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Peperiksaan Semester Pertama  
Sidang Akademik 2005/2006  
*First Semester Examination  
2005/2006 Academic Session*

November 2005  
*November 2005*

**ESA 251/3 – Teori Sistem Kawalan**  
*Theory of Control System*

Masa : 3 jam  
*Duration : 3 hours*

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Sila pastikan bahawa kertas peperiksaan ini mengandungi LAPAN muka surat yang bercetak sebelum anda memulakan peperiksaan ini.

*Please check that this examination paper consists of EIGHT pages of printed material before you begin the examination.*

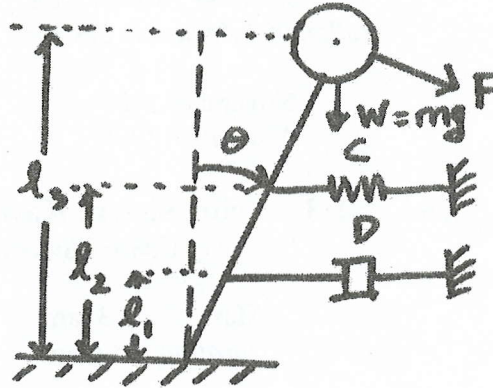
**Arahan**: Jawab **EMPAT (4)** soalan.

**Instructions** : Answer **FOUR (4)** questions.

...2/-

1. Pertimbangkan sistem bandul pegas terendam seperti dalam Gambarajah 1 di bawah.

Consider the damped spring pendulum system below in Figure 1.



Gambarajah 1 : Sistem bandul pegas terendam dalam kedudukan terpesong  
Figure 1 : Damped spring pendulum system in deflected position

Anggapkan bahawa daya pegas dan daya terendam yang bertindak ke atas bandul adalah sifar bila bandul berada dalam keadaan mendatar atau  $\theta = 0$ . Anggapkan juga bahawa geseran yang terlibat boleh diabaikan dan sudut ayunan  $\theta$  adalah kecil.

Assume that the spring and damper force acting on the pendulum is zero when the pendulum is vertical or  $\theta = 0$ . Assume also that the friction involved is negligible and the angle of oscillation  $\theta$  is small.

- (a) Dapatkan model matematik bagi sistem itu dalam bentuk
- (i) Persamaan perbezaan
  - (ii) State Space Representation
  - (iii) Fungsi pindah

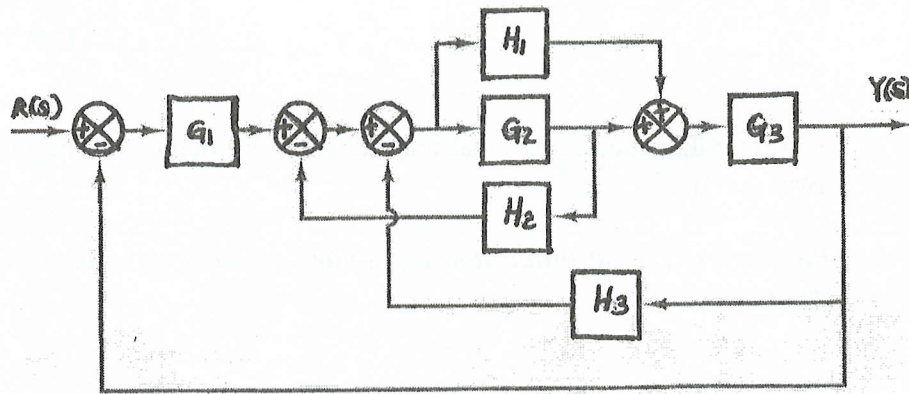
Obtain the mathematical model of the system in form of

- (i) The differential equation
- (ii) State Space Representation
- (iii) Transfer function

(50 markah/marks)

2. Dapatkan fungsi alih litar tertutup untuk blok diagram berikut:

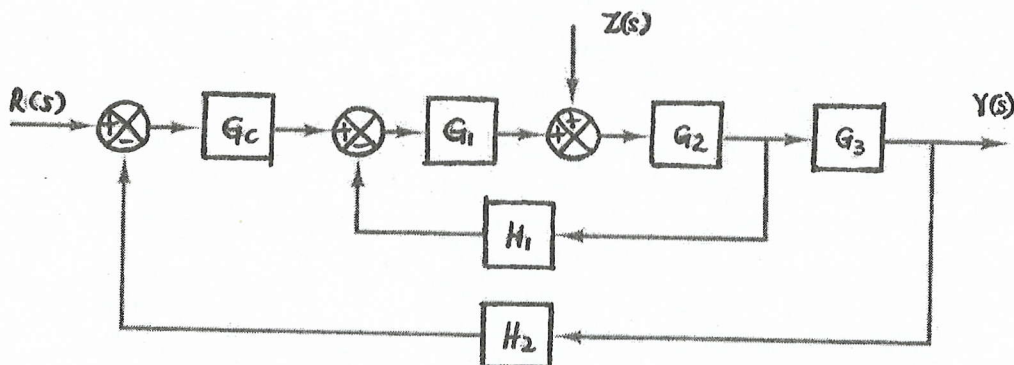
(a)



Gambarajah 2(a) : Block Diagram of Closed Loop 1  
 Figure 2 (a) : Block Diagram of Closed Loop 1

(40 markah/marks)

(b)



Gambarajah 2(b) : Block Diagram of Closed Loop System 2  
 Figure 2 (b) : Block Diagram of Closed Loop 2

(30 markah/marks)

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