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. It is required to raise the temperature of a swimming pool containing 80,000 litres of water from 12 degrees Celsius to 25 degrees Celsius in 24 hours. The average losses from the pool and all its associated equipment is 26,000 kJ per hour. Determine the minimum size of water heater required. The specific heat capacity of the water may be taken as 4.2 kJ/kg°C. **(20 marks)**

2. A moving coil instrument gives full scale deflection with a current of 1.8 mA, and its coil has resistance of 54 ohm. Determine:
   a. The value of the multiplier required to produce a voltmeter reading up to 100V. **(10 marks)**
   b. The value of the shunt required to convert the instrument to an ammeter reading up to 10 amperes. **(10 marks)**

3. A supply voltage of 230V at a frequency of 50Hz is applied to a series circuit consisting of a resistance of 10 ohms, a coil of inductance 0.2 Henries and a capacitor of 20 microfarads. Calculate:
   i) The current in the circuit. **(5 marks)**
   ii) The voltage across each component. **(6 marks)**
   iii) The power factor of the circuit. **(2 marks)**
   iv) The total power. **(2 marks)**
   v) Draw the phasor diagram. **(5 marks)**

4a. Draw a circuit diagram using the correct symbols showing the correct connection of the +ve and –ve terminals for three rows of batteries connected in parallel supplying an external load. (Indicate the conventional electron flow of current). **(4marks)**

b. A battery consisting of 10 cells joined together in series. Internal resistance of each cell is 0.02Ω and e.m.f. 1.2volts. The resistance of the external load is 0.5Ω.
   i) Find the currents flowing in the circuit. **(6marks)**
   ii) If a battery of 10 cells connected in series has two of its cells wrongly connected i.e. reversed. What is the reduction of the current due to its wrong connection? **(10marks)**

5a. A 250W sodium vapour lamp is installed on a pole, 10m above the road as shown in Figure 5.1. The luminous intensity of the lamp is 22500cd in all directions.

Calculate the illuminance:
i) at the foot of the pole directly underneath the lamp, point A. **(4 marks)**
ii) at a point 5m to the left away from the foot of the pole, point B. **(4 marks)**
iii) at a point 6m to the right away from the foot of the pole, point C. **(4 marks)**

b. A new similar lamp is to be installed on a pole, having the same height, some metres away from the existing lamp so that the illumination under each lamp, at the foot of each pole, is 300 lux. Calculate the distance between the two poles to achieve the required illumination. **(8 marks)**

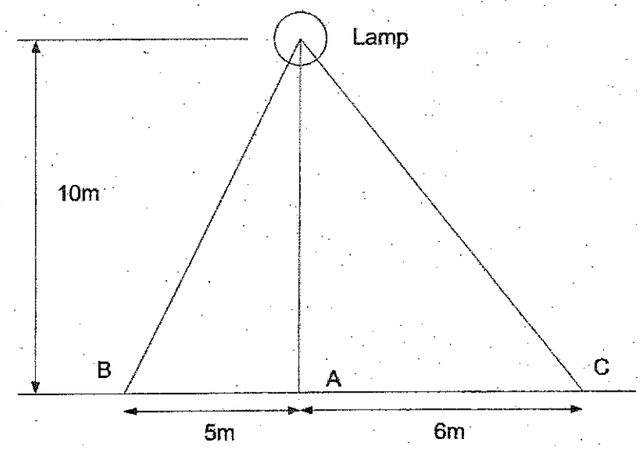

Figure 5.1

6a. Define Faraday's Law of electro-magnetic induction (hint: e=Blv). **(4 marks)**
b. A conductor 250mm long traverses a magnetic field of flux density 0.8T at right angles. Choose six values of velocity from 5 to 10m/s. Calculate:
   i) The induced e.m.f. in each case and **(4 marks)**
   ii) Plot a graph showing the e.m.f. against velocity. **(8 marks)**

c. The total magnetic flux in the air –gap of a solenoid is 0.15mWb and the cross-sectional area of the gap is 200mm^2. Calculate the flux density. **(4 marks)**

END OF PAPER

BLANK PAGE

EXAMINATION FOR THE ISSUE OF A LICENCE TO ACT AS WIREMAN - LIC 'A'

Paper I (Theory) Time Allowed - 3Hrs

June 2012