PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING: COMPUTER SYSTEMS* *ENGINEERING: ELECTRICAL*
SUBJECT	:	**CONTROL SYSTEMS 2**
CODE	:	**ASY211**
DATE	:	JUNE EXAMINATION 23 MAY 2019
DURATION	:	08:30 - 11:30
WEIGHT	:	40 : 60
FULL MARKS	:	100
TOTAL MARKS	:	100

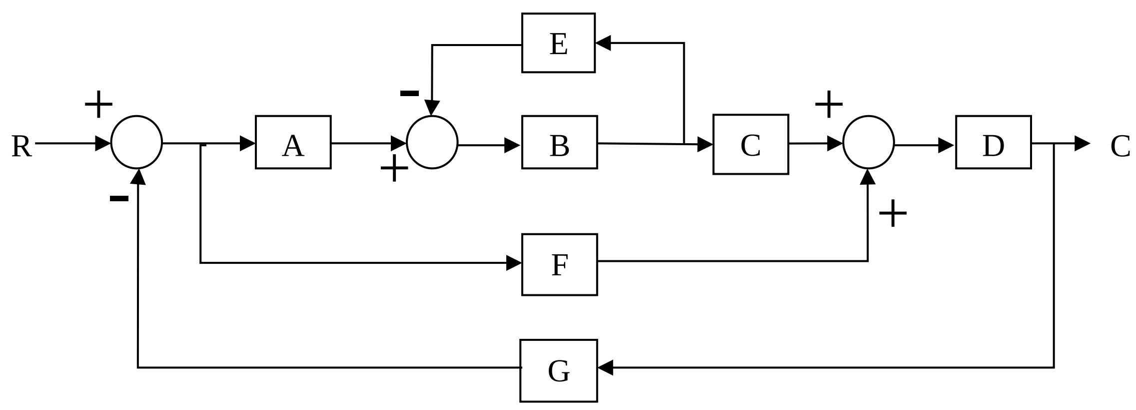
EXAMINER	:	PROF THOKOZANI C SHONGWE	
MODERATOR	:	MR DR VAN NIEKERK	2330
NUMBER OF PAGES	:	6 PAGES, INCLUDING 2 SEMILOG GRAPH PAPERS AND 1 FORMULAE SHEET	

INSTRUCTIONS	:	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). (12)

(b) **Block Diagram Reduction Method**. (12)

(c) **Mason's Rule**. (12)

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QUESTION 2

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

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

(a) Subjected to a 25 V ramp input. (20)

(b) Subjected to a unit step input. (20)

[40]

QUESTION 3

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

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

and the transfer function of the feedback path is

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

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]

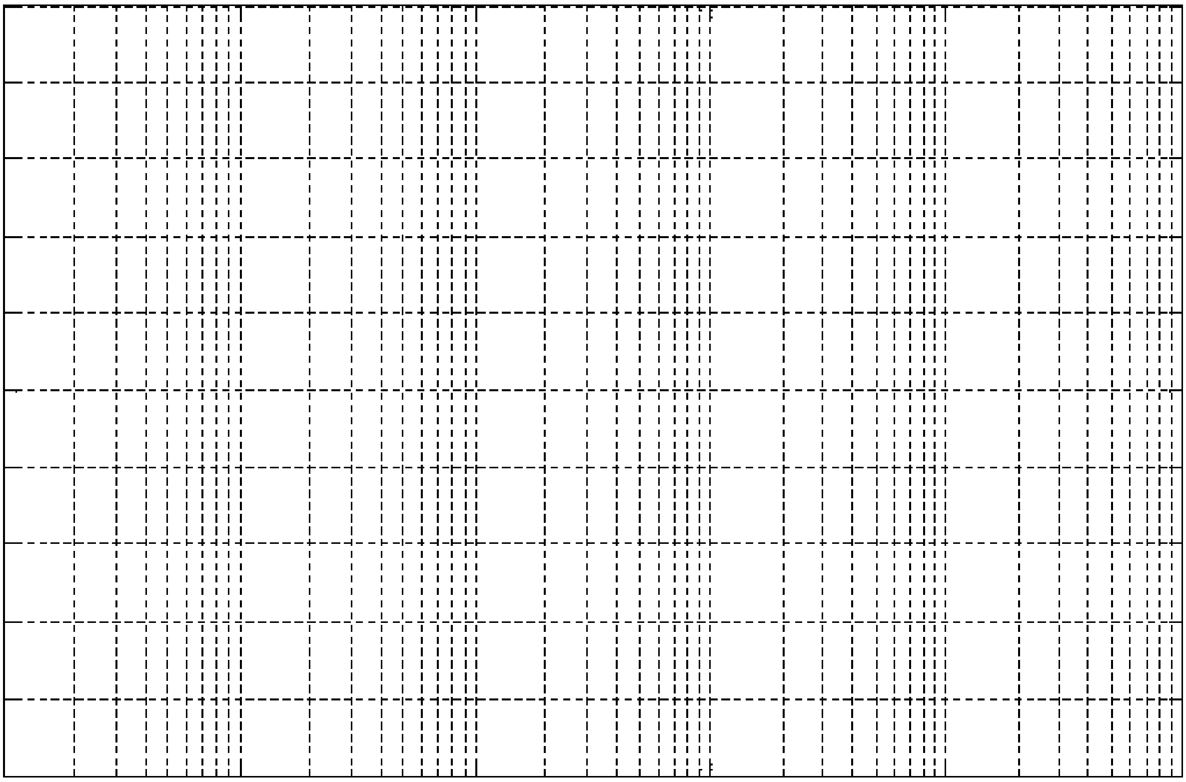
QUESTION 4

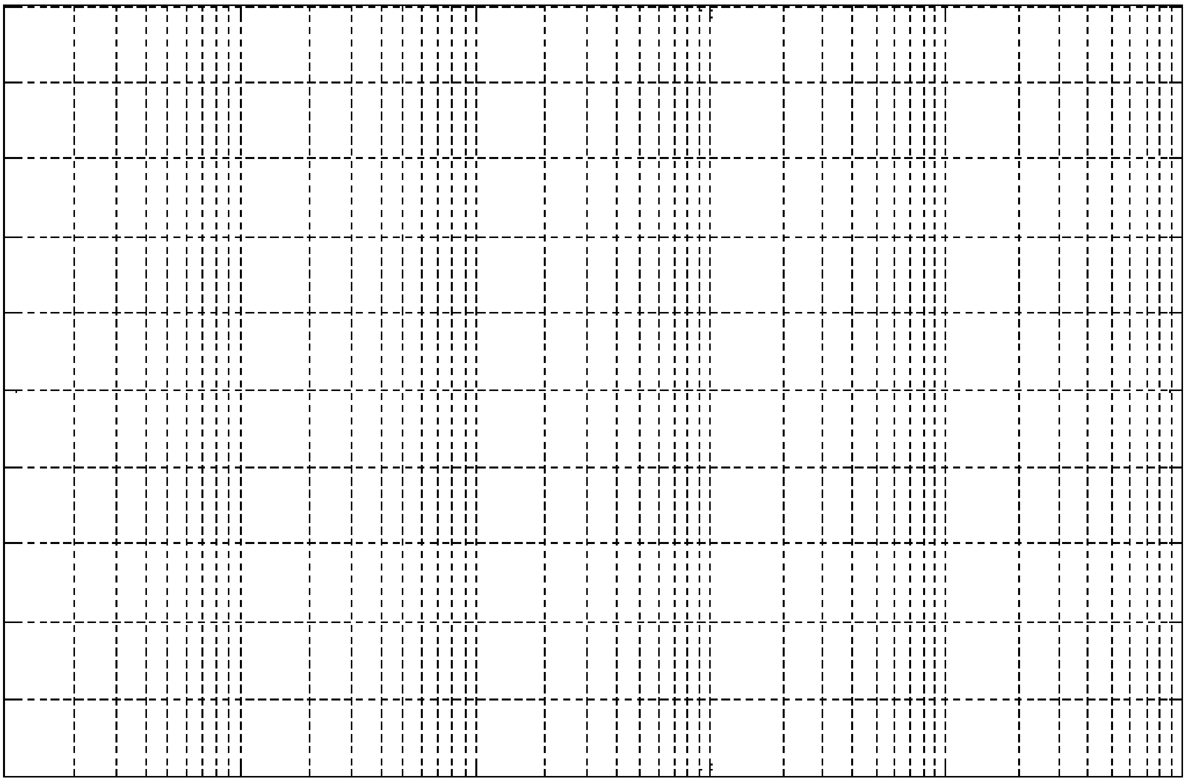
The table below show the effects of increase the PID parameters of feedback controllers. The table is partially filled. Completely fill in the table with the appropriate word or phrase (***Decrease*** or ***Increase*** or ***Small Change***).

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

[10]

TOTAL MARKS : 100





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^{-at})	$\frac{1}{p+a}$
Sinusoidal ($\sin(\omega t)$)	$\frac{\omega}{p^2+\omega^2}$
Co-sinusoidal ($\cos(\omega t)$)	$\frac{p}{p^2+\omega^2}$
$\frac{1}{(n-1)!}t^{n-1}e^{-at}$	$\frac{1}{(p+a)^n}$
$e^{-at}\sin(\omega t)$	$\frac{\omega}{(p+a)^2+\omega^2}$
$e^{-at}\cos(\omega t)$	$\frac{p+a}{(p+a)^2+\omega^2}$