6.5/8

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Problem 1 (8 points):

What are the different parts or subsystems of an Electrical Power System?

- Production (generation)
- transmission
- distribution

Describe the role of a distribution planning engineer.

he estimate the loades and desghnen the system for this and, check for demand and max demand every period time,

Explain why is it important to have an optimum insulation thickness? What happens when the insulation is too thick? if it too thick the sparkes will appeare between wires and may be a fault with ground, so we insure that we have optimum insulation

Define distributed generation, give two examples.

it's we have more then one source to generat voltage and if not in the same place, in the same grid

ex, Solar cell, wind energy (wind turbin)

How does distributed generation affect classical distribution systems?

it increes the system capcity

Describe the benefit of using higher voltage on transmission systems.

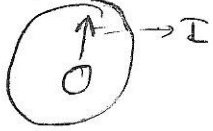
we can reduce losses by reducing I (P = VI), and we can ~~resive voltage~~ send voltage to long distance

What is the difference between "max demand", and "diversified demand"?

max demand is the ~~point~~ max point of the totat demand but diversified is the sum of demands (comertial, residential) to the demand we choos

What is charging current in a conductor? Where does it flow?

is the current due to capacitance of cable and it flow from the conductor to the outsurface (sheeth) of cable due to insulator



Problem 2 (4 points):

If a 4 room house's appliance consumption is as following: Refrigerator 24 Hours/7 days a week, Lighting 6 hours a day, washing machine 5 hours a week, AC 4 hours a day, TV 4 hours a day. What is the monthly electric bill if the utility company charges a rate of .07JD/kWh.

Washing Machine	920W
Refrigerator	650
Lighting	100 W per room
AC	1800
TV	500W

$E_{Ref} = 650 \times 24 \times 30$
$= 468$ kw.h

$E_{wash} = 920 \times 5 \times 4 = 18.4$ kw.h

$E_{light} = 100 \times 4 \times 6 \times 30 =$
$= 72$ kw.h

$E_{AC} = 1800 \times 4 \times 30 =$
$= 216$ kw.h

$E_{TV} = 500 \times 4 \times 30 =$
$= 60$ kw.h

$E_{Total} = 834.4$ kw.h

Cost $= 834.4 \times 0.07$
$= 58.408$ JD

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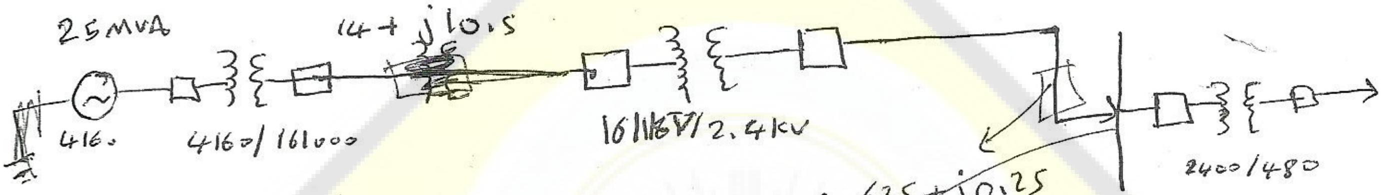
Problem 3 (6 points):

a. Draw a one line diagram for the following system:

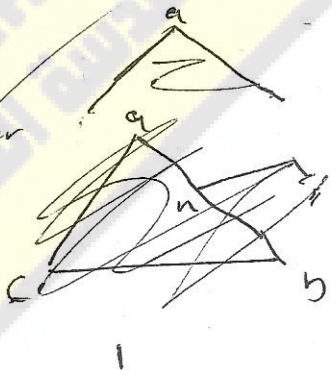
A power plant generates 25 MVA at 4160V. Transmission is at 161 kV using (0.2+j0.15)Ohm/km overhead line for 70 kilometers. The substation reduces the voltage to 2.4kV. A 5km (0.125+j0.05)Ohm/km underground distribution cable feeds the distribution transformer, which reduces the voltage to 480V. Include all transformers, CB, etc. in your drawing.

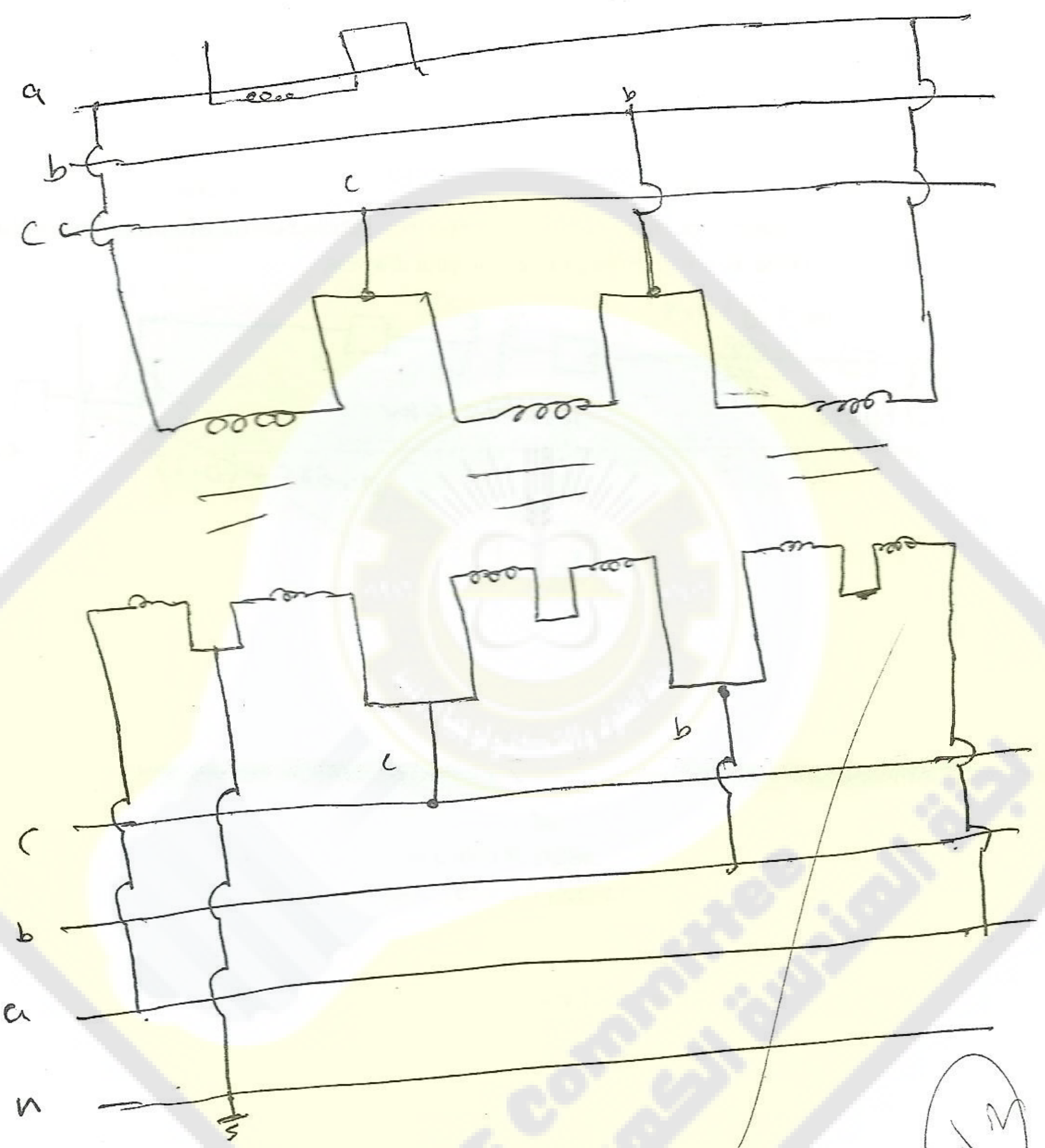


b. For the above system, if the load consists of both a three phase and a single phase load, what would be the appropriate way to supply the load? Draw the schematic of the transformer connection.

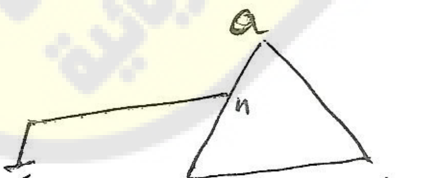
we can use grand Delta

if we assume power of 1Ø much smaller than power of 3Ø





$V_{an} = V_{cn} = 240\ v$



$V_{bn} = 415.7\ v$

$V_{ab} = V_{bc} = 480\ v$

Problem 4 (7 points):

a. How do we experimentally determine a transformer polarity? Draw the test schematic and describe the test procedure. → (high voltage)

- we look to primary / winding and at right ⇒ H_1
- we look to secondary (low voltage) and at left ⇒ X_1

then we put small voltage in the primary and measure as shown if (G) present voltage

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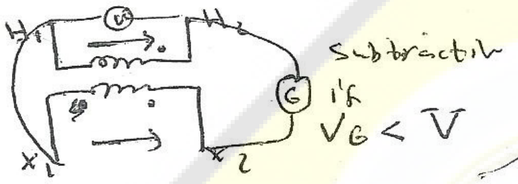
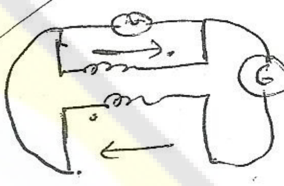
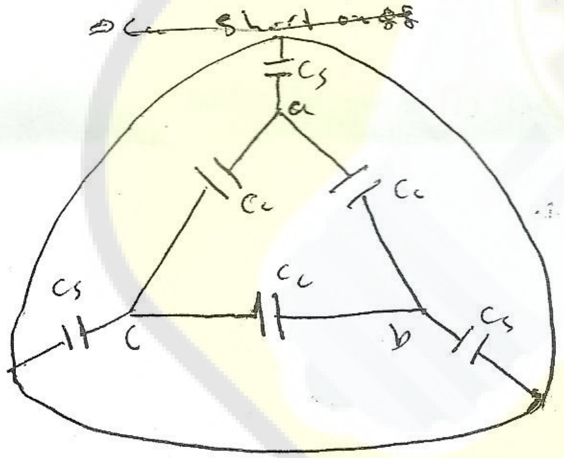




b. Draw the equivalent capacitance schematic of belted underground three conductor cable. Explain how to measure ca, cb, and cd. Draw the equivalent circuit of one of the circuits. And describe the procedure for calculating Cc, Cs and Cn.

⇒ Ca ~~short all~~



⇒ Ca ⇒ short on of the ~~cable~~ conductor to ground (sheath) and measure between two conductor

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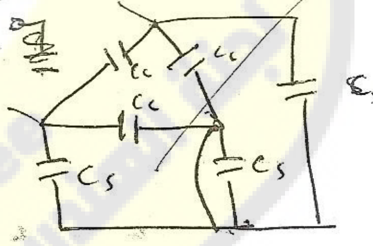
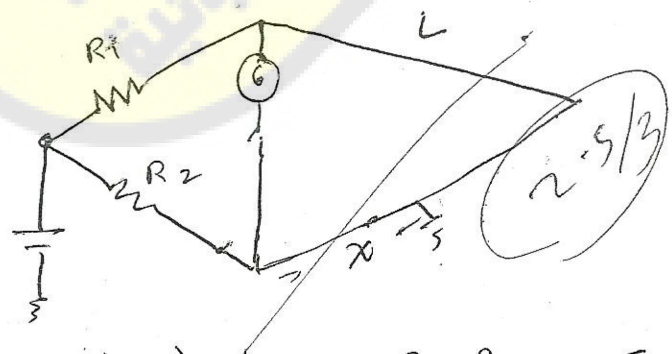


⇒

c. Draw the schematic for a Murray Loop test. If cable length is 10km, with a resistance of 0.5 Ohm/km and a fault occurs at 3 km, what are the resistance values of the variable resistances in the network to get a balanced reading on the Galvanometer?

$$\frac{R_1}{R_2} = \frac{2L - x}{x}$$



$$\frac{R_1}{R_2} = \frac{2[?]}{3} = \frac{20-3}{3}$$

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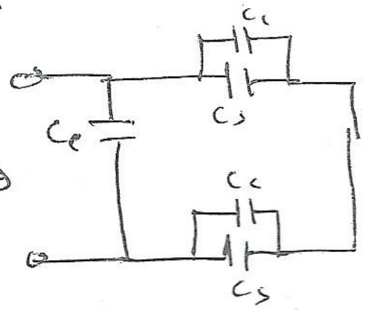
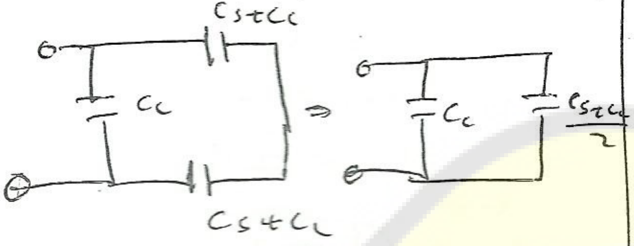
$$\frac{R_1}{R_2} = 5.667$$, the ratio between $R_1, R_2 = 5.667$

⇒

C_a ⇒



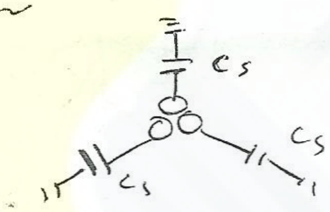
C_a,s



$$C_a = C_c + \frac{1}{2}(C_s + C_c)$$

$$C_n = 2C_a$$

⇒ C_b short all conductors with each other and measure between conductor and ground

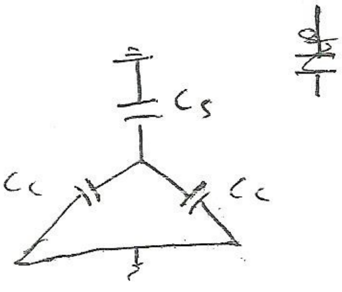


C_b ⇒ 3 capacitor in parallel

$$C_b = 3C_s$$

$$C_n = 2C_b$$

⇒ C_c short two conductor to ground



and measure between the third conductor and ground

$$C_d = C_s + 2C_c$$

$$C_n = 2C_b = 2C_a$$

$$C_s = \frac{C_b}{3}$$

$$C_c = \left(C_d - \frac{1}{3}C_b\right) \times \frac{1}{2}$$