

GAUTENG DEPARTMENT OF EDUCATION  
SENIOR CERTIFICATE EXAMINATION

ELECTRONICS SG

TIME: 3 hours

OCTOBER / NOVEMBER 2005  
OKTOBER / NOVEMBER 2005

MARKS: 200

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**INSTRUCTIONS:**

- Answer ALL the questions.
  - Sketches and diagrams must be large, neat and labelled.
  - All calculations must be shown.
  - Answers must be clearly numbered.
  - An approved pocket calculator may be used.
  - An information sheet, which may be used when applicable, is given on pages 8 to 11 of the question paper.
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**QUESTION 1**  
**ELECTRICAL CURRENT THEORY**

- 1.1 A series circuit consists of a resistance of  $20 \Omega$ , an inductance of  $0,1 \text{ H}$  and a capacitor of  $40 \mu\text{F}$ , and is connected to a  $100 \text{ V}/100 \text{ Hz}$  supply.
- 1.1.1 Sketch a neat, labelled diagram of the circuit. (4)
- 1.1.2 Calculate the
- (a) reactance of each component. (6)
  - (b) total impedance of the circuit. (4)
  - (c) total current flow. (3)
  - (d) voltage drop across each component. (9)
  - (e) phase angle. (3)
  - (f) true power in the circuit. (3)
- 1.1.3 Sketch a labelled phasor diagram for the circuit. (5)
- 1.2 Name THREE conditions at which series resonance occurs. (3)

**[40]**

**QUESTION 2**  
**THREE-PHASE ALTERNATING-CURRENT SYSTEMS**

2.1 Calculate, with reference to the circuit diagram in Figure 2.1, the

- 2.1.1 phase voltage. (1)  
 2.1.2 phase current. (7)  
 2.1.3 line current. (7)

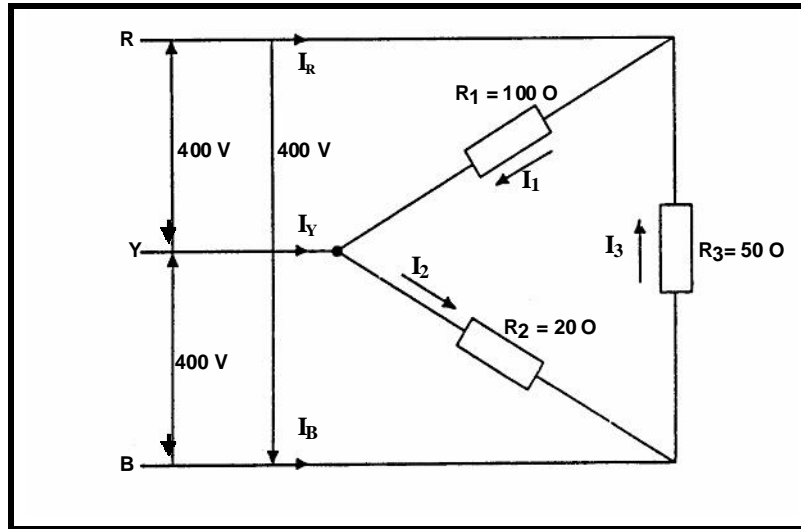


Figure 2.1

[15]

**QUESTION 3**  
**SEMICONDUCTORS**

- 3.1 Sketch a neat, labelled characteristic curve of a silicon-controlled rectifier (SCR). (8)  
 3.2 Sketch a transistor connected in the common-emitter configuration. Input and output waveforms must be shown. Also indicate the properties of this transistor when coupled in this mode. (10)  
 3.3 Draw an operating circuit of a simple Zener-diode regulator. (6)

[24]

**QUESTION 4**  
**AMPLIFIERS**

- 4.1 The push-pull amplifier is classed as a class B amplifier, and is used in the final stage of power amplification in sound systems. Sketch a fully labelled circuit diagram for this amplifier, and explain its operation for the positive and negative half cycles of an input wave. All relevant wave forms must be shown. (20)

- 4.2 Determine by means of calculations and a neatly labelled sketch, the load-line for the circuit shown in Figure 4.2.

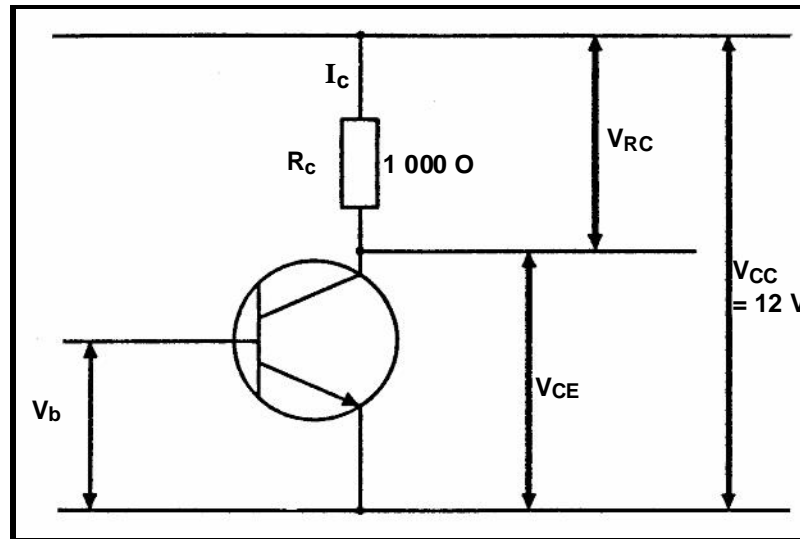


Figure 4.2

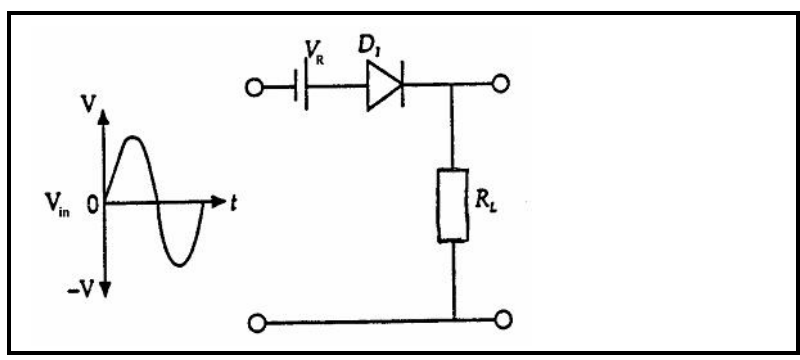
(10)  
[30]

### QUESTION 5 SWITCHING AND CONTROL CIRCUITS

- 5.1 Explain, with the aid of a neatly labelled circuit diagram and brief description, how the brightness of a lamp can be controlled by making use of thyristors. (11)
- 5.2 Explain by means of a neatly labelled circuit diagram and brief description, the working principle of an integrating circuit. Input and output waveforms should be shown. (8)
- 5.3 Clippers and clampers are diode wave-shaping circuits that transmit parts of waveforms and suppress others to a pre-determined value.

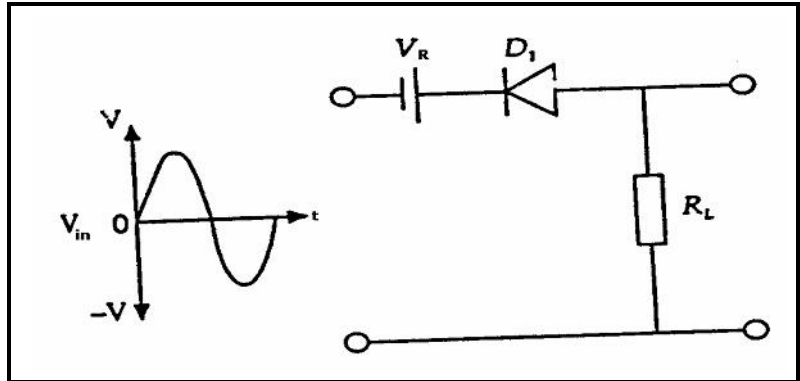
Find the output-voltage wave shapes for the inputs shown in Figure 5.3 (only sketch the output-voltage wave shapes in your answer book).

5.3.1



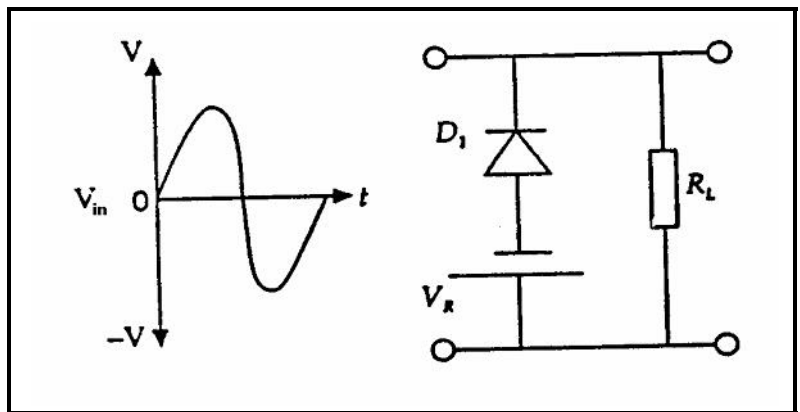
(3)

5.3.2



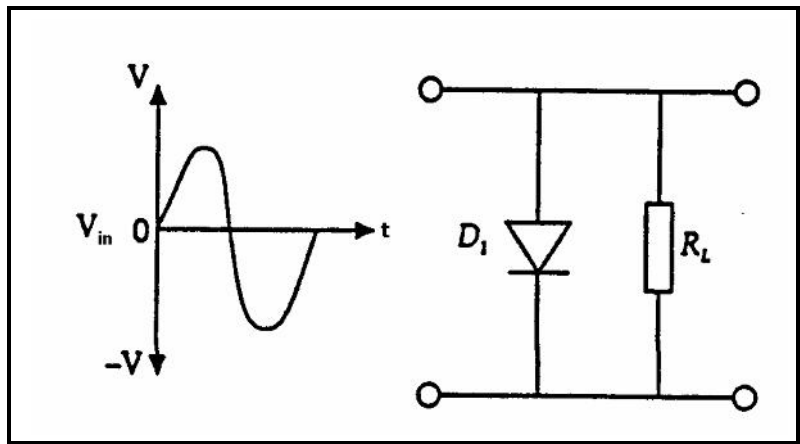
(3)

5.3.3



(2)

5.3.4



(3)

FIGURE 5.3 WAVE-SHAPING CIRCUITS

[30]

P.T.O.

### QUESTION 6 OSCILLATORS

Explain, with the aid of a neatly labelled circuit diagram and brief description, the operating principle of the Hartley oscillator.

[14]

### QUESTION 7 COMPUTER PRINCIPLES

7.1 Computers consist of large numbers of logic gates and memory elements organised to process data at high speed. To identify these logic circuits it is necessary to know their symbols. Sketch the symbol and indicate the truth table of the following gates:

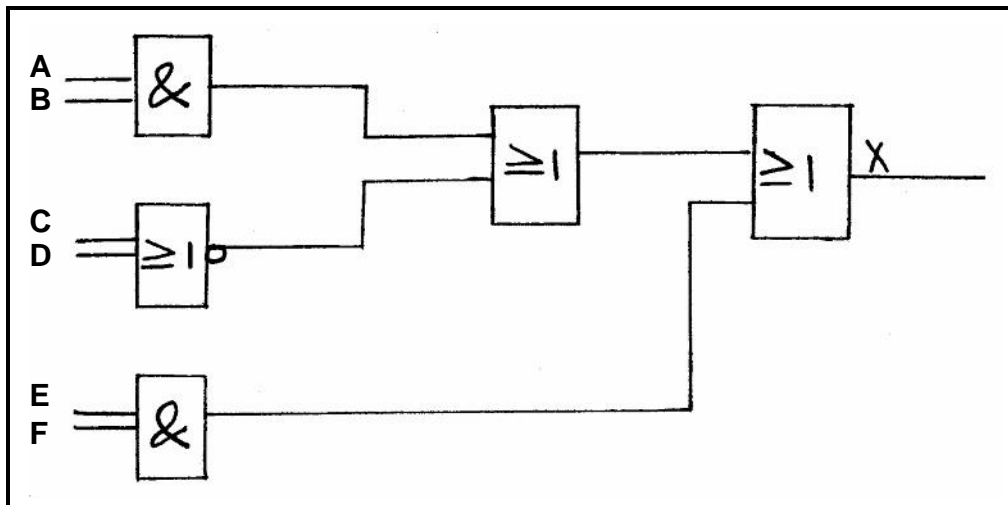
7.1.1 AND gate

(6)

7.1.2 NOR gate

(6)

7.2 Indicate the Boolean expression for the logic circuit in Figure 7.2. Write only the answer in your answer book.



(5)

Figure 7.2 Combination diagram of logic gates

7.3 Draw a combination diagram of logic gates presented by the following Boolean expression:

$$X = (ABC + CD).(EF)$$

(6)

7.4 Simplify the following Boolean expression:

$$X = (A + B) + (A + B)$$

(7)

[30]

**QUESTION 8**  
**ELECTRONIC DEVICES**

Describe the operating principle of the AM radio-frequency receiver by means of a neat, labelled, block diagram. All relevant waveforms should be indicated.

**[10]**

**QUESTION 9**  
**SAFETY PRECAUTIONS**

9.1 Explain THREE ways in which HIV/AIDS can be spread from one person to another.

(3)

9.2 Name FOUR workshop safety precautions that were applied in your workshop this year.

(4)

**[7]**

**TOTAL: 200**