulan penganalisa dikehendaki mengkaji 20 gelung filem. Setiap penganalisa mengira rekod individu yang sepatutnya jatuh dalam ruang ± 5 nilai bagi kadaran yang diketahui. Penyelia memeriksa perbezaan purata adalah - 4.08 nilai bagi 20 filem. Sisihan piawai adalah 6.4. Tentukan:

i) Peratus bagi kadaran penganalisa supaya termasuk dalam kadaran yang dikehendaki.
ii) Nyatakan andaian yang diperlukan bagi nilai sampel.

(40 markah)

Q6. [a] **Maslow identified five ascending levels of human needs. Alderfer suggested only three importance elements of motivation. Compare the Alderfer Theory with Maslow's Theory.**

Maslow mengenalpasti ada lima paras menaik bagi keperluan manusia. Alderfer mencadangkan cuma ada tiga sahaja unsur penting bagi motivasi. Bandingkan Teori Alderfer dengan Teori Maslow.

(30 markah)

[b] **Rewards system bridge the gap between organizational objectives and the individual expectations. Explain the basic components of a reward system to achieve both organization objectives and individual expectations.**

Sistem ganjaran menjadi jambatan mengurangkan jurang antara objektif organisasi dengan inspirasi individu. Jelaskan komponen asas bagi sistem ganjaran supaya memenuhi kedua-dua objektif organisasi dan inspirasi individu.

(25 markah)

[c] **The production rate of a job at XYZ company is 12 pieces per hour. The hourly rate of RM15 is employed. The management decided to change to incentive wage payment where day rate of RM15 is guaranteed. A new study shows that production rate is at 14 pieces per hour, and for first 5 hours the worker produces average 16 pieces per hour.**
Determine :

i) **The initial unit direct labour cost**
ii) **Under the incentive wage payment, what is his earning.**

Then, for the remainder of the workday, the operator could not productively engaged in work. Determine :

i) What is the worker expectation of his daily earnings.
ii) What is the new direct labour cost per unit produced.

Kadar pengeluaran bagi suatu kerja syarikat XYZ adalah 12 unit sejam. Kadar bayaran sejam adalah RM15. Pihak pengurusan memutuskan mengubah bayaran upah kepada bayaran upah insentif yang mana kadar harian RM15 adalah terjamin. Kajian terbaru menunjukkan kadar pengeluaran adalah 14 unit sejam, dan bagi 5 jam pertama pekerja mengeluarka purata 16 unit sejam.

Tentukan :

i) Kos pekerja terus bagi unit awalan
ii) Dibawah bayaran upah insentif, berapakah pendapatannya

Kemudian, untuk baki masa kerja harian, operator tersebut tidak menghasilkan kerja yang produktif. Tentukan :

i) Apakah harapan pekerja tentang pendapatan hariannya.
ii) Berapakah kos pekerja terus yang baru.

(45 markah)

Q7. [a] **Describe briefly Function Analysis Technique, and explain the importance of this technique.**

Terangkan dengan ringkas Teknik Analisis Fungsi, dan jelaskan kepentingan teknik ini.

(25 markah)

[b] **What is FAST Diagram. Compare briefly the differences between FAST Diagram and PERT Chart.**

Apa itu Rajah FAST. Bandingkan dengan ringkas perbezaan di antara Rajah FAST dan Carta PERT.

(25 markah)

[c] **With the aid of a FAST Diagram, explain how a ball point pen works to perform its function.**

Dengan bantuan rajah FAST, terangkan bagaimana pena mata bulat melaksanakan fungsinya.

(50 markah)

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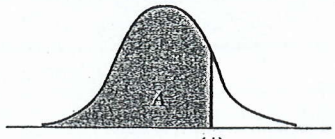
LAMPIRAN 1

Cumulative Probabilities of the Standard Normal Distribution

Entry is area A under the standard normal curve from $-\infty$ to $z(A)$.



z	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	0.8810	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	0.9406	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
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

Selected Percentiles

Cumulative probability A:	0.90	0.95	0.975	0.98	0.99	0.995	0.999
$z(A)$:	1.282	1.645	1.960	2.054	2.326	2.576	3.090

(*From:* J. Neter, W. Wasserman and M. H. Kutner, Applied Linear Statistical Models, 2nd ed. Homewood, IL: Richard D. Irwin, 1985). (Reproduced with permission of the McGraw-Hill Companies)

LAMPIRAN 2

Percentage Points of the *t* Distribution (probabilities refer to the sum of the two tail areas; for a single tail, divide the probability by 2)

	Probability (*P*)												
n	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.05	0.02	0.01	0.001
1	0.158	0.325	0.510	0.727	1.000	1.376	1.963	3.078	6.314	12.706	31.821	63.657	636.619
2	0.142	0.289	0.445	0.617	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	31.598
3	0.137	0.277	0.424	0.584	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	12.941
4	0.134	0.271	0.414	0.569	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	8.610
5	0.132	0.267	0.408	0.559	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	6.859
6	0.131	0.265	0.404	0.553	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.959
7	0.130	0.263	0.402	0.549	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	5.405
8	0.130	0.262	0.399	0.546	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	5.041
9	0.129	0.261	0.398	0.543	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.781
10	0.129	0.260	0.397	0.542	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.587
11	0.129	0.260	0.396	0.540	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.437
12	0.128	0.259	0.395	0.539	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	4.318
13	0.128	0.259	0.394	0.538	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	4.221
14	0.128	0.258	0.393	0.537	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	4.140
15	0.128	0.258	0.393	0.536	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	4.073
16	0.128	0.258	0.392	0.535	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	4.015
17	0.128	0.257	0.392	0.534	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.965
18	0.127	0.257	0.392	0.534	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.922
19	0.127	0.257	0.391	0.533	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.883
20	0.127	0.257	0.391	0.533	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.850
21	0.127	0.257	0.391	0.532	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.819
22	0.127	0.256	0.390	0.532	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.792
23	0.127	0.256	0.390	0.532	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.767
24	0.127	0.256	0.390	0.531	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.745
25	0.127	0.256	0.390	0.531	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.725
26	0.127	0.256	0.390	0.531	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.707
27	0.127	0.256	0.389	0.531	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.690
28	0.127	0.256	0.389	0.530	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.674
29	0.127	0.256	0.389	0.530	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.659
30	0.127	0.256	0.389	0.530	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.646
40	0.126	0.255	0.388	0.529	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.551
60	0.126	0.254	0.387	0.527	0.679	0.848	1.046	1.296	1.671	2.000	2.390	2.660	3.460
120	0.126	0.254	0.386	0.526	0.677	0.845	1.041	1.289	1.658	1.980	2.358	2.617	3.373
∞	0.126	0.253	0.385	0.524	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.291

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