UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Kedua
Sidang Akademik 2002/2003

Februari / Mac 2003

JNG 370/3 – Kejuruteraan Industri

Masa : 3 jam

ARAHAN KEPADA CALON :

Sila pastikan bahawa kertas soalan ini mengandungi **LAPAN (8)** mukasurat dan **ENAM (6)** soalan yang bercetak serta **DUA (2)** halaman lampiran sebelum anda memulakan peperiksaan.

Sila jawab **LIMA (5)** soalan sahaja.

Setiap soalan mestilah dimulakan pada mukasurat yang baru.

Lampiran :

1. Compound Interest Formulas [1 mukasurat]
2. Predetermined time data tables for the methods time measurement system (Time data are in TMU's ; 1 TMU = 0.0006 minute.) [2 mukasurat]

Serahkan **KESELURUHAN** soalan dan jawapan kertas peperiksaan ini kepada Ketua Pengawas di akhir sidang peperiksaan. Pelajar yang gagal berbuat demikian akan diambil tindakan disiplin.

KETUA PENGAWAS : Sila pungut :

(a) **KESELURUHAN** kertas soalan ini (tanpa diceraikan mana-mana muka surat) dan mana-mana kertas soalan peperiksaan ini yang berlebihan untuk dikembalikan kepada Bahagian Peperiksaan, Jabatan Pendaftar, USM.

Peringatan :

1. Sila pastikan bahawa anda telah menulis angka giliran dengan betul.

BAHAGIAN A

S1. [a] Satu operasi pengeluaran yang tidak berulang akan melalui satu kitaran hayat yang berbeza berdasarkan saiz, kompleksiti, dan gaya perlaksanaan oleh suatu organisasi.

A non repetitive production operation passes through a life cycle that may vary with size, complexity, and style established by the organization.

(i) Lakarkan rajah skematik untuk kitaran hayat operasi pengeluaran ini dan namakan setiap fasa yang kebiasaannya ada di dalam kitaran tersebut.

Draw a schematic diagram of the production operation life cycle and name the phases typically included in the cycle.

(10 markah)

(ii) Secara ringkas nyatakan aktiviti yang terlibat di dalam setiap fasa.

Briefly explain the activities involved in each phase.

(20 markah)

[b] Pengurusan operasi dan pengeluaran meliputi tiga kategori system yang direkabentuk untuk pengeluaran secara besar-besaran, pengeluaran berkelompok, dan pengeluaran operasi pengeluaran yang tidak berulang, yang kebiasaannya berkaitan dengan industri dan pembangunan produk baru.

Production and operation management contains three major classes of systems, those designed for mass production, batch (or lot) production, and for undertaking non-repetitive production operation, common to the development of new product.

(i) Lakarkan rajah skematik bagi menggambarkan ketiga-tiga kategori utama system pengeluaran tersebut berdasarkan saiz kelompok dan saiz isipadu pengeluaran.

Draw a schematic diagram to represent those three major classes in terms of their batch and volume sizes.

(10 markah)

(ii) Terangkan perbezaan antara system pengeluaran yang tidak berulang dan sistem pengeluaran berkelompok.

Explain the difference between the non-repetitive production operation, and the batch production system.

(20 markah)

[c] **Berdasarkan satu rangkaian matlamat yang jelas, adalah mungkin untuk membangun satu bentuk penilaian prestasi yang sesuai dan memilih satu struktur organisasi, sumber yang diperlukan, dan dimana pekerja bergabung kepada satu pasukan untuk mencapai matlamat tersebut.**

Based on a well-defined set of goals, it is possible to develop appropriate performance measures and to select the organizational structure, required resources, and people that will team up to achieve these goals.

(i) **Lakarkan satu carta aliran proses yang menunjukkan langkah utama yang diambil di dalam pengurusan projek.**

Draw a process flow chart relevant to the major steps generally taken in project management.

(10 markah)

(ii) **Huraikan setiap langkah bagi carta aliran proses tersebut.**

Explain every single step of the process.

(30 markah)

S2. [a] **Dengan menggunakan data yang terdapat pada jadual dibawah ini :**

By using data from table below:

Minggu ke *(Week)*	**Jumlah Penjualan (unit)** *Total Purchased (unit)*
1	19
2	18
3	15
4	20
5	18
6	22
7	20

Sediakan ramalan-ramalan berdasarkan kepada purata-purata dengan menggunakan :

Determine the speculations based on average by using:

(i) **Pendekatan *naïve.***

Naïve method

(10 markah)

(ii) **Pendekatan *five-period moving average.***

Five-Period Moving Average method

(10 markah)

(iii) **Purata berpemberat *(weighted average)* dengan menggunakan pemberat 0.50 (untuk yang terkini), 0.30 dan 0.20.**

Weighted average by using weight 0.5 (for the latest), 0.3 and 0.2

(10 markah)

(iv) ***Exponential smoothing* dengan *smoothing constant* senilai 0.20.**

Exponential smoothing using smoothing constant equal to 0.2

(20 markah)

[b]

By using information below

Dengan menggunakan informasi di bawah ini,

Minggu ke : *Week*	**Permintaan :** *Demand*
1	440
2	520
3	500
4	540
5	550
6	550
7	600
8	560
9	620

(i) **Plot kan data dan garis pada kertas graf.**

Plotted these data and line on the graph paper

(10 markah)

(ii) **Buatkan persamaan ' *line trend'* untuk graf berkenan.**

Derive an equation 'line trend' on the graph

(20 markah)

(iii) **Gunakan persamaan tersebut untuk meramalkan nilai-nilai permintaan untuk period 10 dan 11.**

Using that equation to speculate demand values for period 10 and 11

(20 markah)

S3. [a] **Sepatutnya peralatan berharga RM 20,000 dijangkakan akan bertahan selama 5 tahun yang mana akan menghasilkan nilai salvaj sebanyak RM 4,000. Sekiranya kadar interaktif minimum pulangan (kadar faedah) ialah 15%, apakah nilai bagi;**

Suppose that a RM 20,000 piece of equipment is expected to last 5 years which will result in a RM 4,000 salvage value. If the minimum attractive rate of return (interest rate) is 15%, what are the values of :

(i) Kos tahunan setara

Annual equivalent (cost)

(ii) Kos semasa setara

Present equivalent (cost)

(20 markah)

[b] **Penjimatan dianggarkan pada RM 10,000 pada akhir bulan ke 4 dan untuk meningkatkannya lagi sebanyak RM 2,000 pada setiap bulan sehingga akhir bulan ke 7. Walaubagaimanapun, akan terdapat penurunan penjimatan sebanyak RM 400 setiap bulan bermula daripada hujung bulan 8 sehinggalah hujung bulan 11, dan kemudian tidak terdapat sebarang peningkatan atau penambahan sehinggalah bulan yang ke 15. Jika MARR ialah 20%, apakah nilai berikut:**

A certain savings is expected to be RM 10,000 at the end of month 4 and to increase RM 2,000 each month until the end of month 7. However, there will be a decline in savings at RM 400 each month from end of month 8 until the end of month 11, and then there will be no increase nor decrease until the end of month 15. If the MARR is 20%, what are the following :

(i) Kos tahunan setara (pada permulaan bulan 1)

Present equivalent (at the beginning of month 1).

(ii) Kos masa depan setara (pada penghujung bulan ke 15)

Future equivalent (at the end of month 15).

(50 markah)

[c] **Syarikat ABC membuat dan menjual komputer. Ia menghasilkan sebahagian komponen dan membeli sebahagian yang lain. Jabatan kejuruteraan percaya bahawa mungkin kos dapat dikurangkan dengan menghasilkan satu komponen yang pada ketika ini dibeli pada harga RM 8.25 setiap satu. Syarikat menggunakan 100,000 komponen ini pada setiap tahun dan pejabat perakaunan menyusun senarai kos-kos tahunan yang berikut berdasarkan anggaran kejuruteraan.**

The ABC Corporation manufactures and sells computers. It makes some of the parts and purchases others. The engineering department believes that it might be possible to cut costs by manufacturing one of the parts currently being purchased for RM 8.25 each. The firm uses 100,000 of these parts each year, and accounting department compiles the following list of annual costs based on engineering estimates.

- **Kos tak boleh ubah akan meningkat sebanyak RM 50,000**

  Fixed costs will increase by RM 50,000.

- **Kos buruh akan meningkat sebanyak RM 125,000**

  Labor costs will increase by RM 125,000.

- **Perbelanjaan kilang yang sekarang pada RM 500,000 dijangka bertambah sebanyak 12%**

  Factory overhead, currently running RM 500,000 per year, is expected to increase 12%.

- **Bahan mentah untuk menghasilkan komponen adalah pada kos RM600,000**

  Raw materials used to make the part will cost RM 600,000.

Berdasarkan anggaran yang diberikan, adakah patut ABC menghasilkan komponen ini atau terus membelinya?

Given the estimates above, should ABC make the part or continue to buy it?

(30 markah)

S4. [a] Bezakan di antara masalah antara-stesyen dan dalaman-stesyen.

Differentiate between Inter- station problem and Intra - station problem.

(25 markah)

[b] Apakah persoalan yang dapat membantu di dalam memudahkan kaedah-kaedah kerja

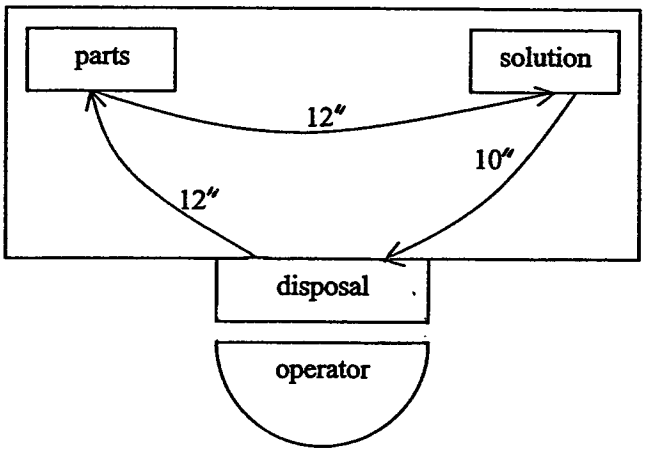
What questions help in simplification of work methods.

(25 markah)

[c] **Amalan piawai (bentangan) untuk proses pencelupan sebahagiannya adalah komponen silinder lebih kurang 200 gram dan diameter maksimum di dalam satu larutan dan menghancurkannya ditunjukkan di dalam rajah S1. Anggarkan masa piawai untuk menghancurkan komponen menggunakan Kaedah Masa Pengukuran (MTM) dan anggapkan keizinan peribadi, lesu dan tunda sebagai 16%.**

Standard practice (layout) for dipping partly a cylindrical part about 200 gram and maximum 25 cm diameter in a solution and disposing it is shown in Figure S1. Estimate the standard time for disposal a part using Method Time Measurement (MTM) and assuming personal, fatigue and delay allowances as 16 %.

(50 markah)



Rajah S4
Figure Q4

S5. **Jadual S5 menunjukkan masa jam randik yang menjalankan kajian kerja pemasangan yang melibatkan empat elemen.**

Table Q5 shows the stopwatch time study of an assembly task that involved four elements :

(i) **Apakah yang sepatutnya dilakukan dalam kitar 2, elemen 3 di dalam kajian?**

What should be done with cycle 2, element 3 in the study?

(20 markah)

(ii) **Kira masa kerja normal.**

Calculate the normal task time.

(30 markah)

(iii) **Kira masa piawai**

Calculate the standard time.

(30 markah)

(iv) **Adakah cukup masa kitaran untuk ketepatan ± 10 % dengan tahap keyakinan 95%? Jika tidak berapakah yang diperlukan?**

Are enough cycles timed for ± 10 % accuracy with 95 % confidence level? If not how many are needed?

(20 markah)

TABLE Q5

Elemen Element	Kitar (Cycle) 1	2	3	4	5	Kedudukan Rating
1	0.04	0.04	0.03	0.03	0.04	100
2	0.12	0.10	0.09	0.10	0.10	90
3	0.16	0.24	0.15	0.16	0.16	115
4	0.13	0.13	0.12	0.14	0.14	120

Keizinan adalah 15 peratus daripada masa normal.

Allowances are 15 percent of normal time.

S6. [a] **Di dalam jaringan projek apakah kepentingan satah kritikal?**

In project network what is the importance of critical path ?

(25 markah)

[b] **Di dalam jaringan projek terangkan penggunaan aktiviti-aktiviti buaian dan dumi**

In project network explain the use of hammock and dummy activities.

(25 markah)

[c] **Apakah apung bebas dan apakah kepentingannya?**

What is free float and what is its importance?

(25 markah)

[d] **Apakah kebaikan yang boleh diperolehi sekiranya jaringan anak panah ditukarkan kepada carta bar?**

What advantage can be obtained if arrow network is transformed to a bar chart?

(25 markah)

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LAMPIRAN

Compound Interest Formulas

i = effective interest rate per interest period, sometimes referred to as the discount rate or minimum attractive rate of return (MARR); given as a decimal number in the formulas below (i.e. 12% is equivalent to 0.12)

n = number of compounding periods

P = present sum of money (equivalent worth of one or more cash flows at a point in time called the present)

F = future sum of money (equivalent worth of one or more cash flows at a point in time called the future)

A = end-of-period cash flow (or equivalent end-of-period value) in a uniform series continuing for n periods (sometimes called "annuity")

G = uniform increase or decrease in end-of-period cash flows or amounts (the arithmetic gradient)

Single-payment compound amount factor

$$(F/P, i\%, n) = (1+i)^n$$

Single-payment present worth factor

$$(P/F, i\%, n) = \frac{1}{(1+i)^n} = \frac{1}{(F/P, i\%, n)}$$

Uniform series compound amount factor

$$(F/A, i\%, n) = \frac{(1+i)^n - 1}{i}$$

Uniform series sinking fund factor

$$(A/F, i\%, n) = \frac{i}{(1+i)^n - 1} = \frac{1}{(F/A, i\%, n)}$$

Uniform series present worth factor

$$(P/A, i\%, n) = \frac{(1+i)^n - 1}{i(1+i)^n}$$

Uniform series capital recovery factor

$$(A/P, i\%, n) = \frac{i(1+i)^n}{(1+i)^n - 1} = \frac{1}{(P/A, i\%, n)}$$

Arithmetic gradient present worth factor

$$(P/G, i\%, n) = \frac{(1+i)^n - in - 1}{i^2(1+i)^n}$$

Arithmetic gradient uniform series factor

$$(A/G, i\%, n) = \frac{(1+i)^n - in - 1}{i(1+i)^n - i}$$

LAMPIRAN

TABLE I—REACH—R

Distance Moved Inches	Time TMU				Hand In Motion	
	A	B	C or D	E	A	B
¾ or less	2.0	2.0	2.0	2.0	1.6	1.6
1	2.5	2.5	3.6	2.4	2.3	2.3
2	4.0	4.0	5.9	3.8	3.5	2.7
3	5.3	5.3	7.3	5.3	4.5	3.6
4	6.1	6.4	8.4	6.8	4.9	4.3
5	6.5	7.8	9.4	7.4	5.3	5.0
6	7.0	8.6	10.1	8.0	5.7	5.7
7	7.4	9.3	10.8	8.7	6.1	6.5
8	7.9	10.1	11.5	9.3	6.5	7.2
9	8.3	10.8	12.2	9.9	6.9	7.9
10	8.7	11.5	12.9	10.5	7.3	8.6
12	9.6	12.9	14.2	11.8	8.1	10.1
14	10.5	14.4	15.6	13.0	8.9	11.5
16	11.4	15.8	17.0	14.2	9.7	12.9
18	12.3	17.2	18.4	15.6	10.5	14.4
20	13.1	18.6	19.8	16.7	11.3	15.8
22	14.0	20.1	21.2	18.0	12.1	17.3
24	14.9	21.5	22.5	19.2	12.9	18.8
26	15.8	22.9	23.9	20.4	13.7	20.2
28	16.7	24.4	25.3	21.7	14.5	21.7
30	17.5	25.8	26.7	22.9	15.3	23.2

CASE AND DESCRIPTION
A Reach to object in fixed location, or to object in other hand or on which other hand rests.
B Reach to single object in location which may vary slightly from cycle to cycle.
C Reach to object jumbled with other objects in a group so that search and select occur.
D Reach to a very small object or where accurate grasp is required.
E Reach to indefinite location to get hand in position for body balance or next motion or out of way.

TABLE II—MOVE—M

Distance Moved Inches	Time TMU				Wt. Allowance		
	A	B	C	Hand In Motion B	Wt. (lb.) Up to	Factor	Constant TMU
¾ or less	2.0	2.0	2.0	1.7	2.5	1.00	0
1	2.5	2.9	3.4	2.3			
2	3.6	4.6	5.2	2.9	7.5	1.06	2.2
3	4.9	5.7	6.7	3.6			
4	6.1	6.9	8.0	4.3	12.5	1.11	3.9
5	7.3	8.0	9.2	5.0			
6	8.1	8.9	10.3	5.7	17.5	1.17	5.6
7	8.9	9.7	11.1	6.5			
8	9.7	10.6	11.8	7.2	22.5	1.22	7.4
9	10.5	11.5	12.7	7.9			
10	11.3	12.2	13.5	8.6	27.5	1.28	9.1
12	12.9	13.4	15.2	10.0			
14	14.4	14.6	16.9	11.4	32.5	1.33	10.8
16	16.0	15.8	18.7	12.8			
18	17.6	17.0	20.4	14.2	37.5	1.39	12.5
20	19.2	18.2	22.1	15.6			
22	20.8	19.4	23.8	17.0	42.5	1.44	14.3
24	22.4	20.6	25.5	18.4			
26	24.0	21.8	27.3	19.8	47.5	1.50	16.0
28	25.6	23.1	29.0	21.2			
30	27.1	24.3	30.7	22.7			

CASE AND DESCRIPTION
A Move object to other hand or against stop.
B Move object to approximate or indefinite location.
C Move object to exact location.

TABLE III—TURN AND APPLY PRESSURE—T AND AP

Weight	Time TMU for Degrees Turned										
	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°
Small— 0 to 2 Pounds	2.8	3.5	4.1	4.8	5.4	6.1	6.8	7.4	8.1	8.7	9.4
Medium—2.1 to 10 Pounds	4.4	5.5	6.5	7.5	8.5	9.6	10.6	11.6	12.7	13.7	14.8
Large— 10.1 to 35 Pounds	8.4	10.5	12.3	14.4	16.2	18.3	20.4	22.2	24.3	26.1	28.2

APPLY PRESSURE CASE 1—16.2 TMU. APPLY PRESSURE CASE 2—10.6 TMU

TABLE IV—GRASP—G

Case	Time TMU	DESCRIPTION
1A	2.0	Pick Up Grasp—Small, medium or large object by itself, easily grasped.
1B	3.5	Very small object or object lying close against a flat surface.
1C1	7.3	Interference with grasp on bottom and one side of nearly cylindrical object. Diameter larger than ½".
1C2	8.7	Interference with grasp on bottom and one side of nearly cylindrical object. Diameter ¼" to ½".
1C3	10.8	Interference with grasp on bottom and one side of nearly cylindrical object. Diameter less than ¼".
2	5.6	Regrasp.
3	5.6	Transfer Grasp.
4A	7.3	Object jumbled with other objects so search and select occur. Larger than 1" x 1" x 1".
4B	9.1	Object jumbled with other objects so search and select occur. ¼" x ¼" x ¼" to 1" x 1" x 1".
4C	12.9	Object jumbled with other objects so search and select occur. Smaller than ¼" x ¼" x ¼".
5	0	Contact, sliding or hook grasp.

TABLE V—POSITION*—P

CLASS OF FIT		Symmetry	Easy To Handle	Difficult To Handle
1—Loose	No pressure required	S	5.6	11.2
		SS	9.1	14.7
		NS	10.4	16.0
2—Close	Light pressure required	S	16.2	21.8
		SS	19.7	25.3
		NS	21.0	26.6
3—Exact	Heavy pressure required.	S	43.0	48.6
		SS	46.5	52.1
		NS	47.8	53.4

*Distance moved to engage—1" or less.

TABLE VI—RELEASE—RL

Case	Time TMU	DESCRIPTION
1	2.0	Normal release performed by opening fingers as independent motion.
2	0	Contact Release.

TABLE VII—DISENGAGE—D

CLASS OF FIT	Easy to Handle	Difficult to Handle
1—Loose—Very slight effort, blends with subsequent move.	4.0	5.7
2—Close — Normal effort, slight recoil.	7.5	11.8
3—Tight — Considerable effort, hand recoils markedly.	22.9	34.7

TABLE VIII—EYE TRAVEL TIME AND EYE FOCUS—ET AND EF

Eye Travel Time=15.2 $\times \frac{T}{D}$ TMU, with a maximum value of 20 TMU.

where T=the distance between points from and to which the eye travels.
D=the perpendicular distance from the eye to the line of travel T.

Eye Focus Time=7.3 TMU.

Predetermined time data tables for the methods time measurement system (Time data are in TMU's; 1 TMU = 0.0006 minute.)