

Name of the Student: _____

Max. Marks : 20 Marks

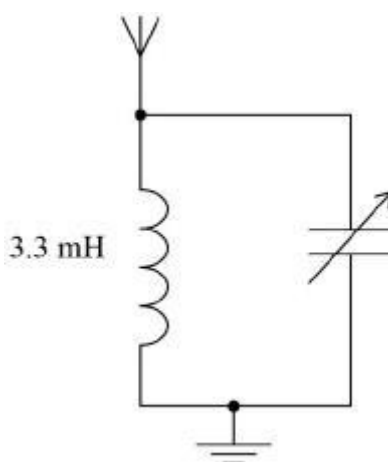
Time : 20 Minutes

Q1.

Figure 1 shows the filter circuit that forms the first stage in an amplitude modulated (AM) radio receiver.

The circuit contains a 3.3 mH inductor and a variable capacitor.

Figure 1



- (a) The circuit is tuned to receive a radio station transmitting at a frequency of 1053 kHz.

Calculate the value of the capacitance needed to receive this station.

capacitance = _____ pF

(1)

- (b) The circuit is retuned to receive a different radio station by setting the variable capacitor to a value of 9.3 pF.

The table shows the capacitance range of four variable capacitors **W**, **X**, **Y** and **Z**.

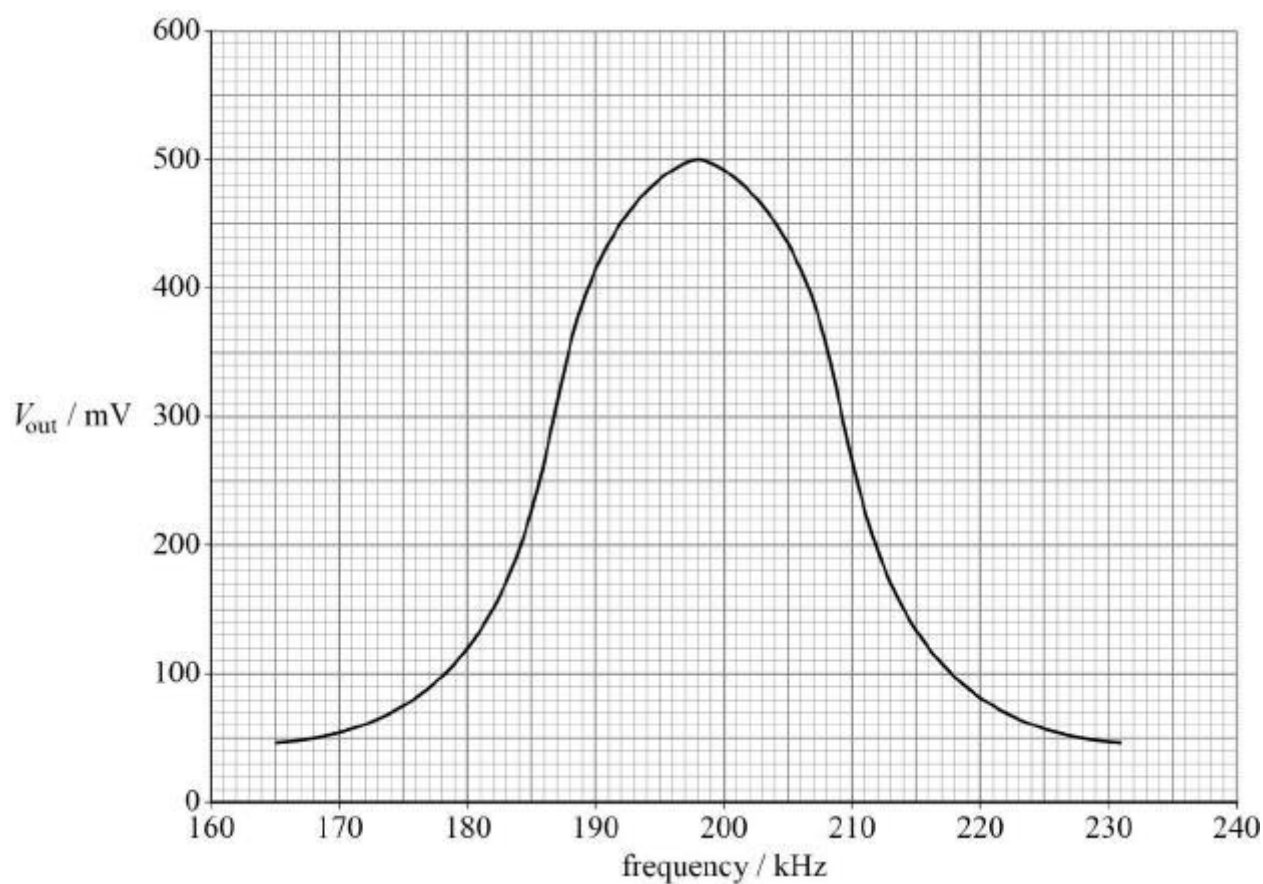
Comment on the suitability of these capacitors for this application and state your preference.

Capacitor	Range / pF
W	2–9
X	3–10
Y	4.5–20
Z	10–50

(2)

- (c) **Figure 2** shows part of the frequency response curve for a different filter circuit.

Figure 2



Determine the bandwidth of the filter circuit.

bandwidth = _____ kHz
(2)

- (d) Calculate the Q factor of the filter circuit in part (c).

Q factor = _____
(1)

- (e) The radio station is tuned using a different filter circuit with a very low Q factor.

State and explain **one** effect of this change on the sound heard by a listener.

(1)
(Total 7 marks)

Q2.

Pulse code modulation (PCM) is used to encode live music as an uncompressed digital audio file. Sampling of the analogue signal is carried out at 44.1 kHz. A 16-bit system is used to encode each of the two channels that make up the stereo signal.

- (a) Explain why the sampling frequency used is suitable for this task.

(2)

- (b) Calculate the number of quantisation levels available on a 16-bit encoding system.

number of quantisation levels = _____

(1)

- (c) A recorded piece of stereo music lasts for 3.5 minutes.

Calculate the size, in megabytes, of the digital file needed to store this recording.

file size = _____ megabytes

(2)

- (d) The music file is used by a call centre to play as background music while a phone call is on hold. However, the telephone network is designed to use a bandwidth of 0.3 kHz – 3.4 kHz.

Compare the quality of the music heard by the telephone caller with that of the original file heard when played directly from a compact disc.

(2)

(Total 7 marks)

Q3.

British embassies in Europe are to be connected to a new long-distance communication link. The link, in the form of a land-based cable, will support multiple simultaneous video conferencing as well as the transmission of sensitive government data.

The company installing the link has to consider the choice between using optic fibre or copper wire in the cables.

Compare the advantages and disadvantages of the two options for use in these cables. State which option you would advise the company to use.

For both types of cable refer to their:

- physical properties
- ability to reject external interference
- signal-carrying properties.

(Total 6 marks)