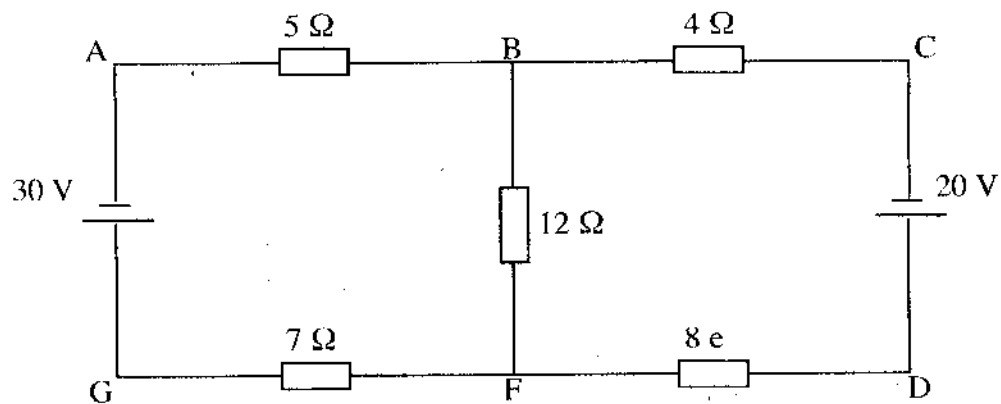


## SECTION A

Answer **ALL** the questions from this section.

1. (a) State the effect of rise in temperature on the Resistance of the following:
- pure metals;
  - alloys;
  - insulators.
- (3 marks)
- (b) With the aid of a diagram, show that the equivalent Resistance ( $R$ ) of two resistors,  $R_1$  and  $R_2$  connected in parallel across a source of supply is given by  $R = \frac{R_1 R_2}{R_1 + R_2}$ .
- (5 marks)
- (c) **Figure 1.0** shows a resistive Network. Using Kirchoff's laws determine the:
- current in each branch;
  - power dissipated in the  $7 \Omega$  resistor;
  - energy absorbed by the  $12 \Omega$  resistor in  $1\frac{1}{3}$  hours.
- (12 marks)



**Figure 1.0**

2. (a) State Lenz's law.
- (2 marks)
- (b) Define the following terms as used in magnetic circuits:
- magnetomotive force;
  - relative permeability.
- (2 marks)

- (c) (i) With the aid of hysteresis loops, distinguish between soft and hard magnetic materials.
- (ii) Two identical coils have a resultant inductance of 27H when connected in series aiding and 15H when connected in series opposing. If the coupling coefficient between them is 0.52, determine the:
- (I) Mutual Inductance between them;  
 (II) Self Inductance of each coil.
- (16 marks)
3. (a) Differentiate between low pass and high pass filters. (2 marks)
- (b) A Hartley oscillator is designed with inductances  $L_1 = 2\text{mH}$ ,  $L_2 = 20\ \mu\text{H}$ , and a variable capacitor. Determine the range of capacitances if the frequency of oscillation is varied between 950 kHz and 2050 kHz. (6 marks)
- (c) (i) Convert the following:
- (I)  $32_{10}$  to Binary;  
 (II)  $1110111_2$  to Octal.
- (ii) Evaluate the following:
- $1101_2 + 11011_2$  (6 marks)
- (d) (i) Use Demorgan's theorem to simplify:  
 $F = (\overline{AB} + BC)D$
- (ii) Draw the symbols of the following logic gates:
- (I) NOR  
 (II) OR. (6 marks)
4. (a) (i) Compare the properties of Acids and Bases.
- (ii) Explain using a chemical equation, the meaning of the term NEUTRALIZATION. (6 marks)
- (b) (i) State the laws of Reflection of light.
- (ii) Define the term "Sound pressure level". (5 marks)

- (c) An experiment was carried out to investigate the performance of a single string pulley system with a velocity ratio of 5. The results obtained were as shown in Table 1.0.

Load (N)	50	100	200	300	400	500	600
Effort (N)	30	45	65	85	105	125	145

Plot a graph of load (N) against Effort (N) and determine:

- (i) mechanical advantage;
- (ii) efficiency corresponding to a load of 450 N.

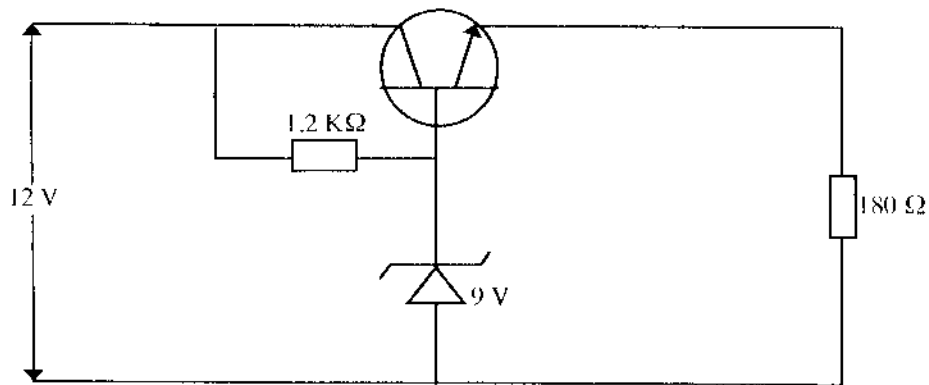
(9 marks)

### SECTION B

*Answer only ONE question from this section.*

5. (a) (i) Define the term Electric Field Intensity as applied in electrostatics.
- (ii) Derive an expression for the total capacitance of three capacitors connected in parallel across a source of supply.
- (6 marks)
- (b) Two capacitors A and B are connected in series across a 100 V supply. The potential drops across them are 60 V and 40 V respectively. A capacitor of  $2 \mu\text{f}$  capacitance is then connected in parallel with A and p.d across B rises to 90 V. Determine the capacitance of A and B in microfarads.
- (7 marks)
- (c) (i) Derive an expression for energy stored in a capacitor.
- (ii) A parallel - plate capacitor with plates of Area  $40 \text{ cm}^2$  and a spacing between them of 5 cm, is charged to 100 V. The dielectric is free space. Determine the force of attraction between the two plates.
- (7 marks)
6. (a) State:
- (i) Faraday's first law of electrolysis;
- (ii) **four** indicators of a fully charged cell.
- (6 marks)
- (b) (i) With aid of a circuit diagram, explain the constant current method of charging a battery.
- (ii) Outline any **three** precautions to be considered during the maintenance of cells.
- (14 marks)

7. (a) (i) State any **two** applications of semiconductor diodes.  
 (ii) Differentiate between zener and avalanche breakdown in zener diodes. (6 marks)
- (b) With aid of a diagram, explain the PNP common emitter transistor configuration. (6 marks)
- (c) **Figure 2.0** shows a transistor voltage regulator. If  $V_{BE} = 0.3 \text{ V}$ , determine the:  
 (i) load voltage ( $V_L$ );  
 (ii) emitter current ( $I_E$ );  
 (iii) collector emitter voltage ( $V_{CE}$ );  
 (iv) power dissipated by the transistor. (8 marks)



**Figure 2.0**

8. (a) (i) Explain the BOHR Theory;  
 (ii) State **three** limitations of a(i). (7 marks)
- (b) (i) Write the Electronic Configuration of the following elements.

Element	Atomic Number
Ne	10
Kr	36
Xe	54

- (ii) State **three** classifications of chemical bonds. (6 marks)