THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND COMMUNICATIONS ENGINEERING

SECOND SEMESTER EXAMINATION (2021)

EE223 – CIRCUIT THEORY

ELECTRICAL ENGINEERING – YEAR 2 (DEGREE)

TIME ALLOWED: 3 HOURS

INFORMATION FOR STUDENTS:

- You have **TEN (10)** minutes to read the paper. You must **NOT** begin writing during this time.
- All answers must be written in the **ANSWER BOOK** supplied. **COMPLETE THE DETAILS REQUIRED ON THE FRONT COVER OF YOUR ANSWER BOOK. DO THIS NOW.**
- Drawing instruments and calculators are permitted.
- Answer **ALL FIVE (5)** questions.
- All questions carry equal marks.
- If you are found cheating in the examination, the penalties specified by the University shall apply.
- Switch OFF all mobile phones.

Question One Sinusoidal Steady-State Analysis

Nodal analysis utilizes the Kirchhoff's current law (KCL) and mesh analysis utilizes the Kirchhoff's voltage law (KVL) in the analysis of ac circuits.

(a) Use nodal analysis to find v_o in the circuit of Fig 1.1. *(5)*

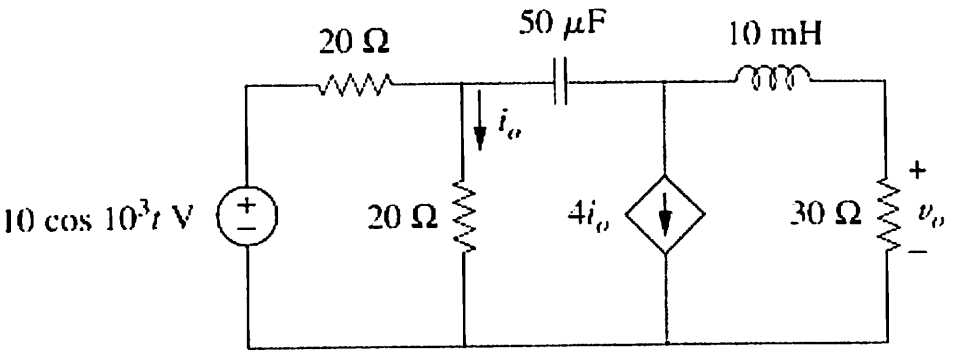

Fig. 1.1

(b) Find $\mathbf{I}_o$ in Fig. 1.2 using mesh analysis. *(5)*

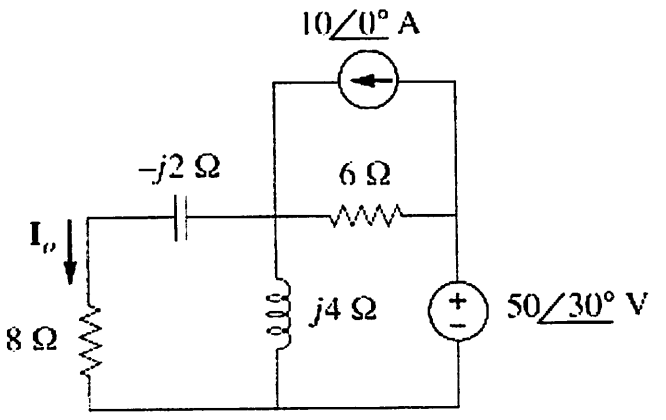

Fig. 1.2

Question Two Instantaneous and Average Power

Power analysis is of paramount importance. The instantaneous power, in watts, is the power at the instant of time and the average power, in watts, is the average of the instantaneous power over one period.

(a) Calculate the instantaneous power and average power absorbed by the passive linear network shown in Fig. 2.1, if the sinusoidal source $v(t) = 330\cos(10t + 20^\circ)$ V and current $i(t) = 33\sin(10t + 60^\circ)$ A.

(5)

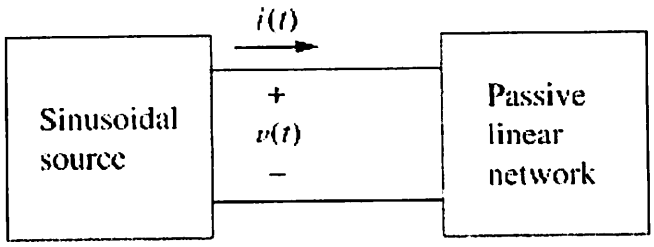

Fig. 2.1

(b) If $v(t) = 160\cos 50t$ V and $i(t) = -33\sin(50t - 30^\circ)$ A, calculate the instataneuos power and the average power absorbed by the sbove passisve network. *(5)*

Question Three **Balanced Wye-Wye Connection**

A balanced Y-Y system is a three-phase system with a balanced y-connectioed source and a balanced y-connected load.

A Y-connected balanced three-phase generator with an impedance of 0.4 + $j0.3\ \Omega$ per phase is connected to a Y-connected balanced load with an impedance of $24 + j19\ \Omega$ per phase as illustrated in Fig. 3.1. The line joining the generator and the load has an impedance of $0.6 + j0.7\ \Omega$ per phase. Assuming a positive sequence for the source voltages and that $V_{an} = 120\angle 30^{\circ}$ V, find: ***(10)***

(a) the line voltages, and
(b) the line currents.

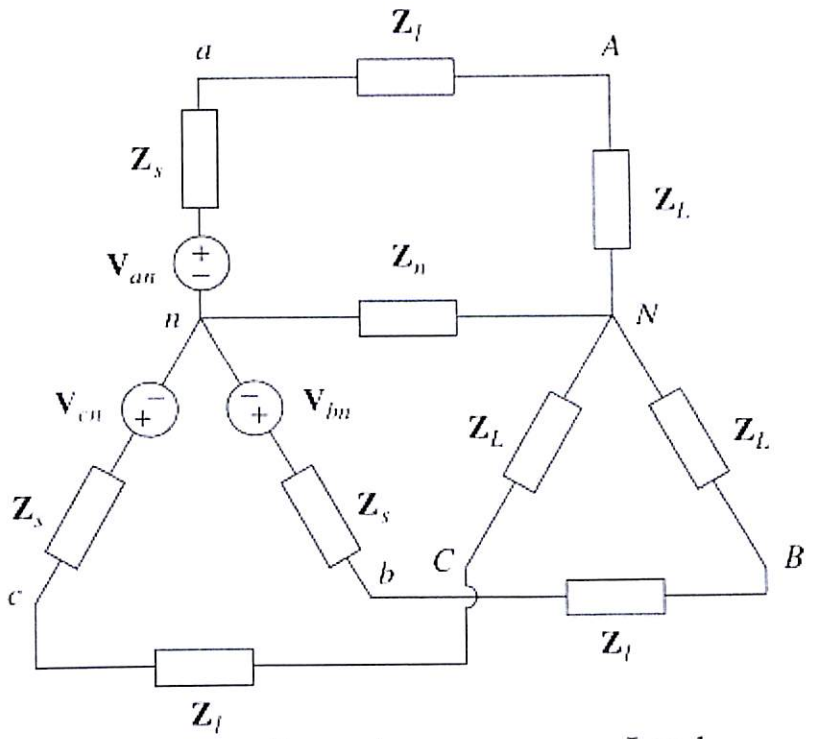

Fig. 3.1

Question Four Impedance Parameters

Impedance parameters are useful in the design and analysis of imepadance – matching networks and power distribution networks which are considered as two-port networks in an electrical network. The **z** terms are known as the *impedance parameters*.

Find the z parameters of the two-port circuit shown in Fig. 4.1. ***(10)***

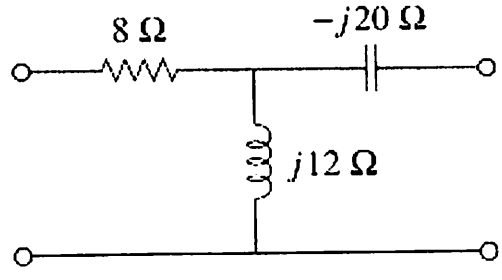

Fig. 4.1

Question Five Admittance Parameters.

Admittance parameters is an alterative means of describing a network if the impedance parameters do nto exist for a two-port networks. The **y** terms are known as the admittance parameters.

Find the y parameters of the two-port circuit shown in Fig. 5.1. ***(10)***

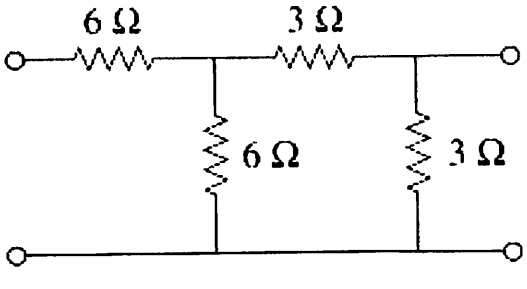

Fig. 5.1