Student Name:

1. The figure on the right shows the control circuit of a household product. Calculate the power factor of the entire circuit if the value of the series resistance is $R=200$ ohms. The AC frequency is 50 Hz.

(a) 0.31  (b) 0.54  (c) 0.69  (d) 0.79  (e) ..................

2. Consider an electricity market with two generator companies. The unit cost for the first generator varies with the electricity $P$[kWh] it produces every hour:

Unit cost for generator #1 – $uc_1$[YKR/kWh] = 20 $P$

It is known that the unit cost function for the generator #2 is similar but with an unknown coefficient $x$ as follows:

Unit cost for generator #2 – $uc_2$[YKR/kWh] = $x P$

In a given hour, the total production from both producers is minimised if 20% of the production comes from Generator #1 and the rest from Generator #2. What is the value of $x$?

(a) 13  (b) 30  (c) 80  (d) 5  (e) ..................

3. A coal-fired power plant is using coal with a lower heating value of 30 MJ/kg. The only combustible part in the coal is carbon (C). Estimate the volumetric air fuel ratio (% A/F) if the air intake into the boiler is 1600 kg/s when the plant was generating 1000 MW at a thermal efficiency of 35%.

(a) 201%  (b) 146%  (c) 164%  (d) 183%  (e) ..................

4. The government is considering building a nuclear power plant at an installed capacity level of 800 MWe. The selected reactor design uses uranium fuel at an enrichment level of 3.75%. The electricity is generated through a Rankine cycle heat engine at an efficiency of 40%. Estimate the total daily consumption of uranium fuel in kilograms, assuming all of the fission energy is produced by the fission of the U-235 atoms in the fuel.

(a) 76  (b) 92  (c) 61  (d) 115  (e) ..................

5. A Chernobyl survivor dies in April 2006. The post-mortem examination of the body reveals a total $^{90}$Sr of 0.50 mg. Estimate the amount of $^{90}$Sr ingested by this person at the time of the Chernobyl accident (April 1986).

(a) 0.82  (b) 1.31  (c) 1.15  (d) 0.98  (e) .................