December 2007 NATIONAL EXAMS

**98 – ELEC – B8**

**Switched Mode Power Supply Design**

**3 Hours Duration**

**NOTES:**

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper a clear statement of any assumption made;

2. "Closed-Book" – Candidates may use one of two calculators, a Casio or Sharp

3. Any five questions constitute a complete paper. Only the first five questions as they appear in your answer book will be marked;

4. All questions are of equal value

## Question 1

a) What is a line impedance stabilization network (LISN)?
b) What is the difference between a Faraday screen and safety screen in a switching transformer?
c) Why is the $i^2t$ rating of a fuse an important selection criterion?
d) Describe the difference between differential-mode interference and common-mode interference.

**Question 2**

a) Why are capacitive input filters often used for direct-off-line switch-mode supplies?
b) What is the typical power factor of a capacitive input filter, and why is it relatively poor?
c) Why must a true wattmeter be used for measuring input power?
d) Why is line inrush-current limiting required with capacitive input filter circuits are employed?

## Question 3

a) Why is output over-voltage protection often considered necessary?
b) Name three types of over-voltage protection in common use.
c) Describe what is meant by crowbar over-voltage protection.
d) Describe the problems normally encountered with a fast-acting crowbar protection circuit.

## Question 4

a) Explain what is meant by the term "snubber network."
b) Explain the two major functions of a typical snubber network.
c) Why is a large snubber capacitor undesirable?
d) Describe a low-loss snubber technique that may be used in place of the conventional *RC* snubber network.

**Question 5**

a) Discuss the major disadvantage of switch-mode power supplies compared with the older linear regulator types.

b) Is the design of the output filter the only most important factor in reducing output ripple noise?

c) Why are power output filters often relatively ineffective in dealing with high-frequency noise?

d) What is the difference between common-mode and differential-mode noise filters?

**Question 6**

a) Why does operation in parallel for constant-voltage power supplies present a problem?
b) Explain the major disadvantages of master-slave operation.
c) How can we achieve forced current sharing for parallel operation ?
d) What is meant by parallel redundant operation?

**Question 7**

a) Explain the basic operation of a fly-back converter.
b) Explain the major parameters that control the selection of the switching transistor in a fly-back converter.
c) What is the steady state input / output voltage and current transfer function of a fly-back converter?
d) What parameters of the fly-back converter control the selection of the output capacitors?