6. (a) Write down the e.m.f. equation of a transformer and briefly explain its terms. **(5 marks)**

(b) The maximum flux density in the core of a 240/3000 volt, 50 hertz transformer is 1.25 Wb/m2. If the e.m.f. induced per turn is 8 volts, find:

i. the net cross-sectional area of the core. **(5 marks)**
ii. the number of turns on the primary. **(5 marks)**
iii. the number of turns on the secondary. **(5 marks)**

Total: 100 marks

END OF EXAMINATION PAPER

DEPARTMENT OF EXAMINATIONS
THE MALL, SARRIA STREET. FLORIANA. MALTA

Examination for Authorisation B

Paper 1: **Theory**

Date: **04 February 2020**

Time: **09:00 – 12:00 (Three hours)**

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. An RLC circuit is made up of a 50Ω resistor, a 20mH coil and a 5μF capacitor which are all connected in parallel across a 50V, 100Hz supply.

   (a) Sketch the RLC circuit. **(2 marks)**

   Calculate:

   (b) the total current drawn from the supply. **(3 marks)**
   (c) the current flowing in each branch. **(6 marks)**
   (d) the circuit impedance. **(5 marks)**
   (e) Draw the current and admittance triangles representing the circuit. **(4 marks)**

2. (a) State Kirchhoff `s laws as applied to an electrical circuit. **(4 marks)**

   (b) For the circuit shown in Figure 1 below and use Kirchoff`s laws to find:

   i. the current flowing in resistor X which is equal to 3Ω. **(6 marks)**

   ii. the current flowing in the 6Ω resistor. **(4 marks)**

   iii. the current flowing in resistor Y which is equal to 1Ω. **(6 marks)**

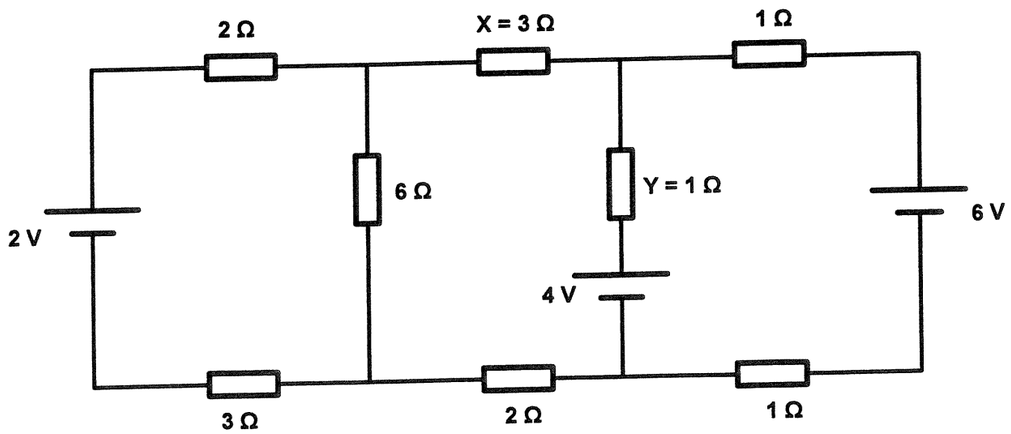

Figure 1

3. A three-phase 400 volts star connected generator supplies a three phase, 75kW, mesh connected induction motor. The motor has an efficiency of 90% and is running at a power factor 0.85.

   (a) Draw a diagram showing this configuration. **(5 marks)**

   (b) Calculate the current:

   i. in each motor phase **(3 marks)**

   ii. in each generator phase **(2 marks)**

   iii. Find the active and reactive component of the motor phase current. **(5 marks)**

   iv. Find the active and reactive component of the generator phase current. **(5 marks)**

4. (a) State the advantages and disadvantages between the following:

   i. series, shunt and compound DC motors

   ii. squirrel-cage and wound-rotor induction motor **(12 marks)**

   (b) A 240 Volt shunt motor takes a total current of 30 amps. If the field winding resistance R_f = 150 Ω and the armature resistance R_a = 0.4Ω, calculate:

   i. the current in the armature **(4 marks)**

   ii. the back e.m.f. **(4 marks)**

5. A brake test on a d.c. motor yielded the following results:

   Electrical input

   Terminal voltage = 460 Volts
   Supply current = 18.9 Amperes

   Mechanical output from brake test

   Diameter of brake pulley = 0.4 m
   Nett Brake load = 320 Newtons
   Speed = 950 rev/minute

   Calculate:

   i. the torque. **(5 marks)**
   ii. the mechanical output. **(5 marks)**
   iii. the electrical power. **(5 marks)**
   iv. efficiency of the motor. **(5 marks)**