

VERSITY 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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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

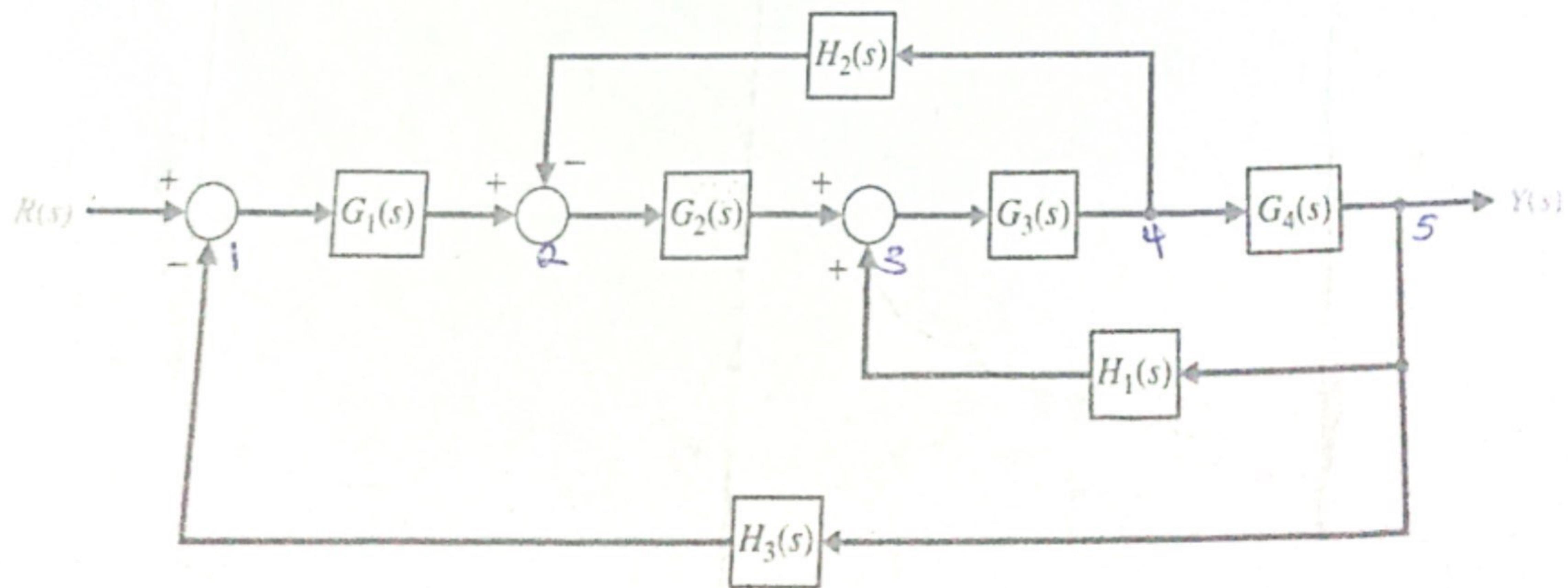


Figure 3a

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

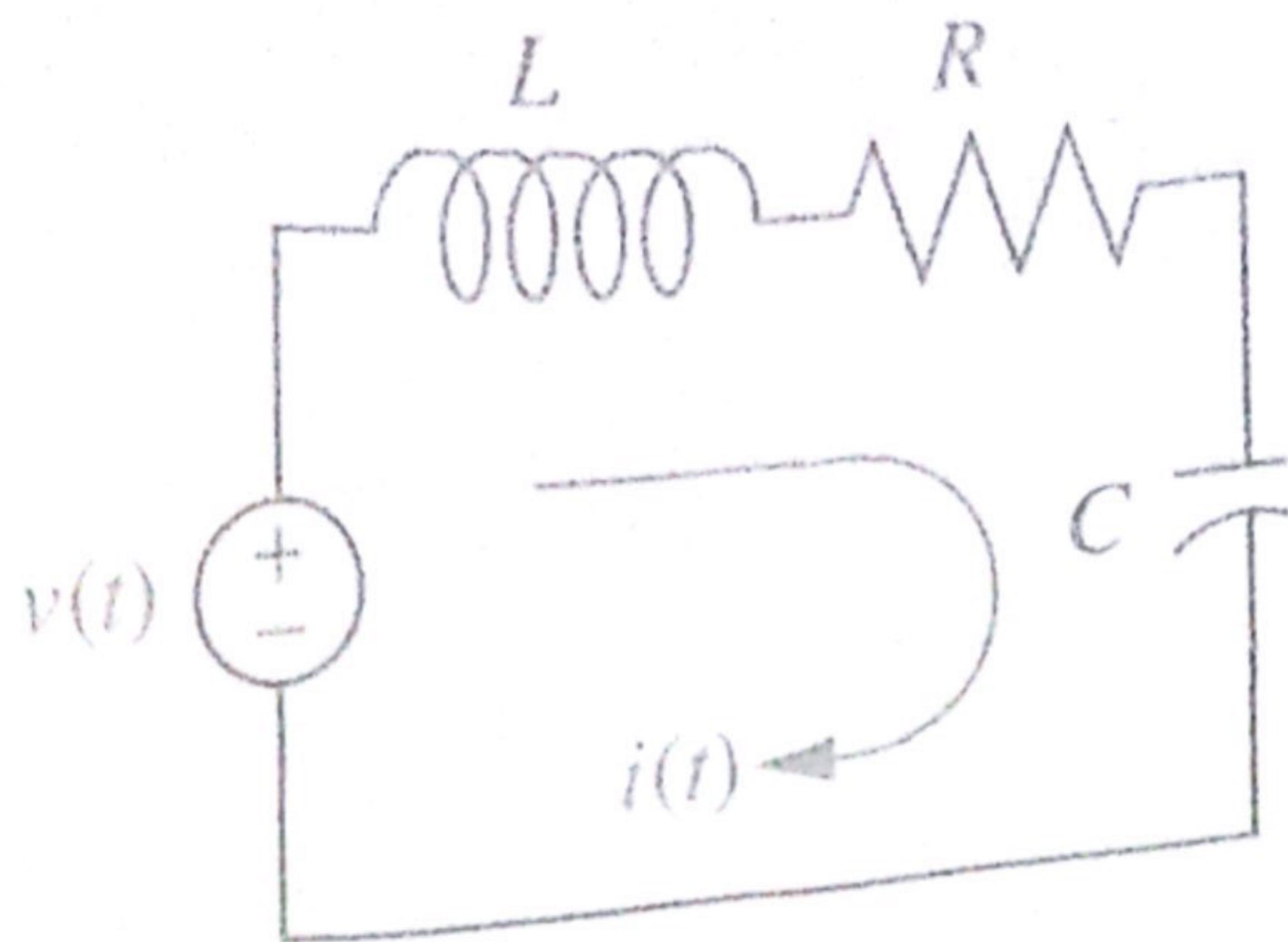


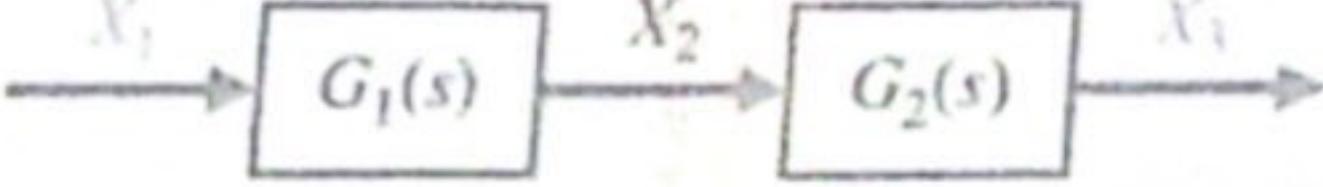
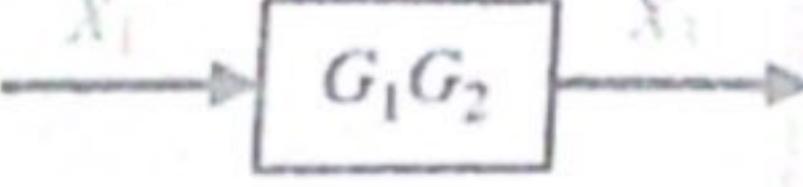
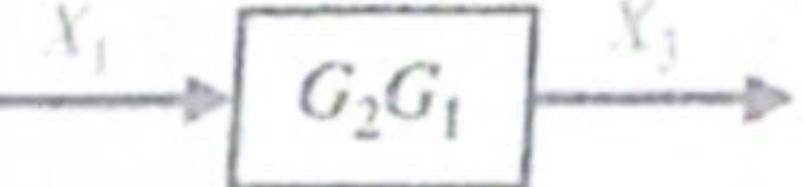
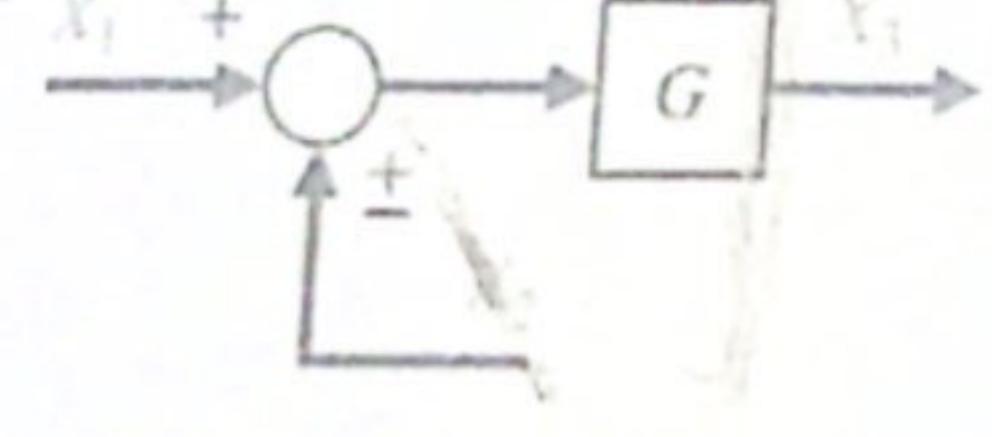
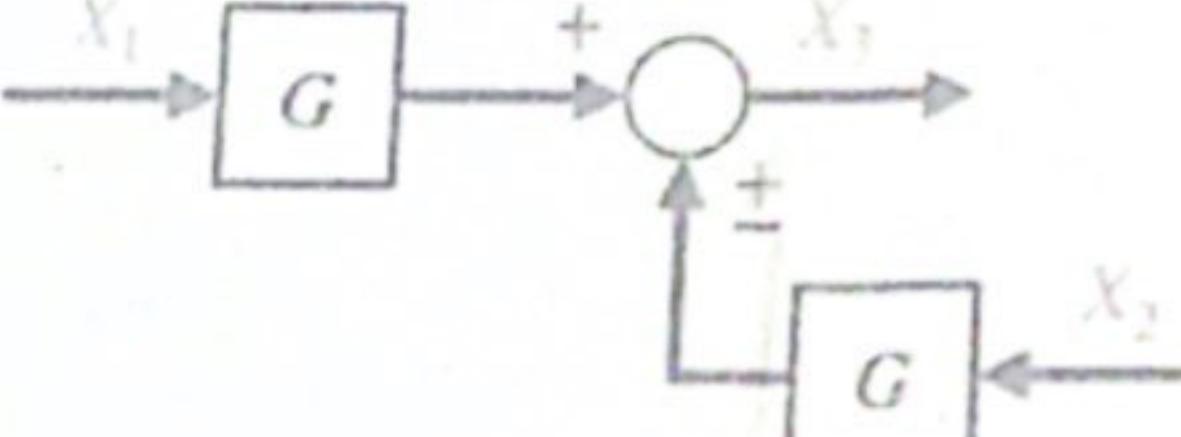
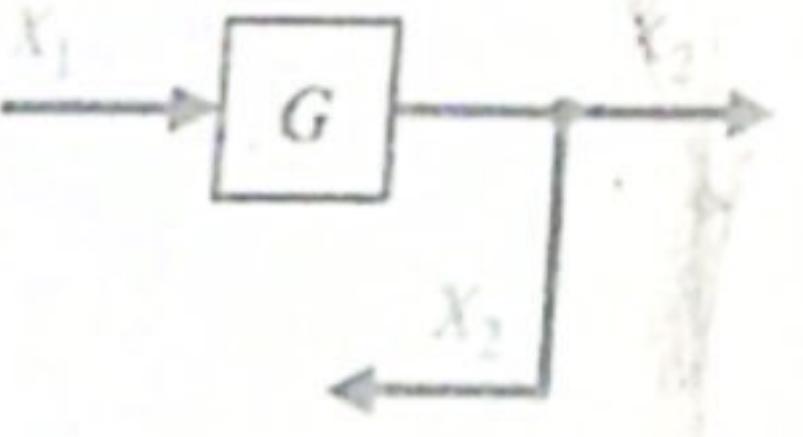
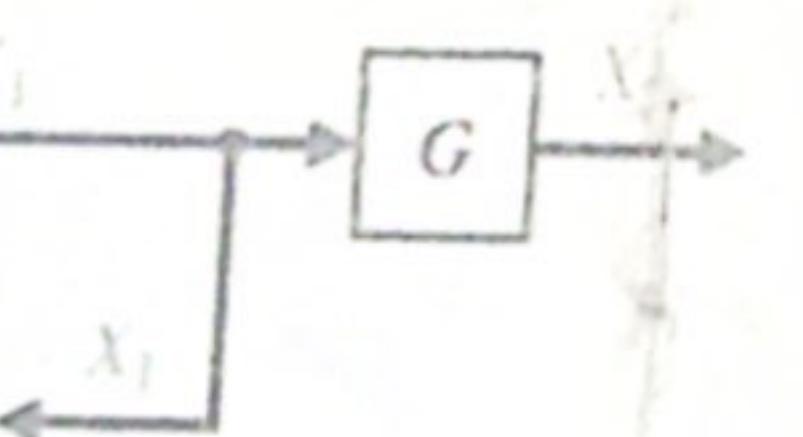
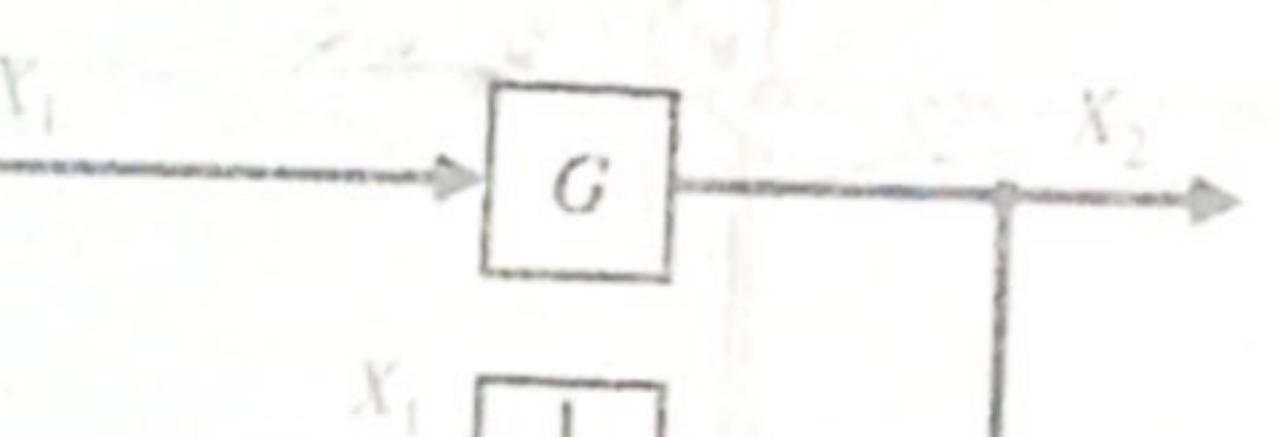
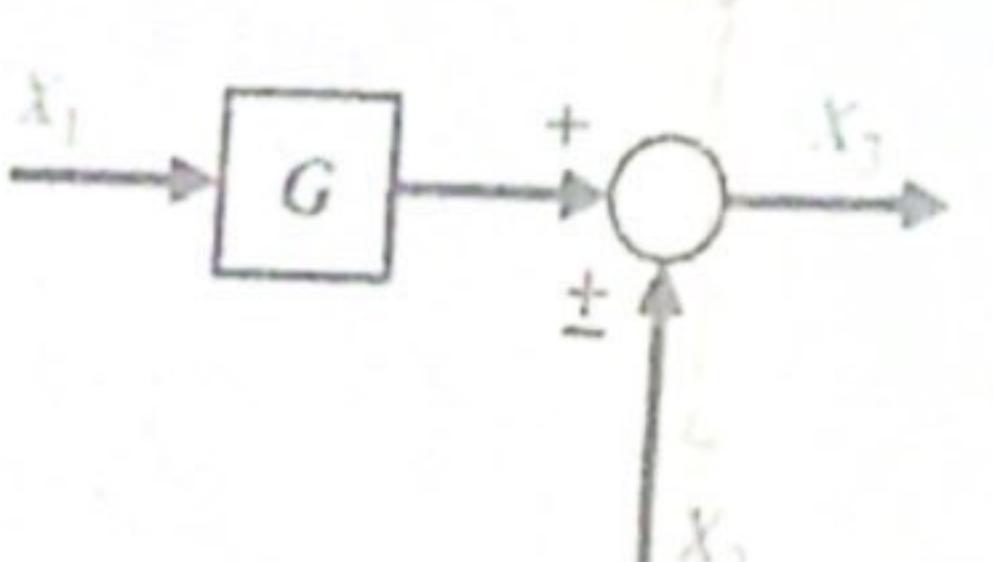
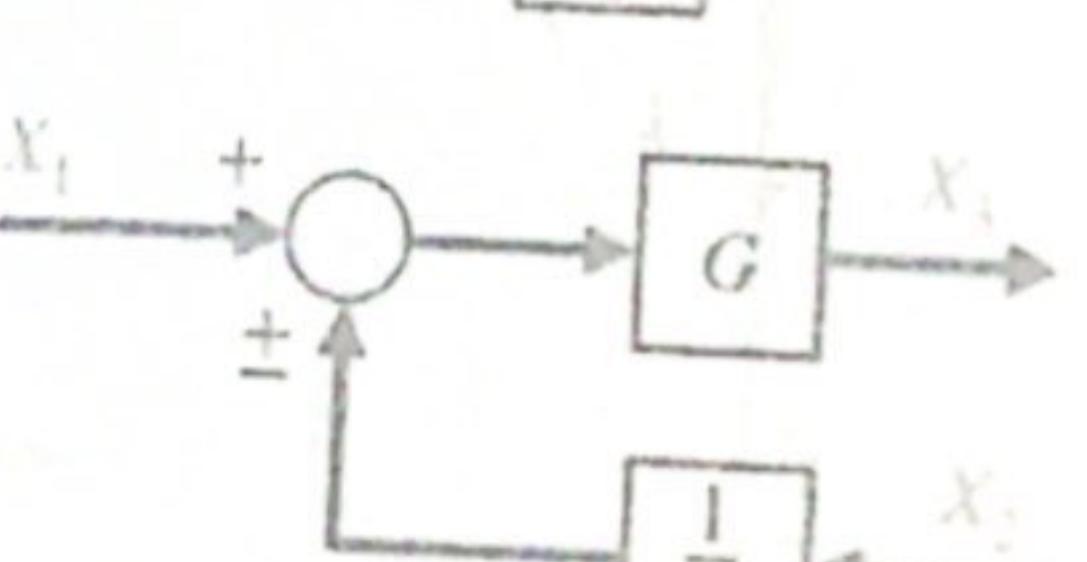
Figure 3C

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		

UNIVERSITY OF ENERGY AND NATURAL RESOURCES, KNUST, KUMASI

LEVEL 300 MID SEMESTER EXAMINATION, 2022

ENGG 309: POWER SYSTEM GENERATION AND TRANSFER
April, 2022

Time: 90 mins (90%)

Instructions: Answer ALL QUESTIONS on the question paper.

SECTION A - Marks 20

- i. Explain the term "Sustainable Energy". Refer to the ability of meeting the present energy needs of the generation process without compromising the ability of the future generation to meet their future needs by referring to the preservation of production.
- ii. List FIVE types of Renewable Energy. ~~1. Solar energy~~
~~2. Wind energy~~
~~3. Biomass or Biogas energy~~
~~4. Coal energy~~
~~5. Geothermal energy~~
- iii. State the types of hydro-power plants and their corresponding turbines used
 - i. High-head power plant - Pelton turbines
 - ii. Medium head power plant - Francis turbines
 - iii. Low-head - Kaplan turbines
- 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. Coal is relatively from natural in that, the source of green coal is relatively from natural resources and does not really diminish easily as compared to other sources. The coal energy source meets peak load and its maximum capacity is usually required, hence economic. The coal energy source does not really pollute the environment. It is environmental friendly. It does not relatively pass health hazards as compared to other sources such as nuclear which passes many health hazard aka do not meet

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. 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 dam is composed of a series of lakes covering an area of 6400 km^2 . Calculate
 - i. the available hydraulic power.
 - ii. 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 = 9.8m/s^2

$$P = 9.8 HDQ$$

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

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

~~2-78~~

2-78

3

Index Number: 4

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?

my f for PB x1Rt4
6
9
0
r
movff
PORTC
PORTB
SPR1 DD SP1
PORTB



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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° out of phase
 B. The upper side frequencies are 180° out of phase
 C. The sideband frequencies are 180° out of phase
 D. None of the above

1 v
 $\frac{2\pi}{T_c}$
 Hz

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.

- i. Find the modulation index.
- ii. 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

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

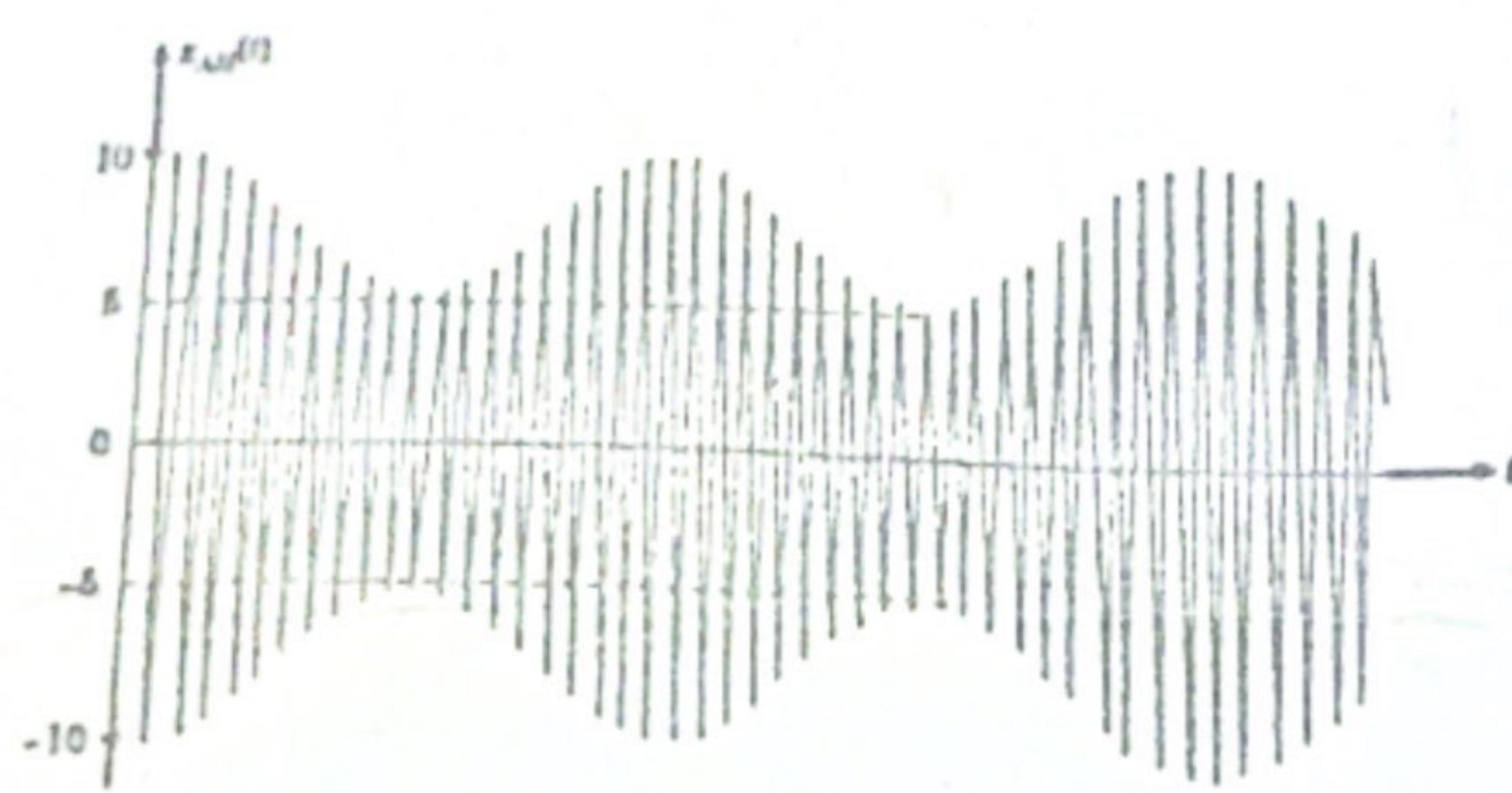


Fig. 1: Question One C

QUESTION TWO [20 MARKS]

Explain why DSB-FC transmission is a waste of power?

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

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.

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 demodulation. What frequency should the student set the signal generator in order to completely recover the message signal?

Given the LSB and USB frequencies at the demodulator in (iii). $\pm 8 \times 10^3 \text{ Hz}$



1. 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. $33/65$

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

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

