6. (a) The voltage at the terminals of an appliance is 235 volts and the current flowing in the circuit is 15.5 amperes. The supply point is some distance away and the voltage there is 242 volts. Calculate:

i. The power used by the appliance. **(4 marks)**
ii. The power wasted in the cables. **(4 marks)**
iii. The percentage power wasted in the cables. **(4 marks)**

(b) Another appliance takes a current of 12.5 A from a 230 volts supply and there is a 1.5% drop in voltage in the supply cables. Determine:

iv. The voltage drop in the cables. **(3 marks)**
v. The voltage at the consumer's end of the circuit. **(2 marks)**
vi. The resistance of the cables. **(3 marks)**

END OF PAPER

EXAMINATION: AUTHORISATION A

Paper I (Theory) Time Allowed - 3Hrs

February 2017

WRITE ALL YOUR WORK IN THE ANSWER BOOK PROVIDED. EVERY ANSWER SHOULD INCLUDE ALL WORKINGS, NECESSARY DIAGRAMS AND FORMULAE.

START EACH ANSWER ON A FRESH PAGE.

Choose any **FIVE** questions.

1. (a) Define Energy and Power **(2 marks)**

   (b) Calculate the amount of power dissipated by this electric heating element, if the generator's output voltage is 110 volts and the heater's resistance is 2.5 ohms. **(3 marks)**

   (c) Now, calculate the power dissipated by the same heater if the generator's output voltage is doubled. **(3 marks)**

   (d) A tank filled with water of volume 150 litres is to be raised in temperature from 15 °C to 85 °C using a 5 kW heater. Assuming that 15% of the energy is wasted, determine the time that the operation will take. **(12 marks)**

Note: Assume specific heat capacity of water as 4187 J/kg °C

Mass of water as 1 kg/litre

2. (a) Define:
   i. Impedance **(2 marks)**
   ii. Inductive Reactance. **(2 marks)**
   iii. Capacitive Reactance. **(2 marks)**
   iv. Resistance. **(2 marks)**

   (b) A coil of inductance 0.15 Henries and resistance 10 ohms is wired in series with a 60 microfarad capacitor to a 240 volts, 50 Hz supply.

   i. Draw a neat and well labelled diagram of the arrangement. **(2 marks)**
   ii. Calculate the current which flows in the circuit. **(5 marks)**
   iii. The voltage drop across the capacitor. **(5 marks)**

3. (a) List ANY four capacitor types. **(4 marks)**
   (b) With the aid of a diagram explain the construction **capacitor.** **(2 marks)**
   (c) A capacitor network is connected to a d.c. supply as shown in Figure 1.

   Calculate the following:
   (i) The charge drawn from the supply **(6 marks)**
   (ii) The charge on C_3 **(4 marks)**
   (iii) The p.d. across C_1 **(4 marks)**

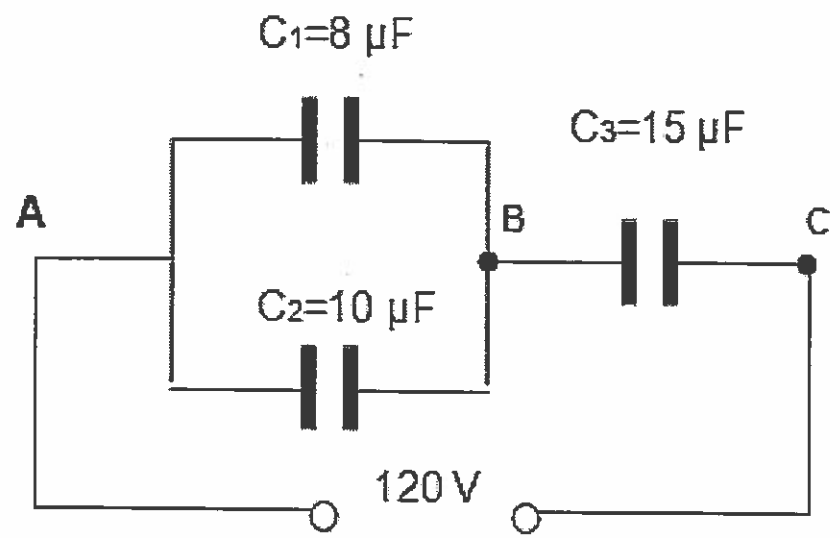

FIGURE 1

4. (a) Define Magnetic flux, Magnetic flux density, Magneto motive force and also state their units. **(9 marks)**

   (b) The maximum working flux density of an electromagnet is 1.9 T and the effective area of a pole face is circular in cross-section. If the total magnetic flux produced is 611mWb, determine the radius of the pole face. **(11 marks)**

5. (a) Explain the meaning of the following terms as applied to an illumination scheme:

   - Utilisation factor, **(2 marks)**
   - Maintenance factor, **(2 marks)**
   - Spacing to Mounting Height ratio **(2 marks)**

   (b) A hall measuring 25m by 45m requires an average illumination of about 400 lux over the horizontal plane. The lighting fittings selected to illuminate the hall are metal halide lamps each rated at 250-Watt. The manufacture catalogue specifies that when the fittings are new, each fitting provides 20,000 lumens. The mounting height of the fittings above the floor will be 4.5m. Assuming a Utilisation factor of 0.6 and a Maintenance factor of 0.85. Calculate,

   i. The number of lighting fitting required to illuminate the hall, **(5 marks)**
   ii. The annual cost of electricity if the lighting fittings are used on average 3 days a week and 4 hours daily. Assume that the hall is supplied from a single phase supply and that the cost of electricity is 17 cents per kWh. **(9 marks)**