

78
100

Name:

Midterm Exam

Tuesday May 5, 2009

60 minutes, Closed Books

A. Comprehensive Part (40 points)

1. Draw an electrical diagram showing the connection between an MV/LV transformer and a distribution panel, considering TT earthing system.



2. Give three emergency loads Examples:

o Exit Alarms

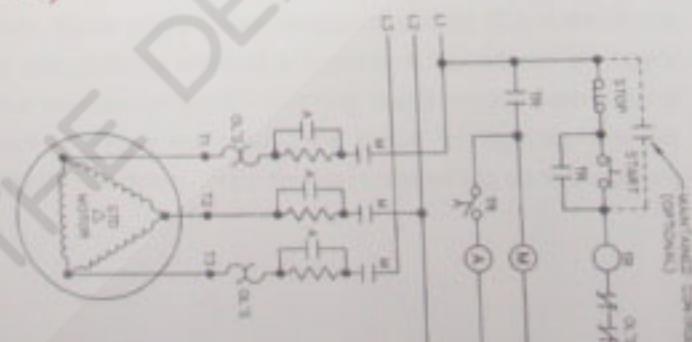
5 o Power Generation set ~~not a load~~

o UPS (charger)

3. What is TR in the following Motor Starter?

It is Re timer

+ co-factor



4. The following expression is used to calculate what?

$$\Delta U = 2 \cdot L \cdot I \cdot (R \cos \alpha + L \cdot W \sin \alpha)$$

It is used to calculate the drop of voltage in a single phase

5. In the previous expression what are the following parameters and what units are used for each one:

L: length

I: current

R: Resistance

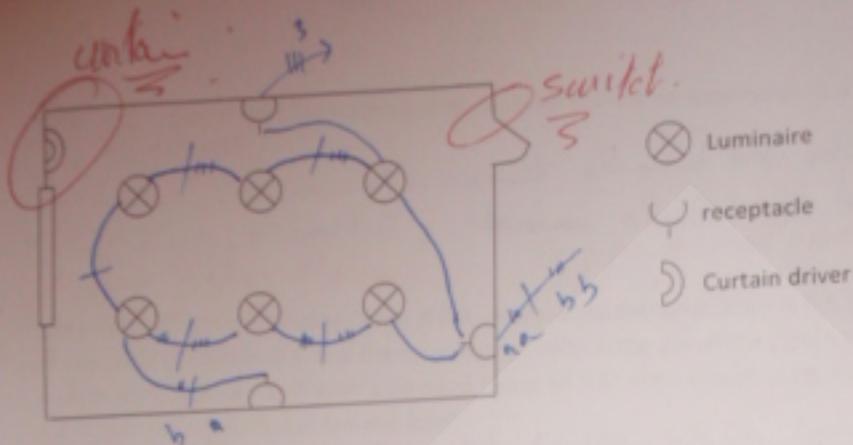
L: inductance

W: radial frequency

α : angle between $U \& I$

B. Exercises (60 points):

- a) A room is lightened by means of 6 luminaires of 60 W each with a PF = 0.9. The light switch is closed to the door. Three single phase receptacles plugs (1.5 A each) are installed in the room and one electrical point of 1 A/phase is considered to supply the three phase driver for a window curtain. Considering that 3 circuits from a same distribution panel are used to supply the room (one circuit for lighting, one for receptacles and one for the curtain driver). Draw the electrical wiring on the drawing below:



- b) Three rooms similar to the one previously described are used in a building. These rooms are supplied from a three phase 220V electrical panel with a capacity of sixteen single or three phase circuits.

Fill the following schedule for the panel:

Load Description	Circuit No	Phase kVA			Load Description
		1	2	3	
lighting	1	0,94			lighting
lighting	3	0,4			receptacles
receptacles	5	990	990	990	receptacles
receptacles	7	990	990	990	receptacles
receptacles	9	990			receptacles
receptacles	11	990			receptacles
Curtain Driver	13	660	660	14	Curtain Driver
Curtain Driver	15	660	660	16	Gearbox

6) c) How the circuit breaker of a circuit that supplies the set of luminaires in a room, should be selected?

The circuit breaker of a circuit should be selected if it is Thermal, hybrid or magnetic, it does not have to be ~~Classical~~ tripping not more than 15A / depends on section of wiring.

d) Consider that lighting demand factor is 0.9, receptacles demand factor is 0.4, curtain drivers demand factor is 1, and the remaining circuits in the panel are used to supply a connected load of 4 kVA with a demand factor of 0.6 and a simultaneity factor of 0.8. What is the panel total demand load?

$$\text{for light: } P = 6 \times 60 = 360 \text{ W} ; \text{ Connected: } S = \frac{360}{0.9} = 400 \text{ VA Demand: } 400 \times 0.9 = 360 \text{ VA}$$

$$\text{for receptacles: Connected: } S = 3 \times 1.5 \times 120 = 990 \text{ VA Demand: } 990 \times 0.4 = 396 \text{ VA}$$

$$\text{for drivers: Connected: } S = 1 \times 120 = 120 \text{ VA Demand: } 120 \text{ VA}$$
~~$$\text{for remaining: Demand: } S = 4 \times 0.6 = 2.4 \text{ kVA, } S = 2.4 \times 0.8 = 1.92 \text{ kVA, } S = 1.92 \times 0.8 = 1.536 \text{ kVA, } S = 1.536 \times 0.8 = 1.2288 \text{ kVA, } S = 1.2288 \times 0.8 = 0.98224 \text{ kVA, } S = 0.98224 \times 0.8 = 0.785792 \text{ kVA, } S = 0.785792 \times 0.8 = 0.6286336 \text{ kVA, } S = 0.6286336 \times 0.8 = 0.50290688 \text{ kVA, } S = 0.50290688 \times 0.8 = 0.402325504 \text{ kVA, } S = 0.402325504 \times 0.8 = 0.3218604032 \text{ kVA, } S = 0.3218604032 \times 0.8 = 0.25748832256 \text{ kVA, } S = 0.25748832256 \times 0.8 = 0.2059906576 \text{ kVA, } S = 0.2059906576 \times 0.8 = 0.16479252608 \text{ kVA, } S = 0.16479252608 \times 0.8 = 0.131834020864 \text{ kVA, } S = 0.131834020864 \times 0.8 = 0.1054672166912 \text{ kVA, } S = 0.1054672166912 \times 0.8 = 0.08437377335296 \text{ kVA, } S = 0.08437377335296 \times 0.8 = 0.067498986682368 \text{ kVA, } S = 0.067498986682368 \times 0.8 = 0.054000000000000004 \text{ kVA, } S = 0.054000000000000004 \times 0.8 = 0.043200000000000004 \text{ kVA, } S = 0.043200000000000004 \times 0.8 = 0.034560000000000004 \text{ kVA, } S = 0.034560000000000004 \times 0.8 = 0.027648000000000004 \text{ kVA, } S = 0.027648000000000004 \times 0.8 = 0.022118400000000004 \text{ kVA, } S = 0.022118400000000004 \times 0.8 = 0.017694720000000004 \text{ kVA, } S = 0.017694720000000004 \times 0.8 = 0.014155776000000004 \text{ kVA, } S = 0.014155776000000004 \times 0.8 = 0.011324620800000004 \text{ kVA, } S = 0.011324620800000004 \times 0.8 = 0.0090596966400000004 \text{ kVA, } S = 0.0090596966400000004 \times 0.8 = 0.0072477573120000004 \text{ kVA, } S = 0.0072477573120000004 \times 0.8 = 0.0058022058496000004 \text{ kVA, } S = 0.0058022058496000004 \times 0.8 = 0.0046417646796800004 \text{ kVA, } S = 0.0046417646796800004 \times 0.8 = 0.0037134117437440004 \text{ kVA, } S = 0.0037134117437440004 \times 0.8 = 0.0029707293949952004 \text{ kVA, } S = 0.0029707293949952004 \times 0.8 = 0.0023765835159961604 \text{ kVA, } S = 0.0023765835159961604 \times 0.8 = 0.0019012668127969284 \text{ kVA, } S = 0.0019012668127969284 \times 0.8 = 0.0015209734494375424 \text{ kVA, } S = 0.0015209734494375424 \times 0.8 = 0.0012167787595496336 \text{ kVA, } S = 0.0012167787595496336 \times 0.8 = 0.0009734230076397068 \text{ kVA, } S = 0.0009734230076397068 \times 0.8 = 0.0007867384061117654 \text{ kVA, } S = 0.0007867384061117654 \times 0.8 = 0.0006293907248894123 \text{ kVA, } S = 0.0006293907248894123 \times 0.8 = 0.0005035125799115298 \text{ kVA, } S = 0.0005035125799115298 \times 0.8 = 0.0004028096639292238 \text{ kVA, } S = 0.0004028096639292238 \times 0.8 = 0.00032224773114337904 \text{ kVA, } S = 0.00032224773114337904 \times 0.8 = 0.0002577981849146632 \text{ kVA, } S = 0.0002577981849146632 \times 0.8 = 0.00020623854793173056 \text{ kVA, } S = 0.00020623854793173056 \times 0.8 = 0.00016500000000000004 \text{ kVA, } S = 0.00016500000000000004 \times 0.8 = 0.00013200000000000004 \text{ kVA, } S = 0.00013200000000000004 \times 0.8 = 0.00010560000000000004 \text{ kVA, } S = 0.00010560000000000004 \times 0.8 = 8.448000000000004 \text{ kVA, } S = 8.448000000000004 \times 0.8 = 6.758400000000004 \text{ kVA, } S = 6.758400000000004 \times 0.8 = 5.406720000000004 \text{ kVA, } S = 5.406720000000004 \times 0.8 = 4.3253760000000004 \text{ kVA, } S = 4.3253760000000004 \times 0.8 = 3.4603008000000004 \text{ kVA, } S = 3.4603008000000004 \times 0.8 = 2.7682406400000004 \text{ kVA, } S = 2.7682406400000004 \times 0.8 = 2.2145925120000004 \text{ kVA, } S = 2.2145925120000004 \times 0.8 = 1.7716740096000004 \text{ kVA, } S = 1.7716740096000004 \times 0.8 = 1.4173392076800004 \text{ kVA, } S = 1.4173392076800004 \times 0.8 = 1.1338713661440004 \text{ kVA, } S = 1.1338713661440004 \times 0.8 = 0.9070970929152004 \text{ kVA, } S = 0.9070970929152004 \times 0.8 = 0.7256776743321604 \text{ kVA, } S = 0.7256776743321604 \times 0.8 = 0.5805421394657283 \text{ kVA, } S = 0.5805421394657283 \times 0.8 = 0.4644337115725826 \text{ kVA, } S = 0.4644337115725826 \times 0.8 = 0.3715469692580656 \text{ kVA, } S = 0.3715469692580656 \times 0.8 = 0.2972375754064525 \text{ kVA, } S = 0.2972375754064525 \times 0.8 = 0.2377900603251620 \text{ kVA, } S = 0.2377900603251620 \times 0.8 = 0.1902320482601296 \text{ kVA, } S = 0.1902320482601296 \times 0.8 = 0.15218563860810368 \text{ kVA, } S = 0.15218563860810368 \times 0.8 = 0.12174851088648294 \text{ kVA, } S = 0.12174851088648294 \times 0.8 = 0.09739880870918635 \text{ kVA, } S = 0.09739880870918635 \times 0.8 = 0.07867384061117654 \text{ kVA, } S = 0.07867384061117654 \times 0.8 = 0.06293907248894123 \text{ kVA, } S = 0.06293907248894123 \times 0.8 = 0.05035125799115298 \text{ kVA, } S = 0.05035125799115298 \times 0.8 = 0.04028096639292238 \text{ kVA, } S = 0.04028096639292238 \times 0.8 = 0.032224773114337904 \text{ kVA, } S = 0.032224773114337904 \times 0.8 = 0.02577981849146632 \text{ kVA, } S = 0.02577981849146632 \times 0.8 = 0.020623854793173056 \text{ kVA, } S = 0.020623854793173056 \times 0.8 = 0.016500000000000004 \text{ kVA, } S = 0.016500000000000004 \times 0.8 = 0.013200000000000004 \text{ kVA, } S = 0.013200000000000004 \times 0.8 = 0.010560000000000004 \text{ kVA, } S = 0.010560000000000004 \times 0.8 = 0.008448000000000004 \text{ kVA, } S = 0.008448000000000004 \times 0.8 = 0.006758400000000004 \text{ kVA, } S = 0.006758400000000004 \times 0.8 = 0.005406720000000004 \text{ kVA, } S = 0.005406720000000004 \times 0.8 = 0.0043253760000000004 \text{ kVA, } S = 0.0043253760000000004 \times 0.8 = 0.0034603008000000004 \text{ kVA, } S = 0.0034603008000000004 \times 0.8 = 0.0027682406400000004 \text{ kVA, } S = 0.0027682406400000004 \times 0.8 = 0.0022145925120000004 \text{ kVA, } S = 0.0022145925120000004 \times 0.8 = 0.0017716740096000004 \text{ kVA, } S = 0.0017716740096000004 \times 0.8 = 0.0014173392076800004 \text{ kVA, } S = 0.0014173392076800004 \times 0.8 = 0.0011338713661440004 \text{ kVA, } S = 0.0011338713661440004 \times 0.8 = 0.0009070970929152004 \text{ kVA, } S = 0.0009070970929152004 \times 0.8 = 0.0007256776743321604 \text{ kVA, } S = 0.0007256776743321604 \times 0.8 = 0.0005805421394657283 \text{ kVA, } S = 0.0005805421394657283 \times 0.8 = 0.0004644337115725826 \text{ kVA, } S = 0.0004644337115725826 \times 0.8 = 0.0003715469692580656 \text{ kVA, } S = 0.0003715469692580656 \times 0.8 = 0.0002972375754064525 \text{ kVA, } S = 0.0002972375754064525 \times 0.8 = 0.0002377900603251620 \text{ kVA, } S = 0.0002377900603251620 \times 0.8 = 0.0001902320482601296 \text{ kVA, } S = 0.0001902320482601296 \times 0.8 = 0.00015218563860810368 \text{ kVA, } S = 0.00015218563860810368 \times 0.8 = 0.00012174851088648294 \text{ kVA, } S = 0.00012174851088648294 \times 0.8 = 0.00009739880870918635 \text{ kVA, } S = 0.00009739880870918635 \times 0.8 = 0.00007867384061117654 \text{ kVA, } S = 0.00007867384061117654 \times 0.8 = 0.00006293907248894123 \text{ kVA, } S = 0.00006293907248894123 \times 0.8 = 0.00005035125799115298 \text{ kVA, } S = 0.00005035125799115298 \times 0.8 = 0.00004028096639292238 \text{ kVA, } S = 0.00004028096639292238 \times 0.8 = 0.000032224773114337904 \text{ kVA, } S = 0.000032224773114337904 \times 0.8 = 0.00002577981849146632 \text{ kVA, } S = 0.00002577981849146632 \times 0.8 = 0.000020623854793173056 \text{ kVA, } S = 0.000020623854793173056 \times 0.8 = 0.000016500000000000004 \text{ kVA, } S = 0.000016500000000000004 \times 0.8 = 0.000013200000000000004 \text{ kVA, } S = 0.000013200000000000004 \times 0.8 = 0.000010560000000000004 \text{ kVA, } S = 0.000010560000000000004 \times 0.8 = 0.000008448000000000004 \text{ kVA, } S = 0.000008448000000000004 \times 0.8 = 0.000006758400000000004 \text{ kVA, } S = 0.000006758400000000004 \times 0.8 = 0.000005406720000000004 \text{ kVA, } S = 0.000005406720000000004 \times 0.8 = 0.0000043253760000000004 \text{ kVA, } S = 0.0000043253760000000004 \times 0.8 = 0.0000034603008000000004 \text{ kVA, } S = 0.0000034603008000000004 \times 0.8 = 0.0000027682406400000004 \text{ kVA, } S = 0.0000027682406400000004 \times 0.8 = 0.0000022145925120000004 \text{ kVA, } S = 0.0000022145925120000004 \times 0.8 = 0.0000017716740096000004 \text{ kVA, } S = 0.0000017716740096000004 \times 0.8 = 0.0000014173392076800004 \text{ kVA, } S = 0.0000014173392076800004 \times 0.8 = 0.0000011338713661440004 \text{ kVA, } S = 0.0000011338713661440004 \times 0.8 = 0.0000009070970929152004 \text{ kVA, } S = 0.0000009070970929152004 \times 0.8 = 0.0000007256776743321604 \text{ kVA, } S = 0.0000007256776743321604 \times 0.8 = 0.0000005805421394657283 \text{ kVA, } S = 0.0000005805421394657283 \times 0.8 = 0.0000004644337115725826 \text{ kVA, } S = 0.0000004644337115725826 \times 0.8 = 0.0000003715469692580656 \text{ kVA, } S = 0.0000003715469692580656 \times 0.8 = 0.0000002972375754064525 \text{ kVA, } S = 0.0000002972375754064525 \times 0.8 = 0.0000002377900603251620 \text{ kVA, } S = 0.0000002377900603251620 \times 0.8 = 0.0000001902320482601296 \text{ kVA, } S = 0.0000001902320482601296 \times 0.8 = 0.00000015218563860810368 \text{ kVA, } S = 0.00000015218563860810368 \times 0.8 = 0.00000012174851088648294 \text{ kVA, } S = 0.00000012174851088648294 \times 0.8 = 0.00000009739880870918635 \text{ kVA, } S = 0.00000009739880870918635 \times 0.8 = 0.00000007867384061117654 \text{ kVA, } S = 0.00000007867384061117654 \times 0.8 = 0.00000006293907248894123 \text{ kVA, } S = 0.00000006293907248894123 \times 0.8 = 0.00000005035125799115298 \text{ kVA, } S = 0.00000005035125799115298 \times 0.8 = 0.00000004028096639292238 \text{ kVA, } S = 0.00000004028096639292238 \times 0.8 = 0.000000032224773114337904 \text{ kVA, } S = 0.000000032224773114337904 \times 0.8 = 0.00000002577981849146632 \text{ kVA, } S = 0.00000002577981849146632 \times 0.8 = 0.000000020623854793173056 \text{ kVA, } S = 0.000000020623854793173056 \times 0.8 = 0.000000016500000000000004 \text{ kVA, } S = 0.000000016500000000000004 \times 0.8 = 0.000000013200000000000004 \text{ kVA, } S = 0.000000013200000000000004 \times 0.8 = 0.000000010560000000000004 \text{ kVA, } S = 0.000000010560000000000004 \times 0.8 = 0.000000008448000000000004 \text{ kVA, } S = 0.000000008448000000000004 \times 0.8 = 0.000000006758400000000004 \text{ kVA, } S = 0.000000006758400000000004 \times 0.8 = 0.000000005406720000000004 \text{ kVA, } S = 0.000000005406720000000004 \times 0.8 = 0.000000004325376000000004 \text{ kVA, } S = 0.000000004325376000000004 \times 0.8 = 0.000000003460300800000004 \text{ kVA, } S = 0.000000003460300800000004 \times 0.8 = 0.000000002768240640000004 \text{ kVA, } S = 0.000000002768240640000004 \times 0.8 = 0.000000002214592512000004 \text{ kVA, } S = 0.000000002214592512000004 \times 0.8 = 0.000000001771674009600004 \text{ kVA, } S = 0.000000001771674009600004 \times 0.8 = 0.000000001417339207680004 \text{ kVA, } S = 0.000000001417339207680004 \times 0.8 = 0.000000001133871366144004 \text{ kVA, } S = 0.000000001133871366144004 \times 0.8 = 0.000000000907097092915204 \text{ kVA, } S = 0.000000000907097092915204 \times 0.8 = 0.000000000725677674332164 \text{ kVA, } S = 0.000000000725677674332164 \times 0.8 = 0.0000000005805421394657283 \text{ kVA, } S = 0.0000000005805421394657283 \times 0.8 = 0.0000000004644337115725826 \text{ kVA, } S = 0.0000000004644337115725826 \times 0.8 = 0.0000000003715469692580656 \text{ kVA, } S = 0.0000000003715469692580656 \times 0.8 = 0.0000000002972375754064525 \text{ kVA, } S = 0.0000000002972375754064525 \times 0.8 = 0.0000000002377900603251620 \text{ kVA, } S = 0.0000000002377900603251620 \times 0.8 = 0.0000000001902320482601296 \text{ kVA, } S = 0.0000000001902320482601296 \times 0.8 = 0.00000000015218563860810368 \text{ kVA, } S = 0.00000000015218563860810368 \times 0.8 = 0.00000000012174851088648294 \text{ kVA, } S = 0.00000000012174851088648294 \times 0.8 = 0.00000000009739880870918635 \text{ kVA, } S = 0.00000000009739880870918635 \times 0.8 = 0.00000000007867384061117654 \text{ kVA, } S = 0.00000000007867384061117654 \times 0.8 = 0.00000000006293907248894123 \text{ kVA, } S = 0.00000000006293907248894123 \times 0.8 = 0.00000000005035125799115298 \text{ kVA, } S = 0.00000000005035125799115298 \times 0.8 = 0.00000000004028096639292238 \text{ kVA, } S = 0.00000000004028096639292238 \times 0.8 = 0.000000000032224773114337904 \text{ kVA, } S = 0.000000000032224773114337904 \times 0.8 = 0.00000000002577981849146632 \text{ kVA, } S = 0.00000000002577981849146632 \times 0.8 = 0.000000000020623854793173056 \text{ kVA, } S = 0.000000000020623854793173056 \times 0.8 = 0.000000000016500000000000004 \text{ kVA, } S = 0.000000000016500000000000004 \times 0.8 = 0.000000000013200000000000004 \text{ kVA, } S = 0.000000000013200000000000004 \times 0.8 = 0.000000000010560000000000004 \text{ kVA, } S = 0.000000000010560000000000004 \times 0.8 = 0.000000000008448000000000004 \text{ kVA, } S = 0.000000000008448000000000004 \times 0.8 = 0.000000000006758400000000004 \text{ kVA, } S = 0.000000000006758400000000004 \times 0.8 = 0.000000000005406720000000004 \text{ kVA, } S = 0.000000000005406720000000004 \times 0.8 = 0.000000000004325376000000004 \text{ kVA, } S = 0.000000000004325376000000004 \times 0.8 = 0.000000000003460300800000004 \text{ kVA, } S = 0.000000000003460300800000004 \times 0.8 = 0.000000000002768240640000004 \text{ kVA, } S = 0.000000000002768240640000004 \times 0.8 = 0.000000000002214592512000004 \text{ kVA, } S = 0.000000000002214592512000004 \times 0.8 = 0.000000000001771674009600004 \text{ kVA, } S = 0.000000000001771674009600004 \times 0.8 = 0.000000000001417339207680004 \text{ kVA, } S = 0.000000000001417339207680004 \times 0.8 = 0.000000000001133871366144004 \text{ kVA, } S = 0.000000000001133871366144004 \times 0.8 = 0.000000000000907097092915204 \text{ kVA, } S = 0.000000000000907097092915204 \times 0.8 = 0.000000000000725677674332164 \text{ kVA, } S = 0.000000000000725677674332164 \times 0.8 = 0.0000000000005805421394657283 \text{ kVA, } S = 0.0000000000005805421394657283 \times 0.8 = 0.0000000000004644337115725826 \text{ kVA, } S = 0.0000000000004644337115725826 \times 0.8 = 0.0000000000003715469692580656 \text{ kVA, } S = 0.0000000000003715469692580656 \times 0.8 = 0.0000000000002972375754064525 \text{ kVA, } S = 0.0000000000002972375754064525 \times 0.8 = 0.0000000000002377900603251620 \text{ kVA, } S = 0.0000000000002377900603251620 \times 0.8 = 0.0000000000001902320482601296 \text{ kVA, } S = 0.0000000000001902320482601296 \times 0.8 = 0.00000000000015218563860810368 \text{ kVA, } S = 0.00000000000015218563860810368 \times 0.8 = 0.00000000000012174851088648294 \text{ kVA, } S = 0.00000000000012174851088648294 \times 0.8 = 0.00000000000009739880870918635 \text{ kVA, } S = 0$$~~