6. a) List four different types of capacitors. **(4 marks)**

b) Refer to the figure 2 below.

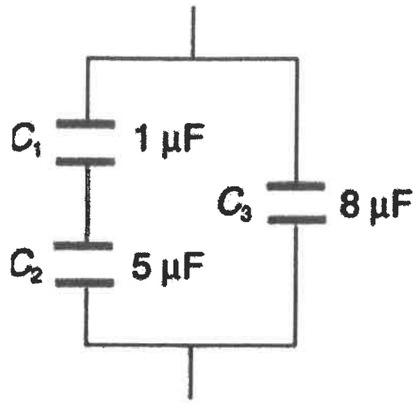

Figure 2

i. Before carrying out the requested calculations, identify which capacitors are in series and those in parallel. **(4 marks)**

ii. Find the total capacitance of the combination of capacitors shown in Figure 2. **(6 marks)**

c) Two capacitors of 4 µF and 5 µF are connected in parallel and charged to 20 Volts. Calculate the charge stored on each capacitor and the total stored energy. **(6 marks)**

Total: 100 marks

END OF EXAMINATION PAPER

GOVERNMENT OF MALTA
MINISTRY FOR EDUCATION AND SPORT
DEPARTMENT OF EXAMINATIONS

EXAMINATION FOR AUTHORISATION A

Supplementary Paper

Paper 1: Theory

Date: 22 February 2022

Time: 09:00 – 12:00 (Three hours)

t + 356 2598 2958 e myexams@gov.mt | www.myexams.gov.mt

This examination paper contains six questions. Candidates are requested to answer any FIVE (5) questions. Candidates are also requested to include all their work in the booklet provided. Every answer should include all workings, any necessary diagrams and formulae. Use a fresh page for each different question. Each question carries 20 marks.

1. A coil of resistance 10 Ω and inductance 150mH is connected in series with a capacitor of 100μF across a 230V, 50 Hz supply.

   a) Draw and label a circuit diagram showing the above-mentioned configuration. **(3 marks)**

   b) For this circuit calculate:

      i. the current flowing in the circuit; **(6 marks)**

      ii. the phase difference between the supply voltage and the current; **(3 marks)**

      iii. the voltage across the coil; **(3 marks)**

      iv. the voltage across the capacitor. **(2 marks)**

   c) Sketch a phasor diagram showing all the voltages across the circuit. **(3 marks)**

2. a) State Ohm's law as applied to a direct current (D.C.) circuit. **(3 marks)**

   b) For the circuit shown below in Figure 1 calculate:

      i. the value of the resistor Rx such that the total power dissipated in the circuit is 2.5 kW; **(9 marks)**

      ii. the current flowing in each of the four resistors. **(8 marks)**

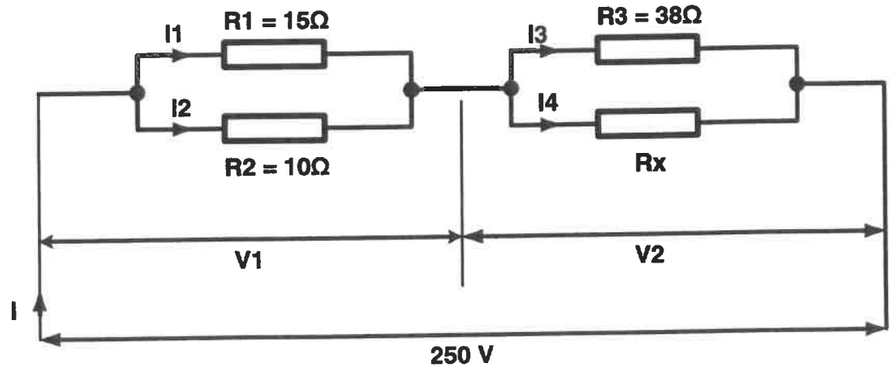

Figure 1

3. Four cells are joined in two parallel groups, each group consisting of two cells in series. The e.m.f of each cell is 1.5V and the internal resistance of each cell is 3 ohms. The combination is connected to an external resistance of 3 ohms.

   a) Draw a neat and well-labelled diagram of the arrangement. **(5 marks)**

   b) Calculate the total current in the circuit. **(5 marks)**

   c) Calculate current through each cell. **(5 marks)**

   d) Calculate the voltage across the external resistance. **(5 marks)**

4. A two-core cable 150m long supplies a load of 44 kW at 240 volts. The cross-sectional area of each core of the cable is 120 mm^2.

   a) Calculate the voltage drop in the cable. **(10 marks)**

   b) Find the size of copper cable of the same length which is needed to reduce the voltage drop to one half of the value found in (a). Assume the resistivity as 17.5 μΩ mm. **(10 marks)**

5. a) i. List two advantages of auto transformers over double-wound transformers. **(4 marks)**

      ii. State the main disadvantage of auto transformers. **(4 marks)**

      iii. Draw a well-labelled diagram for a double-wound transformer and that for an auto transformer. **(6 marks)**

   b) A single-phase auto transformer has a voltage ratio 320 V:250 V and supplies a load of 20 kVA at 250 V. Assuming an ideal transformer, determine the current in each section of the winding. **(6 marks)**