

UNIVERSITY OF ENERGY AND NATURAL RESOURCE, SUNYANI, GHANA  
SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER AND ELECTRICAL ENGINEERING  
LEVEL 300 MID-SEMESTER EXAMINATION 2022

Bachelor of science Electrical and Electronic / Computer Engineering

ELNG 305: Classical Control Systems

Time: 60 mins

Answer all Questions

(+ 3 = 10 Marks)

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April, 2022

UNIVERSITY OF ENERGY AND NATURAL RESOURCES  
LEVEL 300: MID SEMESTER EXAM  
ELNG 309: POWER SYSTEMS

Programme: BSC. EEE

on

Figure 1a

Question 2 (4 + 2 + 4 = 10 Marks)

- a. Given the differential equation, find the transfer function  $\frac{C(s)}{R(s)}$  if all initial conditions are zero;

$$\frac{d^2c(t)}{dt^2} + \frac{2dc(t)}{dt} + 6c(t) = r(t)$$

- b. Find the response,  $c(t)$  to an input,  $r(t) = u(t)$ , a unit step in (a).  
c. For each of the following Laplace transformed signals, find the initial value and final values;

i.  $F(s) = \frac{s+10}{s(s+5)}$

ii.  $F(s) = \frac{6s+3}{s^2+4s+20}$

Question 3 (5 + 2 + 3 = 10 Marks)

- a. Reduce the system shown in Figure 3a to a single transfer function.  
b. Draw the signal-flow graph for the block diagram in figure 3a.  
c. Find the transfer function relating the inductor voltage,  $V_L(s)$ , to the input voltage,  $V(s)$ , in figure 3c

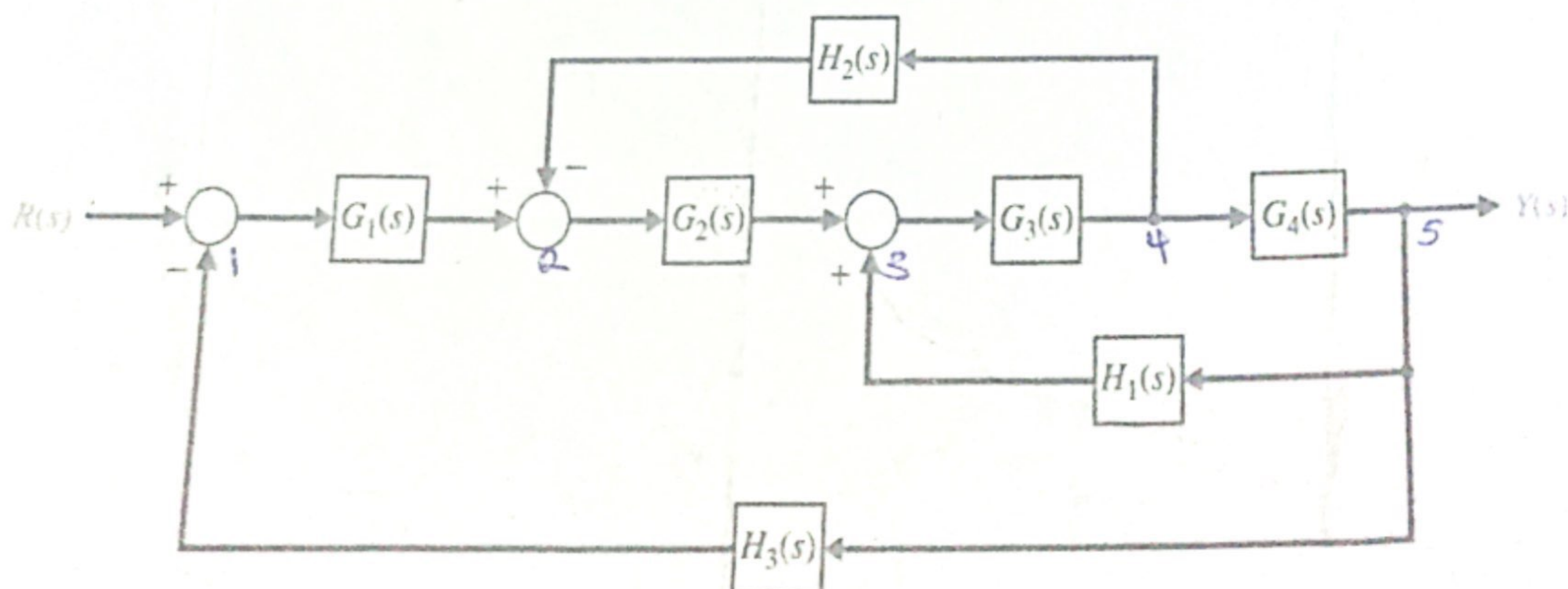


Figure 3a

$$\frac{1}{s(s+2+6)} = \frac{1}{s(s+8)}$$

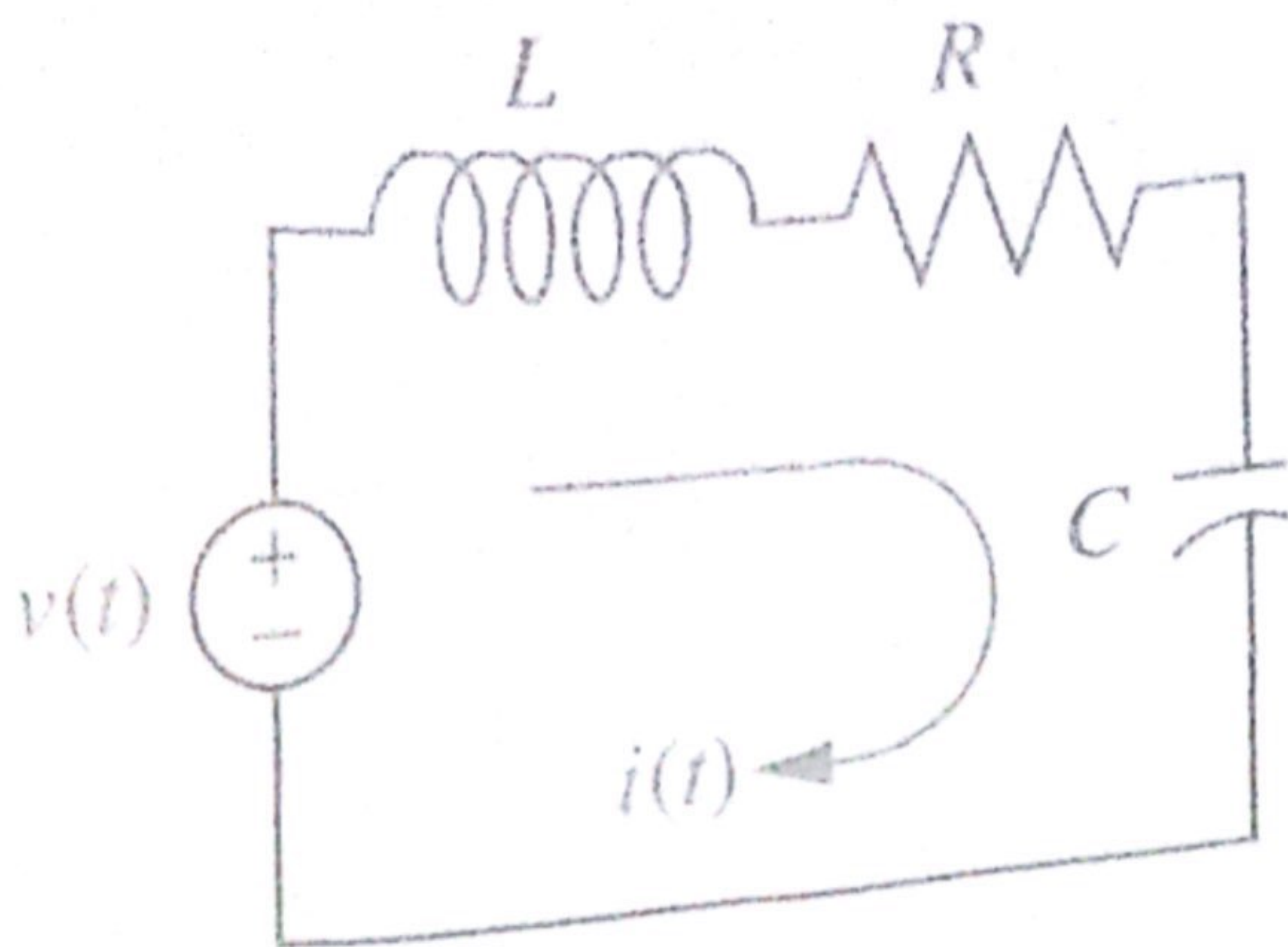


Figure 3C

Table of Laplace

$x(t)$	$X(s)$
Unit impulse $\delta(t)$	1
Delay $x(t-T)$	$e^{-sT} X(s)$
Unit step	$\frac{1}{s}$
$t$	$\frac{1}{s^2}$
$e^{-at}$	$\frac{1}{s+a}$
$1 - e^{-at}$	$\frac{a}{s(s+a)}$
$t - \left( \frac{1 - e^{-at}}{a} \right)$	$\frac{a}{s^2(s+a)}$
$\sin(\omega t)$	$\frac{\omega}{s^2 + \omega^2}$
$\cos(\omega t)$	$\frac{s}{s^2 + \omega^2}$
$e^{-at} \sin(\omega t)$	$\frac{\omega}{(s+a)^2 + \omega^2}$
$e^{-at} \cos(\omega t)$	$\frac{s+a}{(s+a)^2 + \omega^2}$

Final value theorem $\lim_{t \rightarrow \infty} x(t)$	$\lim_{s \rightarrow 0} sX(s)$
Initial value theorem $\lim_{t \rightarrow 0} x(t)$	$\lim_{s \rightarrow \infty} sX(s)$

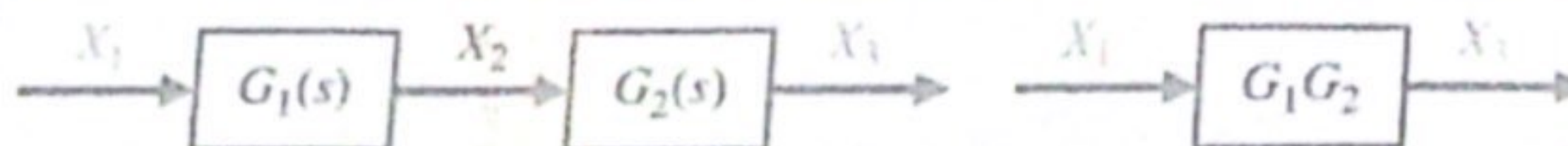
### Block Diagram Transformation

#### Transformation

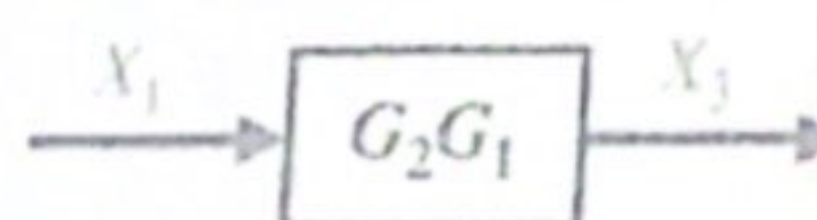
#### Original Diagram

#### Equivalent Diagram

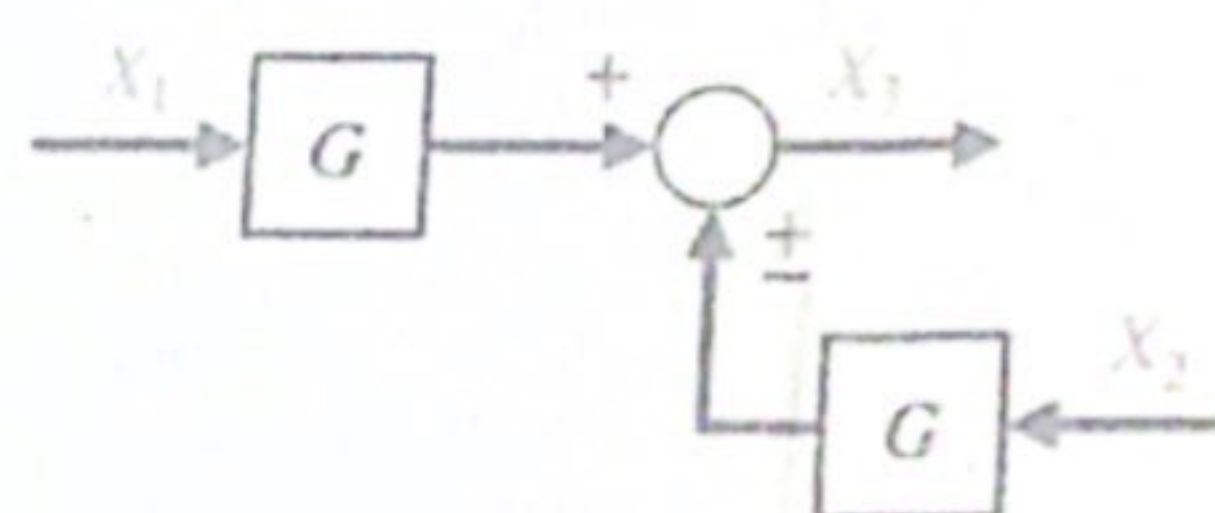
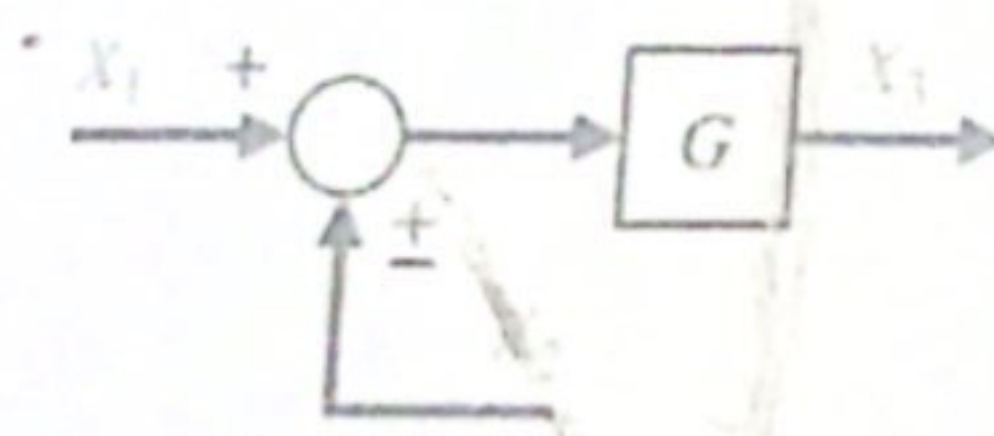
1. Combining blocks in cascade



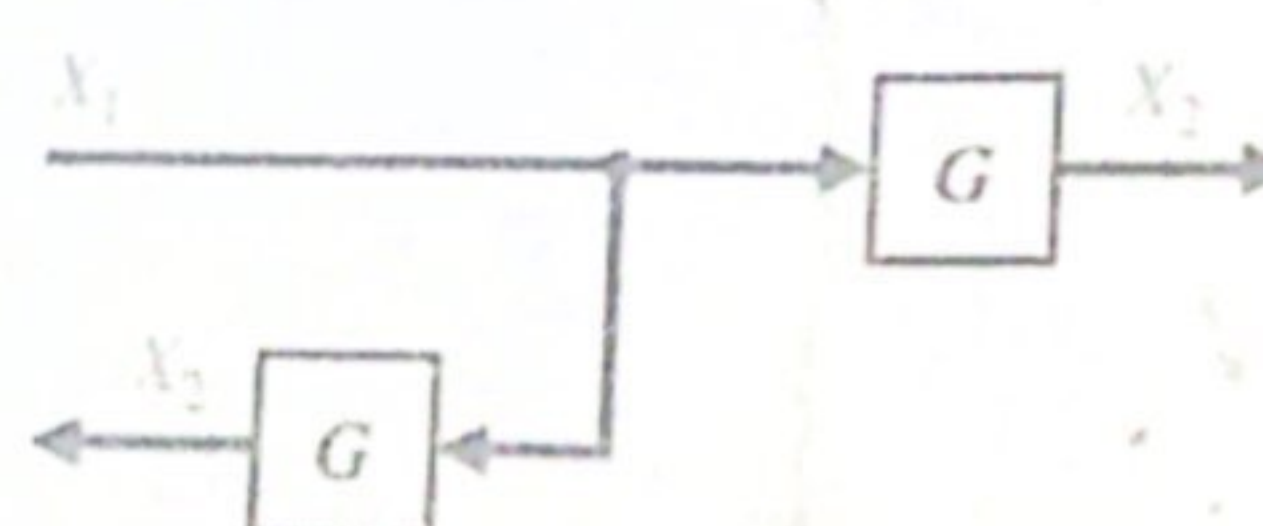
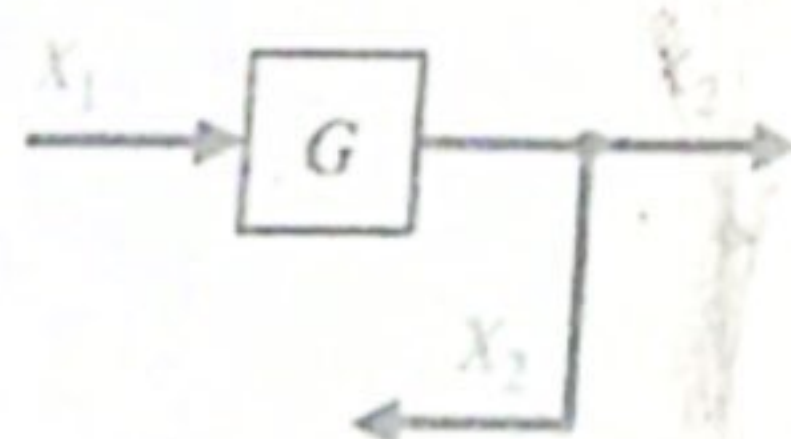
or



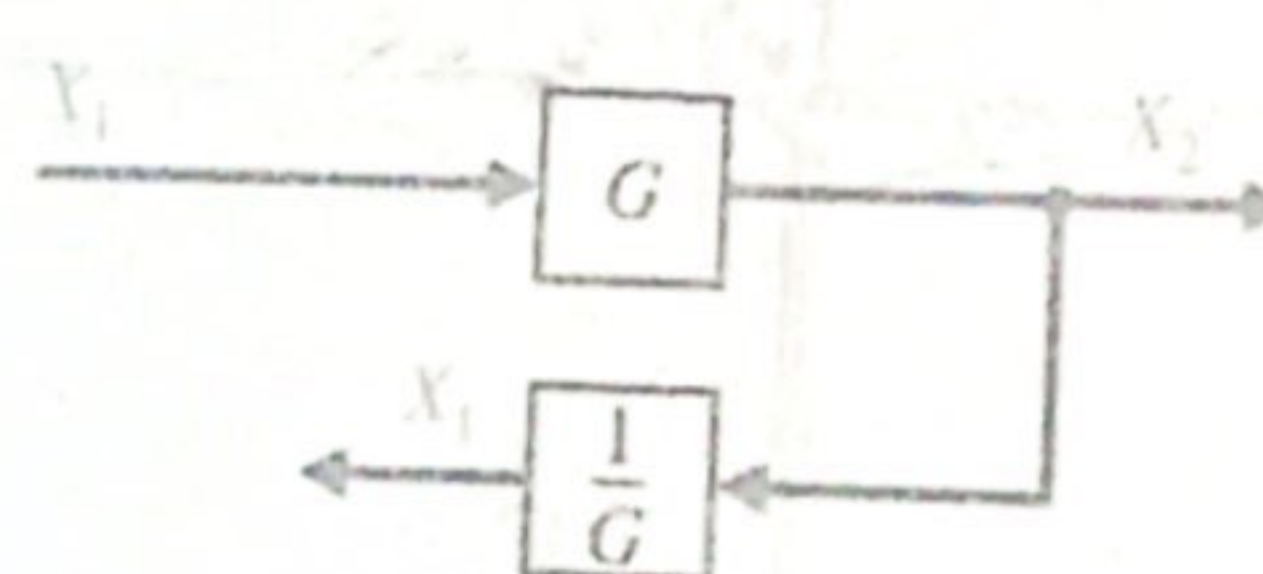
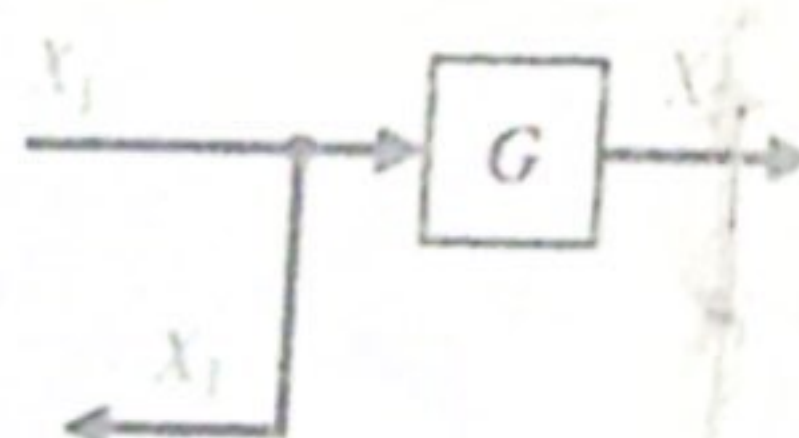
2. Moving a summing point behind a block



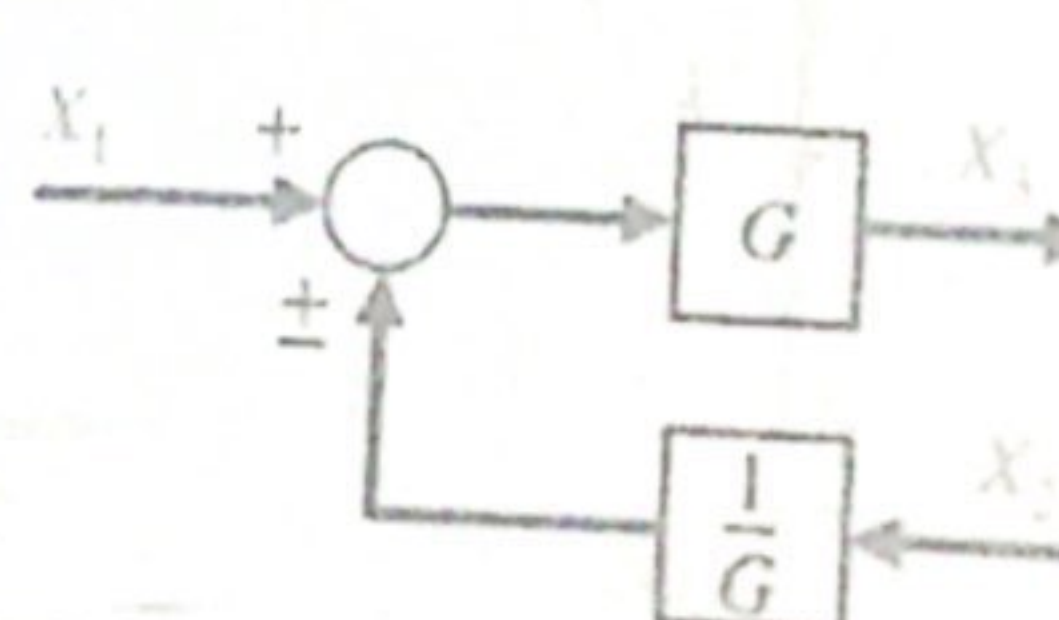
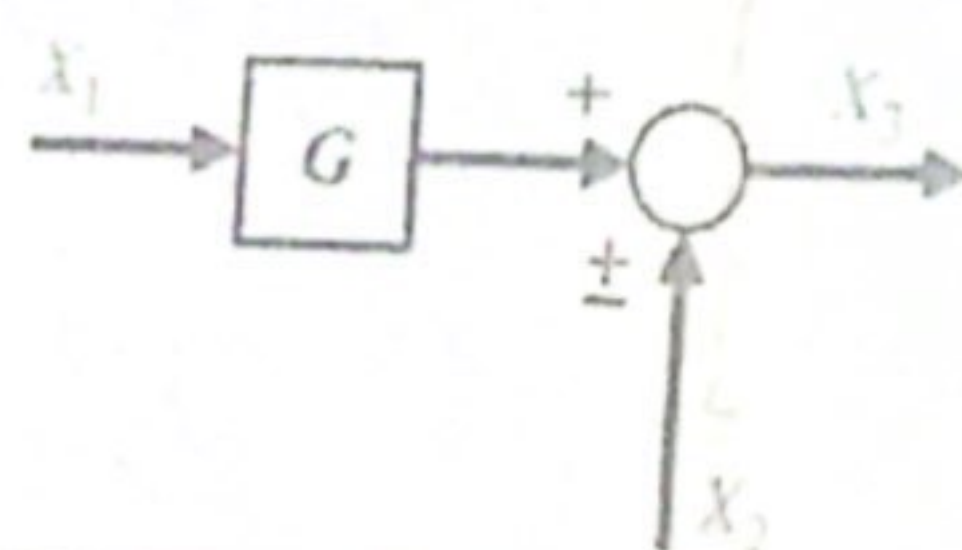
3. Moving a pickoff point ahead of a block



4. Moving a pickoff point behind a block



5. Moving a summing point ahead of a block



Index Number: 2115048134

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UNIVERSITY OF ENERGY AND NATURAL RESOURCES, SINGAPORE

LEVEL 300 MID SEMESTER EXAMINATION 2022

LENG 309: POWER SYSTEM GENERATION AND SUPPLY

April, 2022

Time: 50 mins

(9.5)

Instructions: Answer ALL QUESTIONS on the question paper.

SECTION A - Marks 20

- i. Explain the term "Sustainable Energy" refers to the ability of meeting the present energy needs of the generation (present) without compromising the ability of the future generation to meet their future needs. It refers to the preservation of production.
- ii. List FIVE types of Renewable Energy.  
i. Solar energy  
ii. Biomass or Biogas energy  
iii. Wind energy  
iv. Geothermal energy  
v. Coal energy
- iii. State the types of hydro-power plants and their corresponding turbines used.  
i. High-head power plant - Pelton turbine  
ii. Medium head power plant - Francis  
iii. Low-head - Kaplan turbine
- iv. Explain briefly FOUR (4) factors to be considered when selecting a site for a Hydro Power Plant.  
i. Cost of the station  
ii. Availability of prime movers  
iii. Total capacity of the station  
iv. Maximum demand of the station
- v. Discuss whether Coal as an energy source is classified as Renewable Energy. Please include in your answer economic, environmental, health, safety and political arguments.  
Coal as an energy source is classified as Renewable energy in that, the source of gas coal is relatively from natural resources and does not really diminish easily as compared to other sources. The coal energy sources meets peak load and its maximum capacity is usually realized, hence economical. The coal energy source does not really pollute the environment. It is environmentally friendly. It does not relatively pose health hazards as compared to other sources such as nuclear which poses many health hazard and do not meet

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Programme: BSC. EEE

Maximum or peak load. The coal energy source is somewhat safe since less health hazards are rendered, though some safety precautions are required. The coal which is sometime difficult to find in some countries pushes other big countries to come in to other countries have abundance of coal and this causes political issues and the rich men in the country control everything to their advantage.

### SECTION B -- 10 Marks

1. The Ministry of Energy (Ghana) has awarded a Hydro Power Plant Project to the Electrical and Electronic Engineering Department (UENR) for the installation of a large hydro power station of 324m head and an average flow of  $1370\text{m}^3/\text{s}$ . The reservoir of water behind the dams is composed of a series of lakes covering an area of  $6400\text{ km}^2$ . Calculate
- the available hydraulic power.
  - the number hours this power could sustain if the level of impounded water were to drop by 1m (assume no precipitation or evaporation and neglect water brought in by surrounding rivers and streams).

Note: Select acceleration due to gravity =  $9.8\text{m/s}^2$

$$P = \rho \cdot g \cdot H \cdot Q$$

$$P = 9.8 \times 1370 \times 324$$

$$P = 4350.024\text{ kW}$$

$$\frac{2-78}{2-78}$$

$$2-78$$

3

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Programme: \_\_\_\_\_



UNIVERSITY OF ENERGY AND NATURAL RESOURCES, SUNYANI, GHANA  
SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER AND ELECTRICAL ENGINEERING

LEVEL 300: MID SEMESTER EXAMINATION, 2021/2022

Bachelor of Science (Electrical and Electronics Engineering & Computer Engineering)

ELNG 301: Microprocessors

April, 2022

Time: 45 minutes

Materials required: Non-programmable calculator

Instructions: Answer all questions.

[20 marks]

1. Using the PIC18xxxF microcontroller, and knowledge from your recent Lab exercise:

- Write a program to get data from the SFRs of Port B and send it to the SFRs of PORT C continuously.
- Write a program to get data from the SFRs of Port B. Add the value 5 to it and send it to the SFRs of Port C.
- Write a program to get data from the SFRs of Port B and send it to the SFRs of PORT C continuously using MOVFF. Compare this to Question 1a, and explain the difference.

Suppose that a program runs in 15 seconds on computer A, which has a 100 MHz clock. If a technique is employed to increase the clock rate of the computer, but the technique causes the modified computer to require 1.2 times as many clock cycles as the original machine, what new clock rate would be needed to yield an execution time on the modified machine of 6 seconds?

6  
g  
o  
r

mov f  
wrt  
movff

PORTB x1254  
PORTB SFR  
PORTC



UNIVERSITY OF ENERGY AND NATURAL RESOURCES  
DEPARTMENT OF COMPUTER AND ELECTRICAL ENGINEERING  
LEVEL 300 FIRST SEMESTER MIDSEM EXAMINATION, 2021/2022  
ELNG 307: Analog and Digital Communications

April, 2022

Time: 1 Hrs : 00 Mins

Instructions: Answer all questions in SECTION A and ONE in SECTION B.

**SECTION A – Answer all questions.**

Write the letter corresponding to the correct option in your answer sheet.  
Any correct answer carries 2 marks.

1. The recovery of baseband signal from transmitted signal is \_\_\_\_\_.  
A. Demultiplexing  
B. Passband multiplexing  
C. Demodulation  
D. Translation
2. Which of the following is the odd one out in the choice of modulation techniques use for communication system?  
A. The amount of bandwidth allocated  
B. Channel characteristics  
C. Effective Radiated Power (ERP) of the antenna  
D. Types of noise and/or interference the signal will encounter during transmission
3. To effectively detect the envelope of an DSB-FC wave, one of the conditions below should be satisfied.  
A.  $A_c \ll A_m$   
B.  $f_c = f_m$  and  $\phi_c = 0$   
C.  $f_m \gg f_c$   
D.  $W \ll f_c$
4. The frequency spectrum of an OAM contains the following except \_\_\_\_\_.  
A. A component at  $f_c$   
B. Sidebands at  $f_c + f_m$  and  $f_c - f_m$   
C. Sidebands at  $f_c \pm nf_m$ ;  $n = 1, 2, \dots$   
D. A and C
5. In linear modulation, the intelligent signal is conveyed in \_\_\_\_\_.  
A. The amplitude of the transmitted signal  
B. The sideband components of the transmitted wave  
C. The phase deviation modulated signal  
D. None of the above
6. Narrowband FM and AM share a lot of similarities except that \_\_\_\_\_.  
A. The lower side frequencies are  $180^\circ$  out of phase  
B. The upper side frequencies are  $180^\circ$  out of phase  
C. The sideband frequencies are  $180^\circ$  out of phase  
D. None of the above

Index Number: \_\_\_\_\_ Programme: \_\_\_\_\_

Section B -- This section has TWO questions. Answer any questions in this section.

### QUESTION ONE

[20 MARKS]

With the help of a block diagram, explain in your own words, what an electronic communication system is?

An AM transmitter radiates 9 kW of power when the carrier is unmodulated and 10.125 kW when the carrier is sinusoidally modulated.

- Find the modulation index.
- Now, calculate the total radiated power if another sine wave modulates the carrier to a depth of 40 % that is simultaneously transmitted.

A sinusoidally modulated ordinary AM waveform is shown in Fig. 1

- Determine the modulation index and percent modulation.
- Compute the efficiency.
- Find the amplitude of the carrier which must be added to attain a modulation index of 0.1.

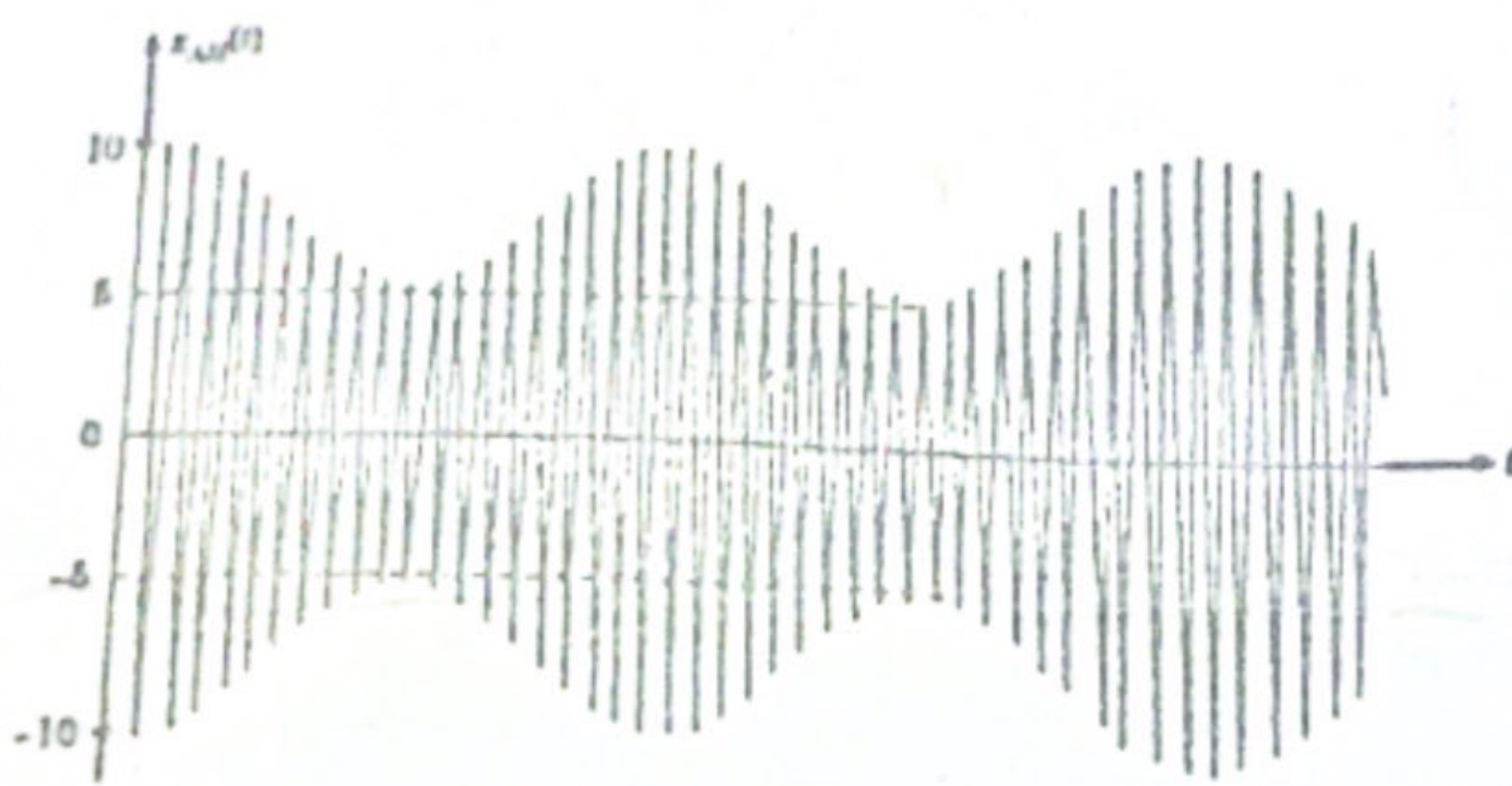


Fig. 1: Question One C

### QUESTION TWO

[20 MARKS]

Why is DSB-FC transmission a waste of power?

The tuned-circuit of the oscillator in an AM transmitter uses a 50  $\mu\text{H}$  coil and a 1 nF capacitor. If the oscillator output is modulated by audio frequencies up to 8 kHz, then determine the following:  
a) The frequency range occupied by the sidebands.

b) The amplitude of the carrier signal is 25 V and the message signal from a microphone is given by  $10\cos(16\pi \times 10^3 t)$ , draw the modulated waveform indicating all peak levels.

c) A computer engineering student wanted to demodulate the DSB-FC waveform from (ii) by using a demodulator circuit. The student used a signal generator to produce a carrier signal for the demodulation. What frequency should the student set the signal generator in order to completely recover the message signal?

d) Determine the LSB and USB frequencies at the demodulator in (iii).  $18 \times 10^3 \text{ Hz}$

A class contains 8 boys and 7 girls. The teacher selects three of the children at random and without replacement. Calculate the probability that the number of boys selected exceeds the number of girls selected.

- a.  $36/65$   
b.  $3/65$   
c.  $54/65$   
d.  $33/65$

$$\frac{{}^8C_2 \times {}^7C_1 + {}^8C_3}{{}^{15}C_3}$$

2. How many functions defined on a set with  $n$ -points are possible if each functional value is either 0 or 1.

- a.  $2^n$   
b.  $n^2$   
c.  $2n$   
d.  $n$

### EXHIBIT 1

Consider an experiment of rolling a balanced die 5 times.  
Use this preamble to answer question 3-5

3. How many possible outcomes are there in the outcomes space?

..... 7776 .....

How many elements are in the event of getting different numbers without repetitions?

..... 30 .....

How many elements are in the event of getting different numbers without repetitions but the second number must be a 4?

..... 24 .....

The important characteristics for describing, exploring, and comparing data sets include all the following EXCEPT

- . Data size
- Centre
- Distribution
- Variation

three common measures of central tendency are?

..... Mode, Median and Mean .....