



**KOLEJ YAYASAN PELAJARAN JOHOR
FINAL EXAMINATION**

COURSE NAME : CONTROL SYSTEMS
COURSE CODE : DKE 2163
EXAMINATION : DECEMBER 2022
DURATION : 2 HOURS 30 MINUTES

**INSTRUCTION TO CANDIDATES/
ARAHAN KEPADA CALON**

1. This examination paper consists of **FOUR (4)** questions. /
Kertas soalan ini mengandungi EMPAT (4) soalan.
2. Candidate are not allowed to bring any material to examination room except with the permission from the invigilator. The formula was attached at the back question paper. /
Calon tidak dibenarkan untuk membawa sebarang bahan/nota ke bilik peperiksaan tanpa arahan/kebenaran daripada pengawas. Rumus dilampirkan di belakang kertas soalan peperiksaan.
3. Please check to make sure that this examination pack consists of: /
Pastikan kertas soalan peperiksaan ini mengandungi:
 - i. Question Paper /
Kertas Soalan.
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Buku Jawapan.

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This examination paper consists of **5** printed pages including front page
Kertas soalan ini mengandungi 5 halaman bercetak termasuk muka hadapan

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This examination paper consists of **FOUR (4)** questions. Answer **ALL** the questions in an answer sheet.

Kertas soalan ini mengandungi EMPAT (4) soalan. Jawab SEMUA soalan dalam kertas jawapan.

QUESTION 1/ SOALAN 1

(a) Describe the use of **four (4)** test waveforms used in control systems and draw the respective waveforms.

Terangkan kegunaan empat (4) gelombang ujian yang digunakan pada sistem kawalan dan lukis gelombang tersebut.

(8 marks / markah)

(b) Fill in the blanks in the **Table 1** below of the differences between closed-loop and open-loop systems.

Isikan tempat kosong pada Jadual 1 di bawah berkenaan perbezaan diantara sistem gelung tertutup dan gelung terbuka.

Closed-loop system <i>Sistem gelung tertutup</i>	Open-loop system <i>Sistem gelung terbuka</i>
	Does not have the feedback path. <i>Tidak mempunyai laluan suapbalik.</i>
Output response: greater accuracy. <i>Respon keluaran : ketepatan yang tinggi.</i>	
	Sensitive to noise, disturbances and changes in the environment. <i>Sensitif terhadap kebisingan, gangguan dan perubahan persekitaran.</i>
The system can compare the output response with the input and make a correction if there is any difference. <i>Sistem mampu membandingkan respon keluaran dengan masukan dan membuat pembetulan jika terdapat perbezaan.</i>	
	Simple and inexpensive. <i>Mudah dan murah.</i>

Table 1 / Jadual 1

(10 marks / markah)

QUESTION 2/ SOALAN 2

Show the transfer function, $X_2(s)/F(s)$, for the translational mechanical system of Figure 2.

Tunjukkan rangkap pindah, $X_2(s)/F(s)$, bagi sistem mekanikal penterjemah pada Rajah 2.

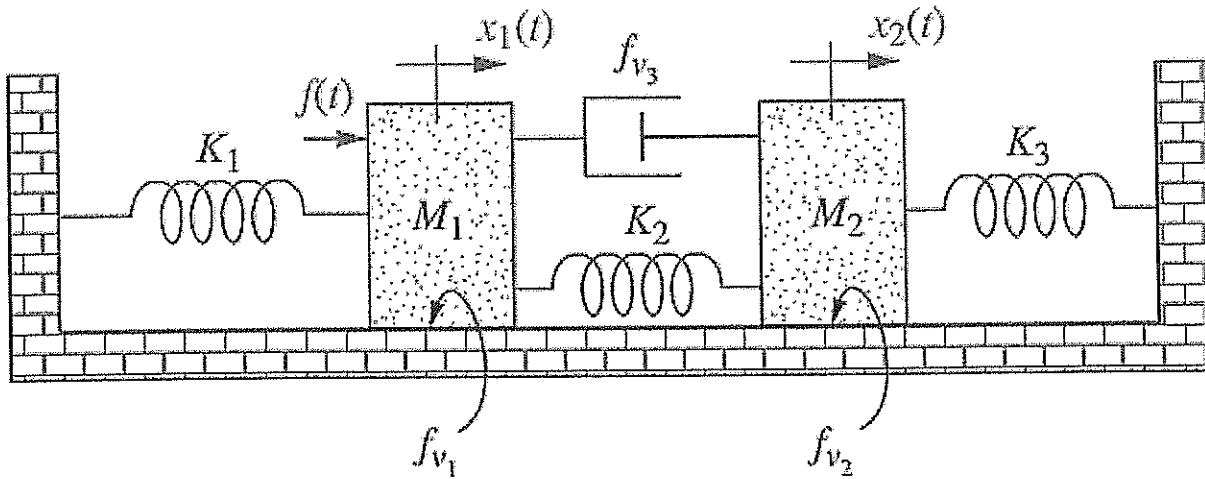


Figure 2 / Rajah 2

(12 marks / markah)

QUESTION 3/ SOALAN 3

(a) Describe three (3) transient response specifications of First Order System with their respective formula.

Terangkan tiga (3) spesifikasi tindak balas sementara pada Sistem Susunan Pertama bersama formula mereka.

(9 marks markah)

(b) Reduce the system in Figure 3 to a single transfer function.

Mudahkan system dalam Rajah 3 kepada rangkap pindah tunggal.

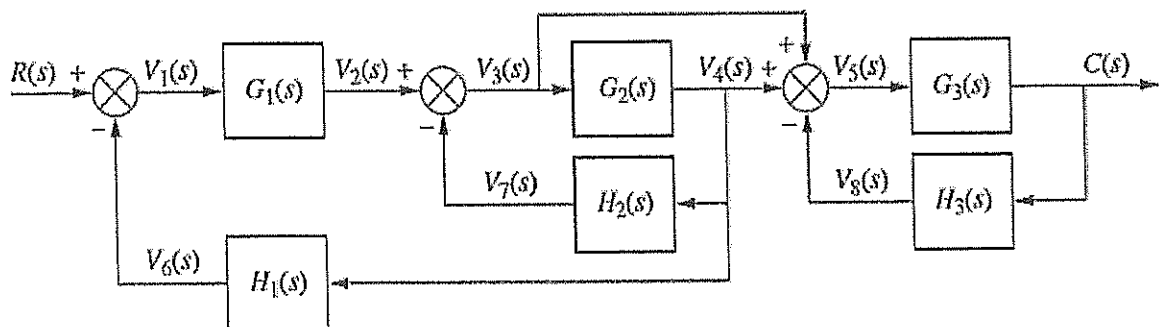


Figure 3 / Rajah 3

(8 marks / markah)

(c) Use Routh-Hurwitz stability criterion to determine how many roots with positive real parts for the equation.

Gunakan kriteria kestabilan Routh-Hurwitz untuk menentukan jumlah punca untuk bahagian sebenar positif untuk persamaan ini.

$$s^5 + 10s^4 + 30s^3 + 80s^2 + 344s + 480 = 0$$

(10 marks / markah)

QUESTION 4/ SOALAN 4

(a) Given the transfer function, $G(s)$ for the control system shown in Figure 4 (a) below. Referring to Figure 4 (b), answer the questions that follows:

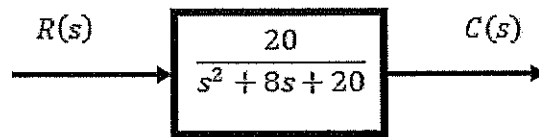


Figure 4 (a) / Rajah 4 (a)

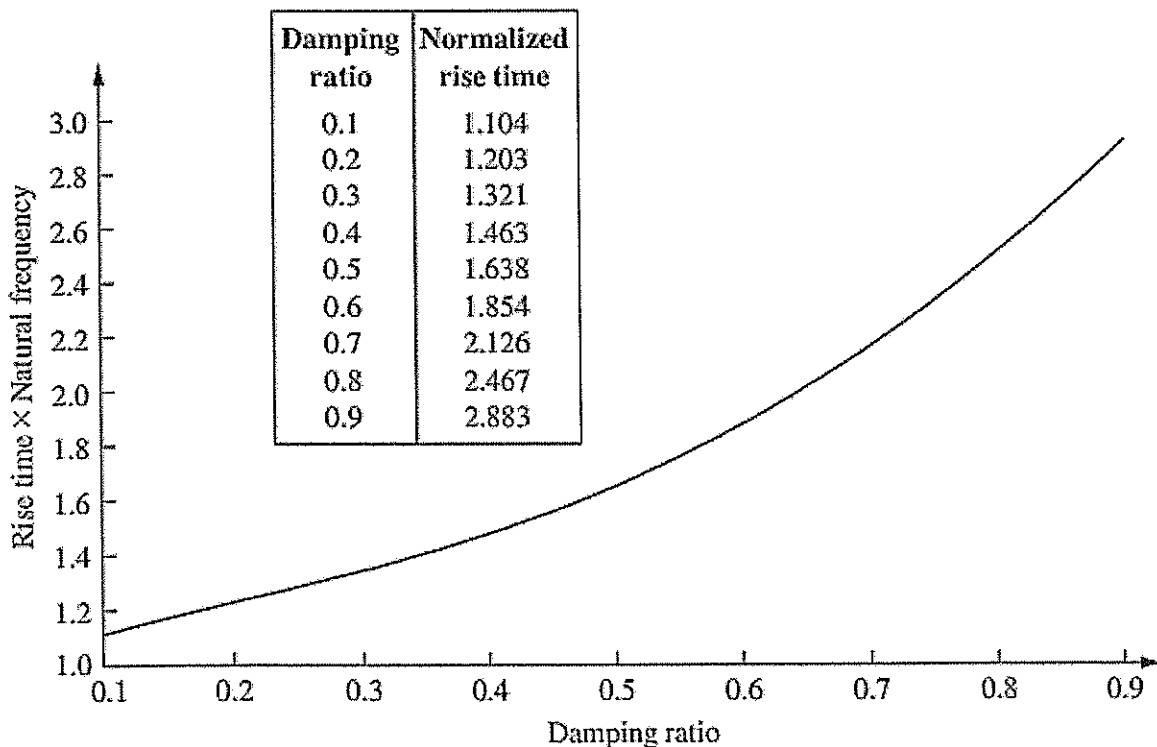


Figure 4 (b) / Rajah 4 (b)

- i) show the natural frequency, ω_n and damping ratio, ξ .
- ii) determine peak time, T_p , percent overshoot, %OS, settling time, T_s , and rise time, T_r .
- iii) characterize the nature of the response.
- iv) draw the response.

(18 marks / markah)

Diberi rangkap pindah, $G(s)$ untuk sistem kawalan ditunjukkan dalam **Rajah 4 (a)** di bawah. Berdasarkan **Rajah 4 (b)**, sila jawab soalan berikut:

- i) tunjukkan frekuensi tabii, ω_n , dan nisbah redaman, ξ .
- ii) tentukan masa puncak, T_p , peratus lajukan, %OS, masa selesai, T_s , dan masa menaik, T_r .
- iii) cirikan sifat tindak balas.
- iv) lukis tindak balas.

(b) Solve the transfer function, $C(s)/R(s)$, for the signal-flow graph in Figure 5.

Selesaikan rangkap, $C(s)/R(s)$, untuk graf isyarat –lalu pada **Rajah 5**.

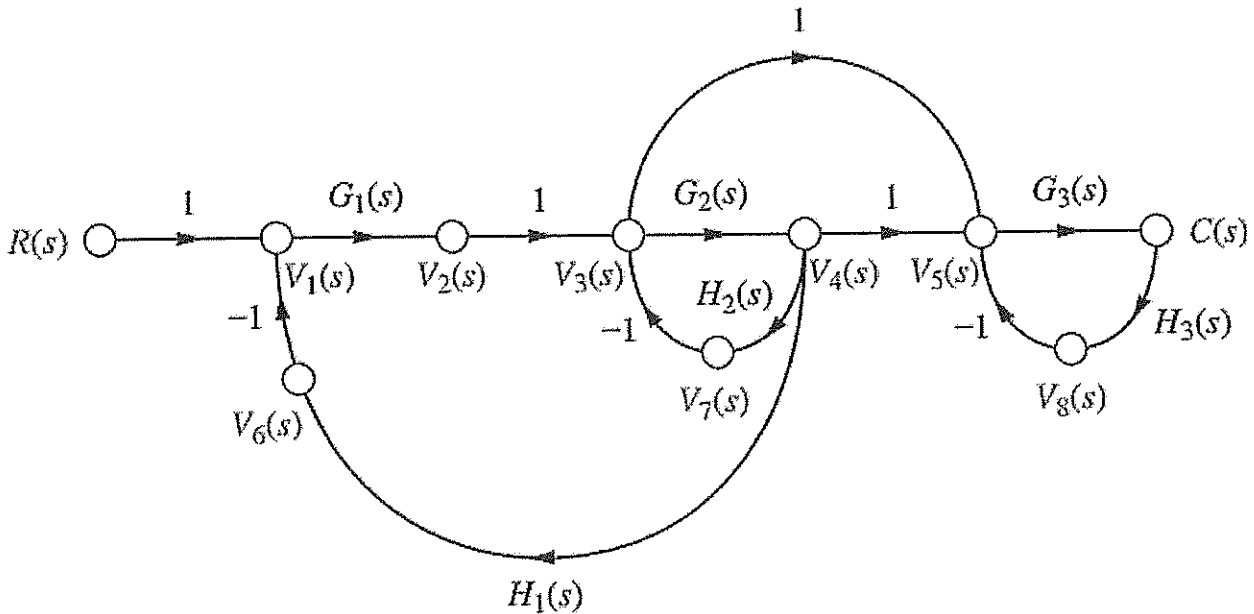


Figure 5 / Rajah 5

(25 marks / markah)

[100 MARKS/ MARKAH]

END OF QUESTION PAPER/ KERTAS SOALAN TAMAT

