

Ollscoil na hÉireann, Gaillimh

National University of Ireland, Galway

SEMESTER I EXAMINATIONS, 2000/2001

B.E. DEGREE (ELECTRONIC)

POWER ELECTRONICS

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Duration of examination: *One Hour and Thirty Minutes*

Instructions: Answer *three* questions.

- 1 Explain the following terms: *distortion factor, displacement factor, power factor*.

Draw the circuit for a full-wave phase-controlled bridge rectifier showing the firing sequence of the switches. Such a circuit has an input voltage of 230 V(R.M.S.) and has a highly inductive load. Calculate

- the d.c. output voltage for a firing angle of  $20^\circ$ ;
- the power factor of the source in (a);
- the total harmonic distortion (THD) of the source in (a).

- 2 Draw the circuit and associated waveforms for a flyback converter and explain its operation.

A flyback converter operates at 50 kHz, 100V and 1000 W with an output voltage of 500 V and with a turns ratio of 4:1. Calculate

- the value of the output capacitance so that the output ripple is 10 V.
- the minimum value of primary inductance to ensure continuous flux.

- 3 What are the principle advantages of a resonant topology over a switching PWM topology in dc-dc converters

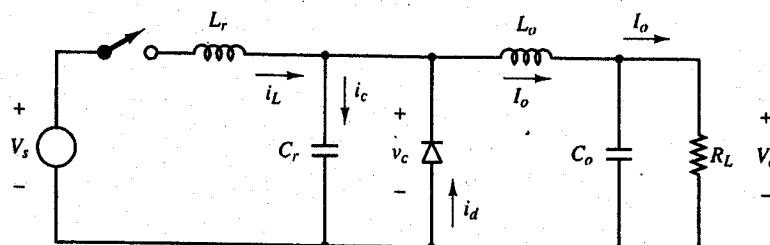


Figure 1

Figure 1 shows a zero-current switching, quasi-resonant converter (ZCS-QRC)

Explain in detail, the four distinct modes of operation of the circuit.

Sketch the resonant inductor current and the resonant capacitor voltage over a full cycle

- 4 Explain the operation of the reset winding in a forward converter.

A forward converter has a source voltage of 75 V and a load of 250 W at 50 V. The output filter has  $L_o=100\ \mu\text{H}$  and  $C_o=150\ \mu\text{F}$ . The switching frequency is 40 kHz.

- (a) Select a duty ratio and transformer turns ratio primary/secondary and primary/reset to provide the required output voltage.
- (b) Calculate the current ripple in the output inductor.