الكترونيك قوى ٢ فصل ٢٠١٦/١/٩

كلية الهندسة بحلوان

Dept/Division : Electrical Power and Machines
Academic level: Third **Semester:** First 2015/16
Course code & title: Power Electronics (1) : PWR3311
Instructor: Prof.Dr. S. S. Abd Elhamid &Assistant Prof.Dr. M. N. Abd El Fattah
Total marks: 90 marks **Time allowed:** 3 hrs

جامعة حلوان

Answer the following questions إعتنى بالنظام و ترتيب الأسئلة و أجب على المطلوب فقط

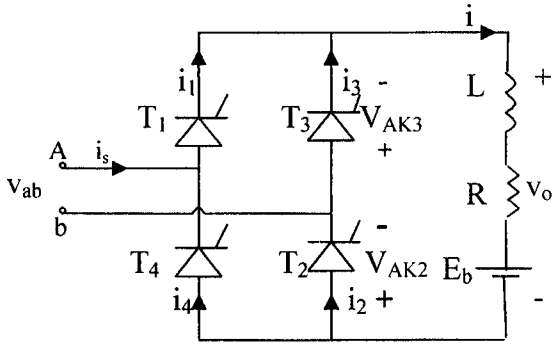
Q1 Explain briefly what is meant by:
(i) Line commutation in rectifier circuits.
(ii) Input power factor in rectifier circuits
(iii) Holding current of a thyristor

(9 Marks)

Q2

$v_{ab}=110\sqrt{2}\sin\omega t$ $\alpha = 60^o$

$R = 5\ \Omega$ $E_b = 20$ V



In the rectifier circuit shown the inductance L is so large such that the current i is maintained constant.
(i) Derive an expression the average value of load voltage v_o
(ii) Calculate the rms value of i_3 and the average value of V_{AK2}
(iii) Sketch the waveforms of v_{ab} , v_o ,, i_3 , i_s ,V_{AK2} and V_{AK3}
(iv) If L = 0 sketch the waveform of i and find its average value

(18 Marks)

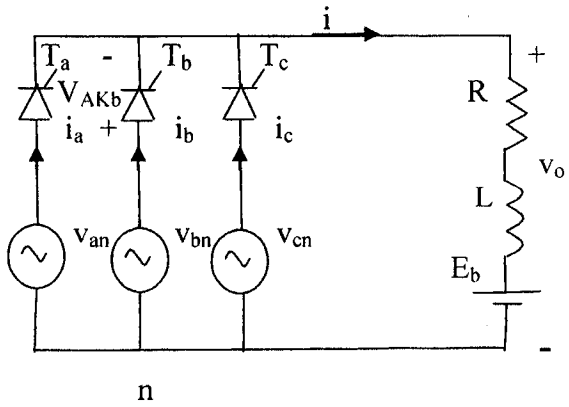
Q3

a) Derive an expression for the average output voltage of a half wave controlled three-phase bridge converter.

b) In the bridge converter circuit shown, L is so large such that the current I is assumed constant, find:

(i) The average value of i and rms value of i_c
(ii) Sketch waveforms of v_{an}, v_{bn}, v_{cn}, v_o and V_{AKb}.
(iii) If the three thyristors were replaced by diodes, sketch waveforms of v_o and i_c and find the average value of i_b

V = 110 V $R = 10\ \Omega$ $\alpha = 60^o$ $E_b = 20$ V
$v_{an} = \sqrt{2}V\sin\omega t$ $v_{bn} = \sqrt{2}V\sin(\omega t - 2\pi/3)$
$v_{cn} = \sqrt{2}V\sin(\omega t + 2\pi/3)$



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(18 Marks)

"من فضلك اقلب الصفحة"

Q 4

a) A single phase bidirectional AC voltage regulator supplies a resistive load R=20Ω, the input rms voltage is 220 V, 50 Hz sinusoidal waveform, the firing Angle for the thyristors $\alpha=\pi/6$

1- Calculate the rms of the thyristor current.
2- Find The input power factor.
3 - If one thyristor is replaced with diode, find the average value of the output voltage

b) A single phase AC voltage bidirectional regulator supplies a series load R=5Ω and L=27.5 mH. The input rms voltage is 220V, 50 HZ sinusoidal waveform, the firing angle of each thyristor $\alpha=\pi/2$ and the conduction angle $\theta_c=106.7°$

1- Calculate the rms output voltage and draw output voltage and current.
2- Calculate the firing angle, rms of output voltage V_o(rms) and rms value of the load current for continuous case.

(15 marks)

Q 5

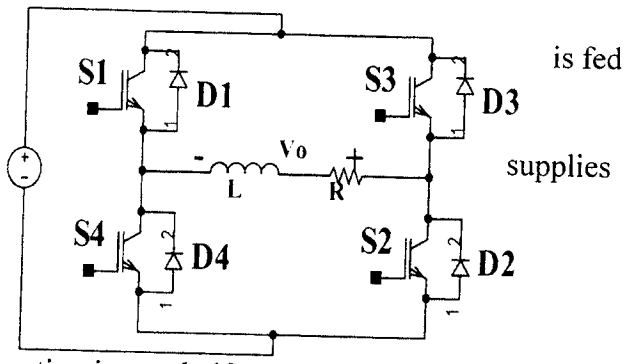
a) Explain briefly the methods for controlling the output of DC chopper and inverter.
b) Draw the power circuit of class B DC chopper and discuss briefly its operation.
c) A step down class A dc chopper its input voltage 110 v spplies a series RLE load with freewheeling diode, R=0.25 Ω, L=1mH and back emf E =11 dc volt, if the switching frequency of the chopper is 400 HZ and T_{ON} = 0.4T,

1- Check the continuiouty operation of the chopper.
2 – calculate the rms of the output voltage V_o
3 – find The steady state ripple of the output load current.

(15 marks)

Q 6

a) A single phase full bridge inverter as shown in the fig, is fed by a group of 20 batteries each12 volt dc series connected through a DC chopper works with duty cycle =0.5. The inverter operates at 1Khz. It supplies a resistive load 10 Ω in series with reactance 62.83Ω . Assume repetitive conditions.



1- Draw the waveform of the output voltage, the load current, and find the total harmonic distortion THD of the output voltage.
2- Obtain a numerical expression for the load current equation in one half cycle.

b) Draw the power circuit of three phase six steps 180^0 mode operation inverter fed inductive load and draw the switching control signals and only one phase load voltage and current for repetitive condition.

(15 marks)

مقرر اختيارى (1) مواصفات قياسيه – الفرقه الثالثه قوى والآلات كهربيه – للعام الدراسى 2016/2015
امتحان الفصل الدراسى الاول يناير 2016 – الامتحان على صفحتين / ورقه واحده - اربعه اسئله

كلية الهندسة بحلوان	**Dept/Division : Electrical Power & Machines Engineering** **Academic Level:** Third **Semester:** First 2014/2015 Exam: January 2016 **Course Code & Title:** POW 3315 – Electrical Standard Specifications **Instructor:** Prof. Alaa Abdel Razek **Total Mark:** 70 Marks **Time Allowed:** 3 hrs	جامعة حلوان

Exam Instruction: Answer all the following questions (Four Questions):

الصفحه الاولى

Question No. 1: [20 marks]

1-1 What is Transient Recovery Voltage?

1-2 Transient recovery voltage is affected by various parameters of the system. Explains.

1-3 Derive of Restriking Voltage and show the relation for:
The Peak Voltage of Retriking Voltage, The restriking voltage natural frequency, and Rate of Rise of Restriking Voltage RRRV

1-4 In a short-circuit test on a three phase, 110kV circuit-breaker, power factor of fault was 0.4, the recovery voltage was 0.95 times full line value. The breaking current was symmetrical. The frequency of oscillations of restriking voltage was 15kHz. Estimate the average rate of rise of restriking voltage. The neutral is grounded and fault involves earth. Neglect First Pole to clear factor.

Question No. 2: [15 marks]

2-1 Explain the degree of protection provided by enclosure (IP code) according to IEC60529 and NEMA Enclosure

2-2 Explain with the aid of sketch motor duty types S1, S2, S3 and S6 according to IEC 60034: Rotating Electrical Machine

Question No. 3: [15 marks]

A 1000 kVA transformer with a rated copper loss of 4 times the core loss operates in an ambient temperature of 25°C. From cold it has a winding temperature-rise of 24°C after 1 hour and 38.5°C after 2 hour on rated load:

(a) Drive the standard duty table for power delivery up to 2 power rated by increasing 10% as a function with permitted operation period under rated ambient temperature 25°C.

(b) Drive the standard de-rating table shows the delivery power with different ambient temperatures over the rating ambient temperature 25°C by 5°C up to 60°C.

انظر خلفه بقيه الاسئله

Question No. 4: [20 marks]

4-1For the power distribution network shown in Figure Q4-1, determine the percentage voltage drops in a. 300mm^2 cable; b. 185mm^2 cable; c. 50mm2 cable and d. Total % is 100 voltage drop up the 22kw motor. The load on the MSB is 400 KVA at 0.9 pf lagging and on the SSB is 100 kVA at 0.85 pf lagging.

4-2 Determine the voltage drop across a 250 KVA, 11 KV /415 V, three-phase, delta-star connected transformer having a percentage impedance of 4.5% and an X/R ratio of 6. The transformer is delivering full load at 0.8 power factor lagging.

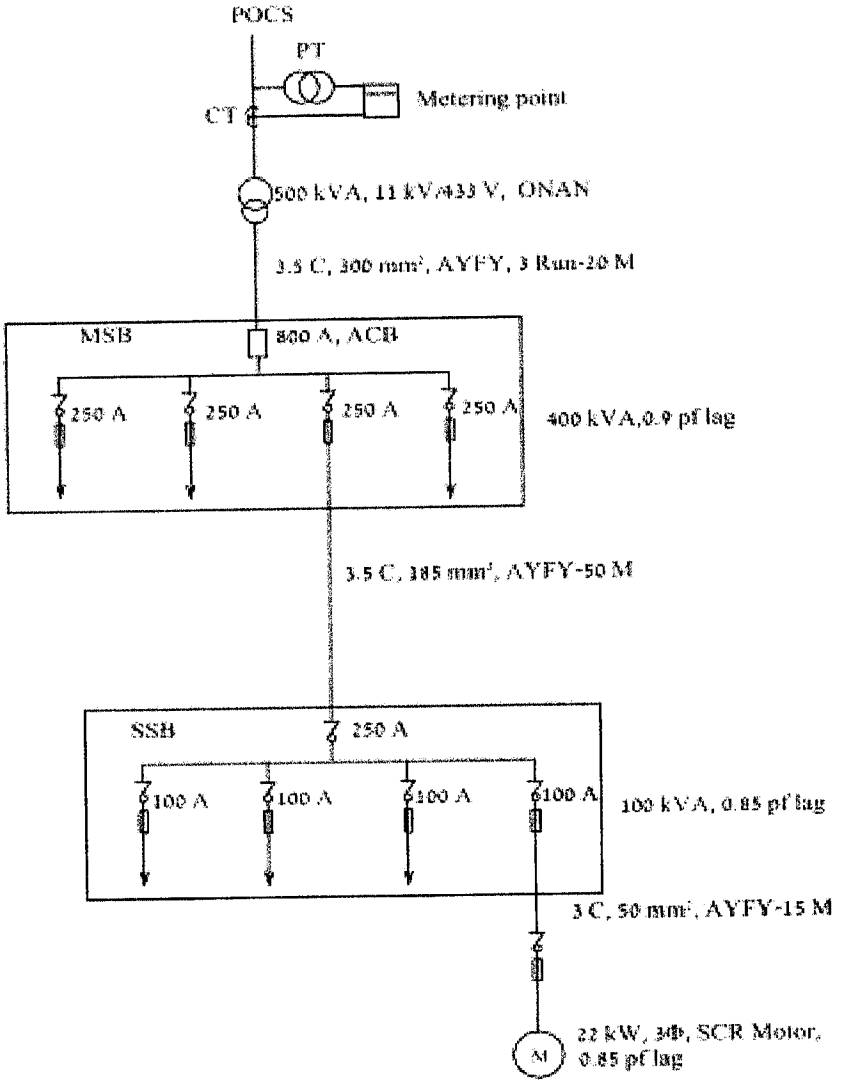


Figure Q4-1

The End of Exam - Good Luck

كلية الهندسة بحلوان	Dept/Division :	Electrical Power Engineering and Machines
	Course Title :	Electrical Power (1)
	Course Code :	POW 3312
	Academic level:	Under Graduate (3rd Year)
	Semester:	Jan. 2016
	Instructors:	Prof. Magdy Adly Dr. Mohamed Ibrahim Dr. Karam Abdel-Latif
	Time Allowed:	3 hrs
	Total Marks	120 Marks

Answer all questions:

Question No. (1) [30 mark]

A three-phase overhead transmission line delivers a load, which has 80 Mw, and 130 kv at the receiving end. The line constants are:

$$A=D=0.95\angle 2,\ B=70\angle 82\ \Omega,\ C=8.288\times 10^{-4}\angle 74.5\ mhos.$$

The phase modifier must be installed at the receiving end to reduce the voltage regulation from -36% to -12%. Draw the combined circle power diagram then determine:

a) The power and power factor at sending end.
b) The rating of the phase modifier, which has 0.174 power factor.
c) The loss line and the efficiency with & without phase modifier.

(Use scale 1 cm = 20 Mva)

Question No. (2) [30 mark]

A completely transposed three phase overhead transmission line, 300 km, are arranged as shown in fig.1. If each conductor is replaced by 3 bundle conductors arranged at the corners of an equilateral triangle of side d cm, and the outside diameter of each conductor is 2.52 cm. the line inductance reduced by 25% from its original value as before. **Find**:

a) The inductance and the capacitance per phase per km with and without bundling.
b) If the fault is occurred on one circuit of the line and it disconnect, **Find** the inductance and the capacitance per phase per km on the other circuit with bundling.

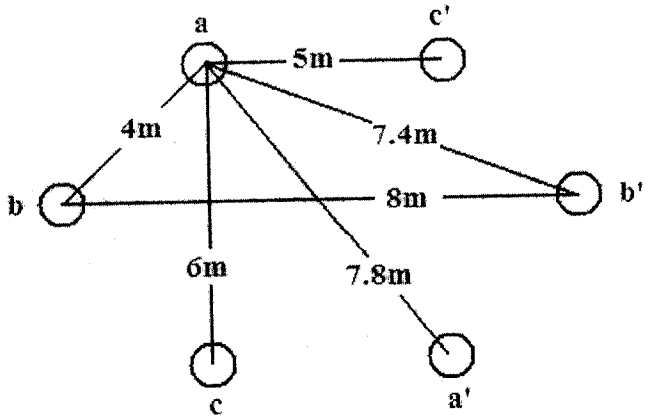


Fig. 1

أنظر الصفحة الثانية

Question No. (3) [30 mark]

A single phase ac ring distributor fed from point A is loaded as shown in Fig.2.

a) **Find** the point of minimum voltage, and calculate the voltage at that point.

b) For the purpose of improving the loop performance a cable of impedance equal half of the main distributor and of length 100 meters is used to connect buses **A** and **C**. recalculate the voltage at the point previously found in part (a)

(Go and return impedance of the main feeder distributor = 0.2 +j0.1 ohm/100 m.)

Loads:

Ld1: (30-j40) A.
Ld2: (50-j10) A.
Ld3: (60) A.
Ld4: (40-j20) A.
Dis. Load (1): 0.4 A/m at 0.8 p.f lag.
Dis. Load (2): 0.5 A/m at unity p.f.

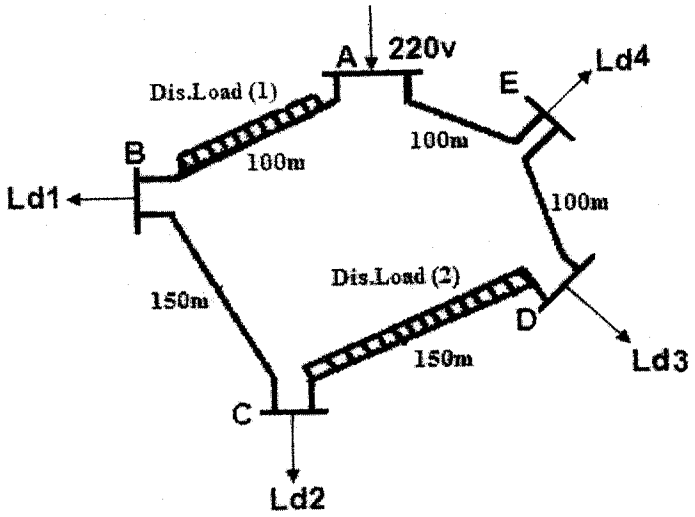


Fig. 2

Question No. (4) [30 mark]

A D.C source of 500kv with internal resistance equal 10 ohms is applied to an overhead transmission line by closing a switch. The end of the overhead transmission line is connected to an underground cable through 5h series inductor. Assume that the line and the cable are lossless. If the end of the cable is terminated by a load consists of 10 ohm resistance and 0.01h reactance as shown in fig.3, find the following:

a) The voltage at the end of the line immediately after the arrival of the incident wave.

b) Draw the voltage at the end of the cable immediately after the arrival of the first voltage wave.

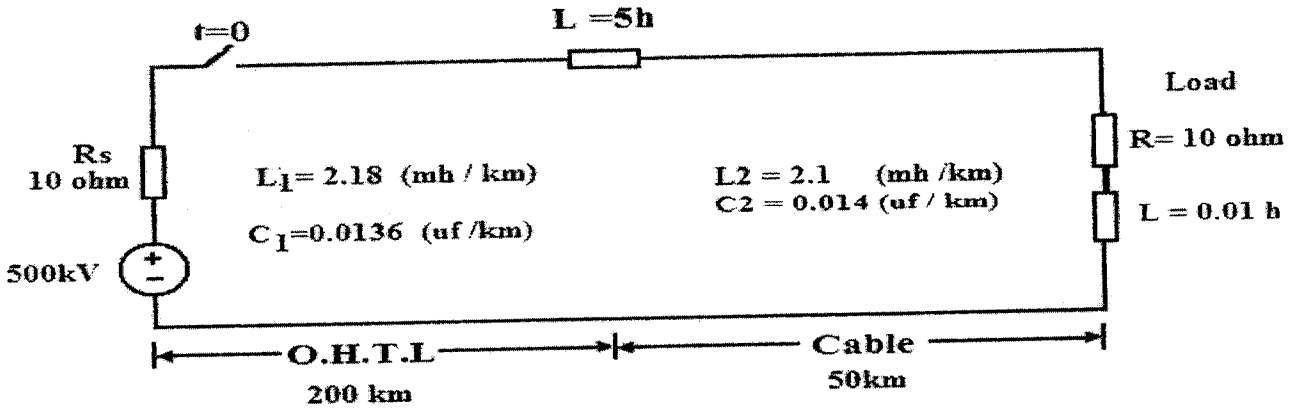


Fig. 3

مع اطيب الامنيات بالتوفيق و النجاح

Faculty of Engineering	**Dept:** Electrical Power and Machines Engineering **Instructors:** Prof. Radwan H. Abdel-Hamid, Dr. Mohamed A. Esmaeel, Dr. Mohamed A. Daowd **Courses code & title:** POW3313 Electrical Machines 2 **Instructions:** 3rd year, First term 2015-2016 **Total mark:** 120 **mark** **Time allowed:** 3 **hrs**	

Answer the following questions

Q1. **(Mark 20)**

A 3ϕ, 460 V, 60 Hz, 1200 rpm, 125 hp synchronous motor has the following equivalent circuit parameters: $R_a = 0.078\Omega$, $X_{al} = 0.05\Omega$, $X_{ar} = 1.85\ \Omega$, $N_{re}/N_{se} = 28.2$. For rated conditions the field current is adjusted to make the motor power factor 0.8 lead. Neglect all rotational losses and power lost in the field winding.

(a) For rated operating conditions, determine the motor current I_a field current I_f, and power angle δ.

(b) Draw the phasor diagram.

Q2. **(Mark 20)**

A 3ϕ, 4.6 kV, 60 Hz, four-pole, Y-connected synchronous machine has the following current ratings:

Armature current rating = 65.75 A, Field current rating = 15.0 A, synchronous reactance $X_s = 1.25$ pu, The excitation voltage (E_f) at the rated speed is 4.6 kV (line-to-line) when the field current is 7.5A

(A) Construct the capability curve for the machine for generator operation. Use per-unit values.

(B) Determine the power factor and the power angle for optimum operating conditions.

Q3. **(Mark 20)**

A 3ϕ, 40 MVA, 11 kV, 60 Hz, salient pole, synchronous machine has $X_d = 1.5$ pu, $X_q = 1.0$ pu, and negligible stator resistance. The machine is connected to an infinite bus, and the field current is adjusted to make the excitation voltage equal to the bus voltage.

A) Determine the maximum value of the steady state power that the machine can supply.

B) Find the stator current (I_a) and the power factor at this maximum power condition. Draw the phasor diagram corresponding to this case.

Please Turn Over

Q4. **(Mark 20)**

A) What is the difference between a synchronous motor and a synchronous generator?

B) Explain - using phasor diagrams - why the armature reaction represented in synchronous machines with inductance of armature reaction X_{ar}

C) Draw the phasor diagram of the non-salient pole synchronous generator at lagging power factor. (neglect the stator resistance R_a). From this phasor diagram, show that the torque angle δ between the generated voltage E_f and the terminal voltage V_t is given by

$$\tan \delta = \frac{X_s I_a \cos \phi}{V_t \pm X_s I_a \sin \phi}$$

Q5. **(Mark 20)**

A) Design a stepper motor (Find Ns and Nr) to obtain a step-angle of 5°. Assume that motor phases are 3.

B) Compare between the Unipolar and Bipolar stepper motors. You may use these viewpoints: constructions, advantages, disadvantages, coils drawing circuits, common step size, applications … etc.

C) The stepper motor can be controlled using open-loop or closed-loop control, with the drawing aid compare between these two types.

Q6. **(Mark 20)**

A) Mention the advantages, disadvantages of the stepper motor and give some of its applications.

B) Explain the reluctance motors types, sources can be applied into these motors, their advantages and disadvantage.

C) Explain the different types of the permanent magnet synchronous machines – you may use motor X-Sec drawing – and their *applications, advantages and disadvantages.*

مع أطيب تمنياتنا لكم بالنجاح والتوفيق