Voorblad
Bij dit tentamen mag gebruik gemaakt worden van een handgeschreven formuleblad met 10 formules. Geen schema's.
Maak elke "problem" opgave op een aparte bladzijde. Geef niet alleen de eindantwoorden maar ook de tussenantwoorden. Onderstreep de antwoorden. Succes!
For this test a handwritten A4 formula sheet with 10 formulas may be used. Every "problem " on a separate sheet. Do not only state the end answers, but also the intermediate answers. Success!

Problem 1 (10 points)

A single phase motor draws a current of 6A from a 120V 60Hz source. The power factor of the motor is 67%. Calculate:
a) The active power absorbed by the motor. (2 points)
b) The reactive power supplied by the line. (2 points)
A 47uF capacitor is placed across the motor terminals. Calculate:
c) The reactive power generated by the capacitor. (2 points)
d) The reactive power absorbed from the line (2 points)
e) The new line current. (2 points)

Problem 2 (10 points)

A synchronous generator with a synchronous reactance of 5Ω is connected floating on an infinite bus. See figure 16.26a. The relation between the exitation current Ix and the voltage Eo is given in figure 16.13b.

a) Draw the phasor diagram of the voltages Eo and E. (2 points)

The generator is over-exited. Ix=250A.

b) Calculate the voltage Ex and draw the phasor diagram of E, Eo,Ex and I (2 points)

The generator is under-exited. Ix=60A.

c) Calculate the voltage Ex and draw the phasor diagram of E, Eo,Ex and I (2 points)

A turbine is driving the generator. The load angle δ between E0 and E is 19,2^{o}, E0=12kV, E=12kV.

d) Calculate the active power delivered to the grid. (4 points)

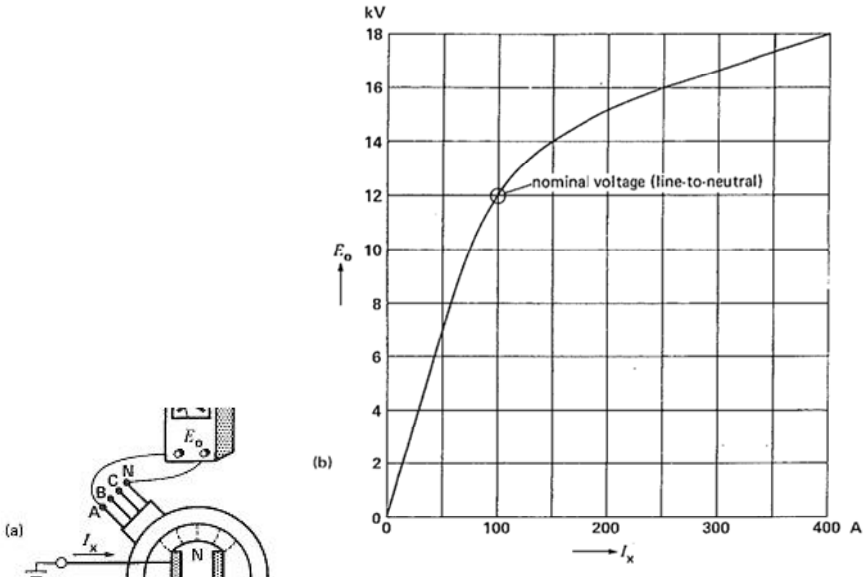

Figure 16.13
a. Generator operating at no-load.
b. No-load saturation curve of a 36 MVA, 21 kV, 3-phase generator.

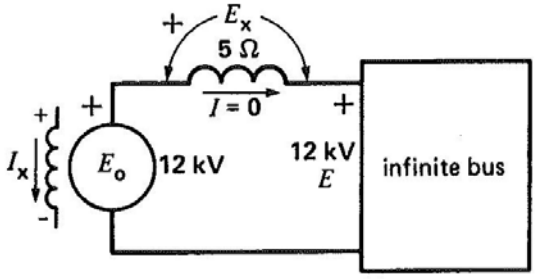

Figure 16.26a
Generator *floating* on an infinite bus.

Problem 3 (10 points)

We wish to generate a 3-phase, 245V line-to-line voltage, 60Hz source using the converter of Fig 21.94. The dc supply voltage E_H is 500V and the carrier frequency f_c is 540Hz.

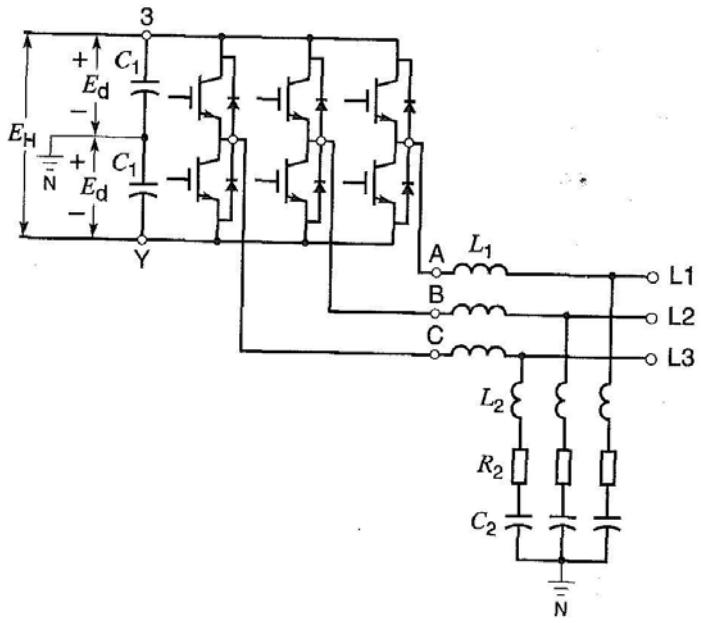

Figure 21.94
A more detailed diagram of a 3-phase PWM converter using IGBTs and a 3-phase *RLC* filter to suppress the carrier frequency components.

Determine:

a) The peak value of the fundamental voltage between terminal L1 and the floating neutral N of the load. (2 points)

b) The period T of the triangular wave and the corresponding angular interval, in degrees. (2 points)

c) The PWM program. (The graphical diagram that enables PWM programming.) (3 points)

d) The waveshape of the PWM voltage between terminals A and Y during one cycle. (3 points)

Questions (10 points)

1. *(2 points)*
Draw the complete torque speed curve of a 3 phase induction machine and mark the brake + motor and generator region.

2. *(3 points)*
A 3-phase, 8-pole, squirrel-cage induction motor, connected to a 60 Hz line, runs at a speed of 890 r/min. The motor absorbs 40kW, and the copper and iron losses in the stator amount to 5 kW and 1 kW respectively. Calculate the torque developed by the motor.

3. *(3 points)*
Figure 21.28a is a thyristor connected to a DC source.
How to stop conduction of the thyristor? (Name at least 2 ways) and draw the circuit of one of this methods.

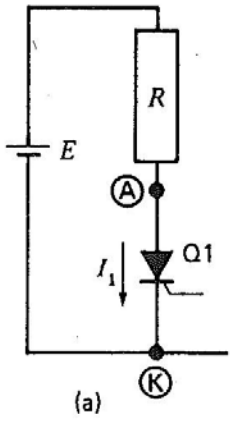

Figure 21.28

4. *(2 points)*
Figure 21.13a is a single-phase bridge rectifier. Figure 21.13c are the voltage and current waveforms in load R.
Draw the schematic of a single phase rectifier with smoothing current filtering and the schematic of a single phase rectifier with smoothing voltage filtering.

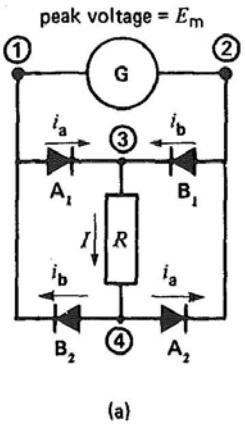

Figure 21.13
a. Single-phase bridge rectifier.

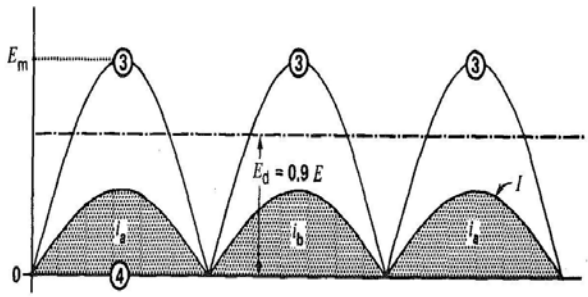

Figure 21.13c
Voltage and current waveforms in load *R*.