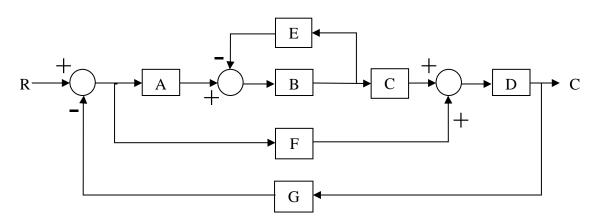
PROGRAM	:	NATIONAL DIPLOMA ENGINEERING: COMPUTER SYSTEMS ENGINEERING: ELECTRICAL
<u>SUBJECT</u>	:	<b>CONTROL SYSTEMS 2</b>
CODE	:	ASY211
<u>DATE</u>	:	JUNE EXAMINATION 23 MAY 2019
<b>DURATION</b>	:	08:30 - 11:30
<u>WEIGHT</u>	:	40 : 60
FULL MARKS	:	100
TOTAL MARKS	:	100
EXAMINER	:	PROF THOKOZANI C SHONGWE
<b>MODERATOR</b>	:	MR DR VAN NIEKERK 2330
NUMBER OF PAGES	:	6 PAGES, INCLUDING 2 SEMILOG GRAPH PAPERS AND 1 FORMULAE SHEET
<b>INSTRUCTIONS</b>		CALCULATORS ARE PERMITTED (ONLY ONE PER STUDENT) USE ONLY THE ANSWER SHEET PROVIDED WITH THIS PAPER

## **INSTRUCTIONS TO CANDIDATES:**

- 1. 100 MARKS = 100%
- 2. ATTEMPT ALL QUESTIONS.
- 3. THEORY TYPE QUESTIONS MUST BE ANSWERED IN POINT FORM BY CAREFULLY CONSIDERING THE MARK ALLOCATION.
- 4. QUESTIONS MAY BE ANSWERED IN ANY ORDER, BUT ALL PARTS OF QUESTION MUST BE KEPT TOGETHER.
- 5. ALL DIAGRAMS AND SKETCHES MUST BE DRAWN NEATLY AND IN PROPORTION.
- 6. ALL DIAGRAMS AND SKETCHES MUST BE LABELLED CLEARLY.
- 7. ALL WORK DONE IN PENCIL EXCEPT DIAGRAMS AND SKETCHES WILL BE CONSIDERED AS ROUGH WORK.
- 8. NOTE: MARKS WILL BE DEDUCTED FOR WORK WHICH IS POORLY PRESENTED.
- 9. NEGATIVE MARKING APPLIES IF YOUR ANSWER DOES NOT COMPLY WITH THE DETAIL REQUIRED AS REQUESTED IN CERTAIN QUESTIONS.

### **QUESTION 1**



Determine the transfer function of the diagram above, using:

- (a) **Kirchoff's Method** (the algebraic method).
- (b) **Block Diagram Reduction Method**.
- (c) Mason's Rule. (12)

(12)

(12)

#### **QUESTION 2**

Find the transient response C(t) of a system with a transfer function:

,

$$G(p) = \frac{C(p)}{R(p)} = \frac{3}{p^2 + 7p + 3}$$

(a) Subjected to a 25 V ramp input.

(b) Subjected to a unit step input.

**[40]** 

(20)

(20)

#### **QUESTION 3**

The transfer function of the forward path of a closed-loop system is given by

$$G(p) = \frac{300p(p^2 + 5p + 4)}{(p + 20)^2(p + 70)}$$

and the transfer function of the feedback path is

$$H(p) = \frac{1}{(p+1)} \, .$$

Use the straight line approximation method to draw a Bode plot (phase Vs frequency and magnitude Vs frequency) of the system consisting of G(p) and H(p) described above.

,

[14]

#### **QUESTION 4**

The table below show the effects of increase the PID parameters of feedback controllers. The table is partially filled. Completely fill in the table with the appropriate word or phrase (*Decrease* or *Increase* or *Small Change*).

PARAMETER	RISE TIME	OVERSHOOT	SETTLING TIME	S-S ERROR
Кр			Small Change	
Ki				Eliminate
Kd				

[10]

TOTAL MARKS : 100

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# Laplace Transforms

TIME FUNCTION f(t)	LAPLACE FUNCTION F(p)
Unit impulse	1
Unit step	$\frac{1}{p}$
Unit ramp	$\frac{1}{p^2}$
Unit parabolic	$\frac{1}{p^3}$
Exponential (e <sup>-at</sup> )	$\frac{1}{p+a}$
Sinusoidal (sin(ωt))	$\frac{\omega}{p^2 + \omega^2}$
Co-sinusoidal $(\cos(\omega t))$	$\frac{p}{p^2 + \omega^2}$
$\frac{1}{(n-1)!}t^{n-1}e^{-at}$	$\frac{1}{\left(p+a\right)^n}$
e <sup>-at</sup> sin( $\omega$ t)	$\frac{\omega}{\left(p+a\right)^2+\omega^2}$
$e^{-at}cos(\omega t)$	$\frac{p+a}{\left(p+a\right)^2+\omega^2}$