The University of Sheffield
Department of Electrical and Electronic Engineering

EEE117 Homework 7

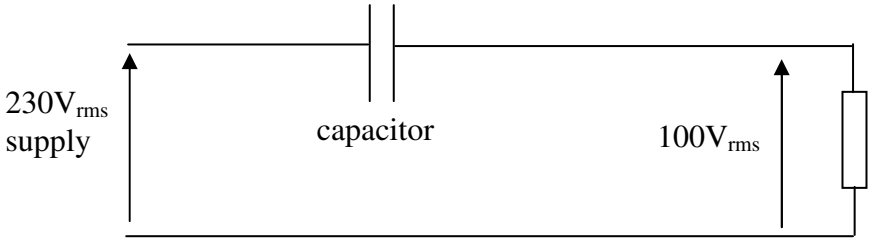
Q1. A pure inductor of value 4H is connected to a time varying current source in which the current varies as $i = 5t^2$.

(a) Derive an expression for the time variation in voltage
(b) Derive an expression for the instantaneous power flowing into the inductor
(c) Calculate the total energy stored in the inductor at the end of the interval t = 0 to t = 3 seconds
(d) Calculate the average power supplied to the inductor over the period t = 0 to t = 3 seconds

Q2. Fill in the blanks in the table for the following loads. Assume phase angle is that of the current with respect the voltage (V< 0°) i.e. positive phase angle means the current leads the voltage.

Volt – Amps	Real Power	Reactive Power	Phase Angle	Power Factor
50 kVA				0.8 lagging
	100 W		+ 45°	
30 MVA	20 MW			(lagging)
	4 kW	−3 kVAR		

Q3. A 100W light bulb, which may be assumed to be a pure resistance, is to be used with a $230V_{rms}$, 50Hz supply. A series capacitor is included in the circuit to reduce the voltage across the bulbs from $230V_{rms}$ to the $100V_{rms}$ required as shown in the figure below.



100W Bulb

(a) Calculate the current required to operate the bulb at its rated voltage and power
(b) Calculate the voltage across the series capacitor (*hint – it is not* $130V_{rms}$)
(c) Hence find the value of capacitor required
(d) Calculate the power-factor of the circuit, and the real and reactive power drawn from the supply.

Answers should be handwritten. Please remember to include your name or registration number on your answer sheet.