EE101:Electrical Sciences, Tutorial-7

DEPARTMENT OF ELECTRONICS & ELECTRICAL ENGINEERING

INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

[Q-1 is for pre-tutorial. Solve it in the space provied and submit at beginning of tutorial]

Name: Roll No.: Tutorial Group:

---

1. Write advantages / applications of a three phase network or circuit. Find the line voltages for a balanced three phase network if the phase voltages are given as $v_{an} = V_P sin(\omega t + 20^o)$, $v_{bn} = V_P sin(\omega t - 100^o)$ and $v_{cn} = V_P sin(\omega t - 220^o)$. Draw the phasor diagram showing all the line and phase voltages.

Polyphase Circuits

2. A balanced three-wire single phase system (Fig.Q2) has loads $Z_{AN} = Z_{NB} = 10\Omega$ and a load $Z_{AB} = 16 + j12\Omega$. The three lines may be assumed to be resistanceless. If $V_{an} = V_{nb} = 120\angle 0^0$ rms, find the currents I_{aA} and I_{nN}. If the system is made unbalanced by connecting another 10Ω resistance in parallel with Z_{AN}, find the currents $I_{aA,}I_{bB}$ and I_{nN}.

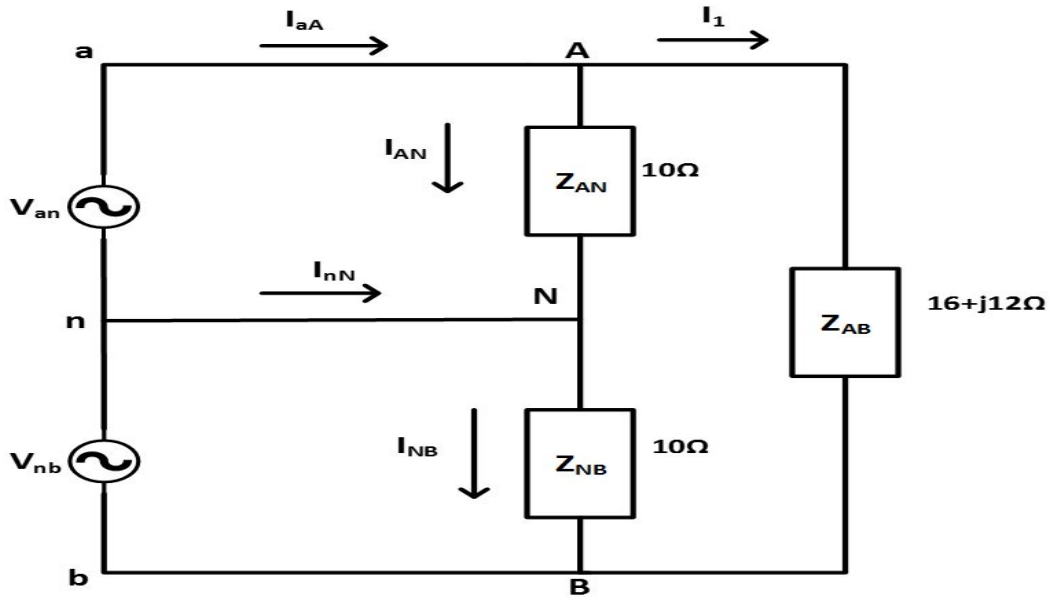

Fig.Q2

3. Three star connected impedances $Z_1 = 20 + j37.7\Omega$ per phase are in parallel with three delta connected impedances $Z_2 = 30 - j159.3\Omega$ per phase. The line voltage is 398 volts rms. Find the line currents, power factor, power and reactive volt ampere taken by the combination.

Basic Electronics (Theme: Build with blocks)

4. A thermistor can be found in many (old) electronic appliances/systems. Some of its applications include (a) in fire alarm system (b) as a temperature detector in ovens, air-conditioners, etc. Design a block level fire alarm system that gets activated for temperatures above 100°C using the following components:

   - A 9V battery
   - a 103 ($10 \times 10^3\Omega$ at 25°C) thermistor. Assume a linear variation in the resistance value with a temperature coefficient of $-120\Omega/°C$
   - other blocks/components required: comparator, an alarm/buzzer with an enable input, and $10k\Omega$ resistors (only)

5. Convert the above system into a 4-bit temperature sensor. Procedure: Divide the temperature range between 25°C and 100°C into 16 levels (including 25°C and 100°C) and assign a 4-bit code to each level starting from 0000 to 1111. Use 16 comparators with appropriate reference voltages to detect the temperature. Use a digital logic to encode the outputs of 16 comparators to 4-bits.