UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2006/2007

October/November 2006

EEE 542 – INDUSTRIALS POWER ELECTRONICS

Duration: 3 hours

Please check that this examination paper consists of FOUR pages of printed material before you begin the examination.

This paper contains SIX questions.

Instructions: Answer **FIVE (5)** questions. If a candidate answer more than five questions, only the first five answered will be examined and awarded marks.

Answer to any question must start on a new page.

Distribution of marks for each question is given accordingly.

All questions must be answered in English.

1. Design a single phase full wave rectifier for 2 quadrant operation with R and L load. In your design avoid using the freewheeling diode.

    (i)   Skecth the output voltage waveform for $\alpha=30^0$

    (ii) Determine the circuit's efficiency at $\alpha=30^0$

    (iii) Value of α if $V_{dc}/V_m =0.6$, where V_m is the maximum dc voltage

    (iv) What is the maximum efficiency of the circuit.

                                                        (100%)

2. Design a 3 phase full wave rectifier (bridge topology), with highly inductive load using 3 phase supply.

    (i)   Sketch the output voltage waveform for $\alpha=90^0$

    (ii) Determine the value of V_{dc} and V_{rms} at $\alpha=90^0$

    (iii) The maximum efficiency of the circuit

    (iv) What is the advantage of this circuit compared to the half wave rectifier?

                                                        (100%)

3. For 3 phase half wave ac controller Y connected with R load :

    (i)   Draw the complete design of this controller assumed that the loads are balanced.

    (ii) Determine the voltage output waveforms for $\alpha=30^0$ at load B.

    (iii) Derive the rms volume of output voltage in term of $\alpha = 30^0$.

                                                        (100%)

4. (a)   What are the performance parameters of inverter circuit.

                                                        (20%)

(b)   Explain in detail the operation of a single-phase bridge inverter with inductive load from a dc source:

   (i)   Sketch the complete design and explains the operation.
   (ii)   The output voltage and current waveforms
   (iii)   The output voltage (rms value)

(40%)

(c)   For question 4b, if the circuit has an RLC with $R=10\Omega$, $L=30mH$, $C=100\mu F$, $f_o=50$ Hz and dc input voltage $V_s=240$ V. Express the instantaneous load current in Fourier series.

(40%)

5.   Explain how a 3 phase inverter is constructed from a single dc supply. Describe in detail the concept apply in your design. How could you generate a nearly sinusoidal output waveform.

(100%)

6.   (a)   What are the advantages and disadvantages of a Boost regulator.

(20%)