

Ollscoil na hÉireann, Gaillimh

National University of Ireland, Galway

**SUMMER EXAMINATIONS, 2000**

**B.E. DEGREE (ELECTRONIC)**

**POWER ELECTRONICS**

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Duration of examination: *Two Hours*

Instructions: Answer *three* questions.

- Q1 Describe the operation of a PWM Bipolar Inverter. Explain how the output is generated and show the switching sequence.

The dc source supplying an inverter with a bipolar PWM output is 96 V. The load is an R-L series combination with  $R=32\ \Omega$  and  $L=24\text{ mH}$ . The output has a fundamental frequency of 50 Hz.

- Specify the amplitude modulation ratio to provide an output of 54 Vrms at the fundamental frequency.
- If the frequency modulation ratio is 15 and the amplitude of the 15<sup>th</sup> harmonic of voltage is 0.82 of the dc supply voltage, estimate the THD of the current waveform.

- Q2 Explain the role of a snubber in a power electronic circuit.

- Draw the voltage and current waveforms of the input switch in a Buck converter during turn-on.
- Calculate the energy dissipated during turn-on in a 100 V, 40 A Buck converter. Assume the rise time of the switch is 0.5  $\mu\text{s}$ .
- Explain how an inductor may be used to reduce the turn-on dissipation.

- Q3 Draw the circuit diagram of a three-phase, phase-controlled full converter, sketch the shape of the output voltage.

The speed of a 4 hp, 400 V, 1500 R.P.M. shunt excited dc motor is controlled by a three-phase full converter drive. The ac input is a 3-phase Y-connected 350V (line-line), 50 Hz supply. The armature resistance is  $5\ \Omega$ . The machine constant is 2.1 V-s/r. Calculate

- The phase angle  $\alpha$  at rated power and speed

1 hp = 746 W

- Q4 Write a short note on two of the following power semiconductor devices under the following headings

- Circuit symbol
- Device physics
- Device characteristics
- Device applications

- Unijunction transistor
- Power MOSFET
- Silicon Controlled Rectifier (SCR)