

Control, PICs and Neural Network revision.

1). (a) A Control System can be described as Open or Closed loop. Explain what is meant by:-

(i) an Open loop control system

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(2)

(ii) a Closed loop control system

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(b) (i) Give an example of an Open loop control system and explain why it is classed as Open loop.

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(2)

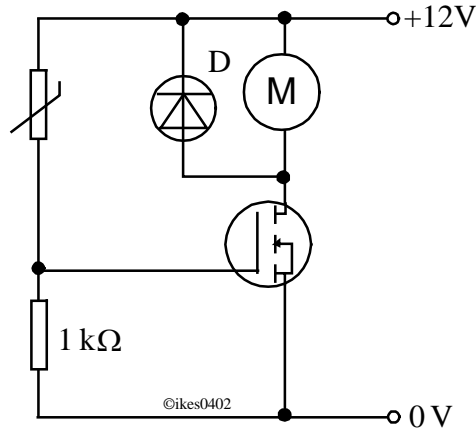
(ii) Give an example of a Closed loop control system and explain why it is classed as Closed loop.

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- (c) By the side of each of the following systems identify whether they are Open or Closed Loop systems:
- (i) a water tap.....
 - (ii) a toilet cistern.....
 - (iii) a security light which switches on in the dark.....
 - (iv) a tropical fish tank heater control system.....
 - (v) an automatic kettle.....
 - (vi) a light switch.....
 - (vii) the cooling system in a freezer.....
 - (viii) paper feed system on a modern printer.....
- (8)
- (d) A closed loop system employs feedback, which can be negative or positive.
- (i) Explain what is meant by negative feedback.
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- (2)
- (ii) Explain what is meant by positive feedback.
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- (2)
- (iii) Briefly describe a control system that uses negative feedback
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- (2)
- (iv) Briefly describe a control system that uses positive feedback
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- (2)

(e) The circuit diagram below controls the cooling fans within a computer system.



(i) Label the gate, source and drain of the MOSFET. (3)

(ii) State the approximate turn on voltage for a MOSFET (1)

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(iii) Using your turn on voltage, calculate the maximum resistance of the thermistor that will turn on the fan. (2)

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(iv) At what temperature does the fan turn on? (1)

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(v) Explain how you would change the temperature at which the fan switches on. (2)

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(vi) Explain the function of the diode. (2)

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- (vii) By describing the operation of this system, explain whether this is an Open or Closed loop system.

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- (viii) State two important advantages of a MOSFET compared with a transistor in this application.

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- (f) This system has some problems. When the temperature is only slightly above room temperature the fan rotates very slowly causing local heating of the fan motor. It is therefore decided to modify the circuit so that the fan is either fully on or fully off.

- (i) In the space below draw the circuit diagram of how you would modify the circuit to produce this change. Use an op-amp and any other components that you need.

(5)

- (ii) Explain how your circuit works.

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(3)

- (iii) The circuit is tested and performs as required except for when the temperature is at the switching temperature for the system, when it is observed that the fan again rotates slowly.
Explain why this occurs.

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- (iv) To overcome this problem it is necessary to introduce Hysteresis into the temperature control system. Explain what is meant by hysteresis.

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- (v) Explain briefly, how you would introduce hysteresis into this system.

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2). With the mass production of microcomputer controllers, most domestic electrical appliances are now fitted with these devices because they are very cheap and can be readily customised.

(a) The essential sub-systems of any microcomputer controller are listed below. Write by the side of each its function

(i) clock

(ii) the processor

(iii) RAM

(iv) ROM

(v) input port

(vi) output port

(6)

(b) These sub-systems are linked by buses.

(i) What is a bus?

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(1)

(ii) What is the purpose of the data bus?

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(1)

(iii) What is the purpose of the address bus?

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(1)

(iv) What is the purpose of the control bus?

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(1)

(v) Explain how does the data bus differ from the other two buses.

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(1)

- (c) In the space below draw a labelled diagram to show how the sub-systems of the computer controller are linked by the buses.

(d) A tristate buffer links the input port to the data bus. (6)

- (i) Explain what is meant by a *tri-state buffer*.

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- (ii) Why is a tri-state buffer essential in this application (2)

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(e) (i) What device is required to link the data bus to the output port? (2)

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- (ii) Why is this device required in this application? (2)

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(f) Input and output ports can be either memory mapped or IO mapped. (2)

- (i) Explain what is meant by memory mapping.

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(ii) Explain how IO mapping differs from memory mapping.

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(2)

(g) Most domestic appliance controllers are either PICs or AVR.

(i) Briefly describe the structure of a PIC/AVR.

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(ii) State and explain two advantages of PICs/AVRs over conventional microprocessor control systems.

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(2)

(iii) State and explain two advantages of PICs/AVRs over traditional control systems.

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(iv) State and explain two effects that the use of PICs/AVRs in domestic appliances has had on the social and economic life of people.

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- (h) While researching computer control systems on the Internet, a student finds references to Neural Networks as being the latest form of control system.
 - (i) State and explain three ways in which a Neural Network differs from a conventional computer system

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(3)

- (ii) Explain, briefly, how a Neural network is programmed.

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(3)

- (iii) Briefly describe two applications for which a Neural Network is ideally suited.

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(2)

- (iv) Briefly describe two applications for which a Neural Network is unsuited.

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- (v) Describe two ways in which Neural Networks are influencing the social and economic life of people.

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- (vi) Suggest two ways in which Neural Networks will affect our lives in the future.

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