Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Q1.

(a) A piezoelectric ultrasound transducer is made from a thin slice of an artificial ceramic such as lead zirconate titanate (PZT).

(i) Describe what happens when an alternating voltage is applied to a PZT transducer so that ultrasound is produced.

_____

_____

_____

_____

(ii) Under what conditions will maximum energy conversion into ultrasound occur?

_____

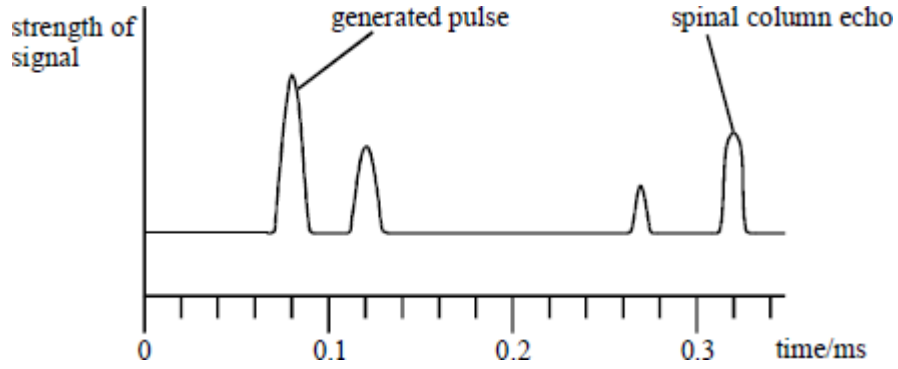
_____

_____

_____

(4)

(b)



The diagram shows the oscilloscope display of pulse amplitude against time for an ultrasound A-scan through a person's abdomen. Assume that the weaker echoes come from internal organs.

(i) Describe the procedures which are used to obtain this type of scan.

_____

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(ii) Explain how the spacing of the pulses is interpreted.

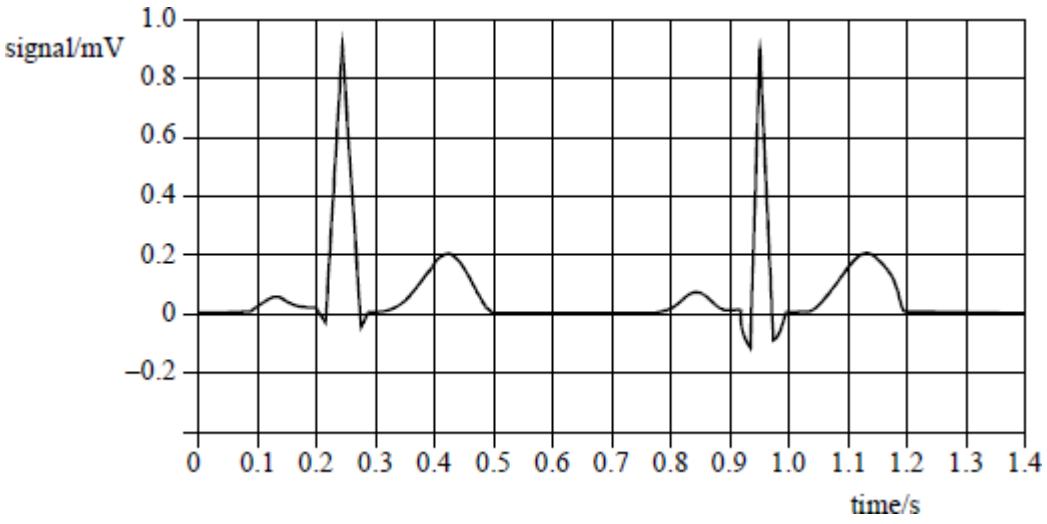
(iii) Give **two** reasons why the amplitude of the reflected pulses varies.

(iv) If the speed of ultrasound through water and soft tissue is about 1500 m s^{-1}, estimate the distance between the front of the patient's abdomen and the spinal column.

(8)

(Total 12 marks)

Q2.



The graph above shows a normal electrocardiogram (ECG) signal obtained at the surface of the skin

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of a patient.

(a) What is the amplitude of the main pulse in the signal?

_____

(1)

(b) Find the period of the heart beat and from it calculate the pulse rate per minute.

_____

_____

_____

_____

(2)

(c) What changes would you expect to see in the electrocardiogram if the patient began to take exercise?

_____

_____

_____

(2)

(d) On the graph, label with a P the points where atrial contraction occurs and with a Q the points where ventricular contraction starts.

(2)

(Total 7 marks)

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