

1522/205
1602/205
TELECOMMUNICATION SYSTEMS
Oct./Nov. 2022
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

**CRAFT CERTIFICATE IN ELECTRICAL AND ELECTRONIC TECHNOLOGY
(TELECOMMUNICATION OPTION)
MODULE II**

TELECOMMUNICATION SYSTEMS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Non-programmable Scientific calculator/Mathematical tables;

Drawing instruments.

This paper consists of EIGHT questions in THREE sections; A, B and C.

Answer any THREE questions from section A, ONE question from section B and ONE question from section C, in the answer booklet provided.

All questions carry equal marks.

Maximum marks for each part of a question are as indicated.

Candidates should answer the questions in English.

This paper consists of 7 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

SECTION A: RADIO SYSTEMS

Answer any **THREE** questions from this section.

1. (a) Define each of the following as applied to radio receivers:

- (i) adjacent channel ratio;
- (ii) tracking.

(4 marks)

(b) Figure 1 shows a circuit diagram of a transistor mixture used in a radio receiver.

(4 marks)

Describe its operation.

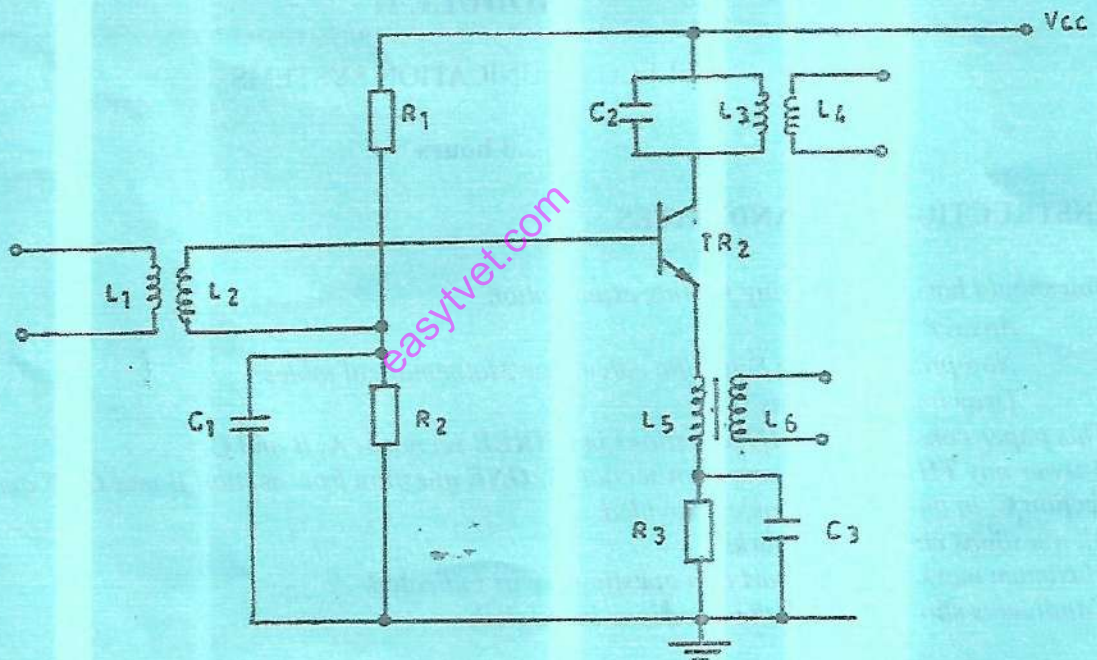


Fig.1

(c) (i) Draw a circuit diagram of a ratio detector used in FM radio receivers.

(ii) State two merits of the detector in (c) (i).

(6 marks)

- (d) A radio receiver with intermediate frequency of 465 kHz is required to tune over a range of 600 kHz to 1800 kHz with a ganged variable capacitor having a range of 320 pF per section.
Determine the:

- (i) minimum capacitance required in the RF circuit;
- (ii) inductance required in the RF circuit.

(6 marks)

- (2) (a) With the aid of a labelled amplitude modulated waveform, show that the modulation index, m is given by:

$$m = \frac{V_{\max} - V_{\min}}{V_{\max} + V_{\min}}$$

(8 marks)

- (b) A 500 kHz carrier wave is amplitude modulated by a 1 kHz audio signal. Determine the:

- (i) upper sideband frequency;
- (ii) lower sideband frequency;
- (iii) bandwidth.

(6 marks)

- (c) Draw a labelled block diagram of an FM transmitter.

(6 marks)

3. (a) (i) Differentiate between selective fading and general fading as applied to wave propagation.

- (ii) With the aid of sketches, explain each of the following;

- (I) skip distance;
- (II) front-to-back ratio.

(10 marks)

- (b) State three modes in which radio waves can be propagated from the transmitting aerial to the receiving aerial.

(3 marks)

- (c) (i) Define radiation pattern as applied to aerials.
- (ii) Sketch a labelled radiation pattern of a $\frac{\lambda}{2}$ vertical dipole in the horizontal plane and state what this pattern means.
- (iii) State how the directivity of a $\frac{\lambda}{2}$ dipole aerial can be increased.

(7 marks)

4. (a) Figure 2 shows block diagram of a stereophonic FM transmitter. State the function of each block. (6 marks)

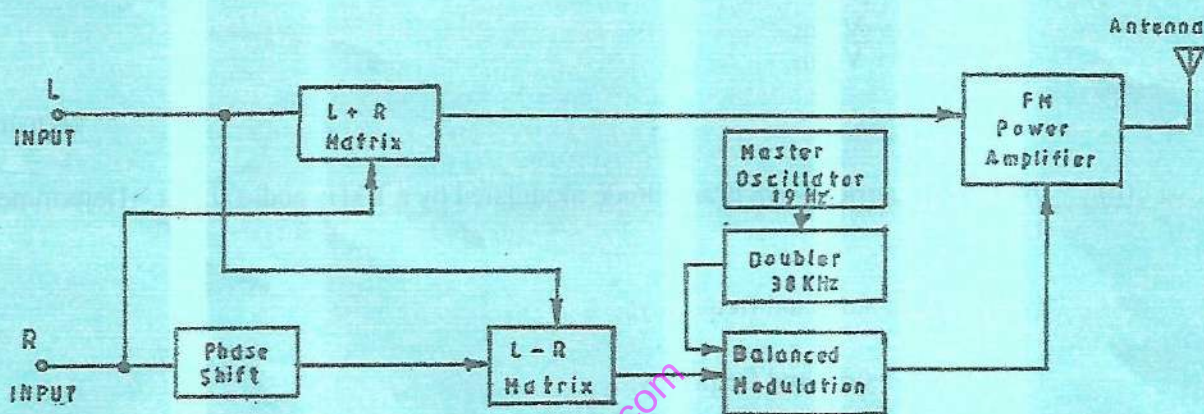


Fig.2

- (b) An AM radio receiver has a local oscillator of frequency of 455 kHz. Determine frequencies produced by a mixer assuming an R.F input of 1000 kHz. (4 marks)
- (c) (i) With the aid of waveforms, explain overmodulation as applied to modulation.
- (ii) A 100 W carrier wave is modulated to a level of 80%. Determine the:
- (I) carrier power after modulation;
 - (ii) sideband power.
- (7 marks)
- (d) (i) Define the term "demodulation".
- (ii) State one advantage of sending audio signals using high frequency carrier wave. (3 marks)

SECTION B: TV FUNDAMENTALS

Answer any ONE question from this section.

5. (a) Define each of the following as used in TV systems:

- (i) frame;
- (ii) field blanking.

(4 marks)

(b) (i) Sketch the waveforms at the following sections of a TV receiver:

- (I) vertical oscillator;
- (II) video amplifier;
- (III) audio amplifier;
- (IV) syn separator.

(ii) State two demerits of a delta gun colour picture tube.

(10 marks)

(c) Figure 3 shows a schematic block diagram of the horizontal output stage of a TV receiver.

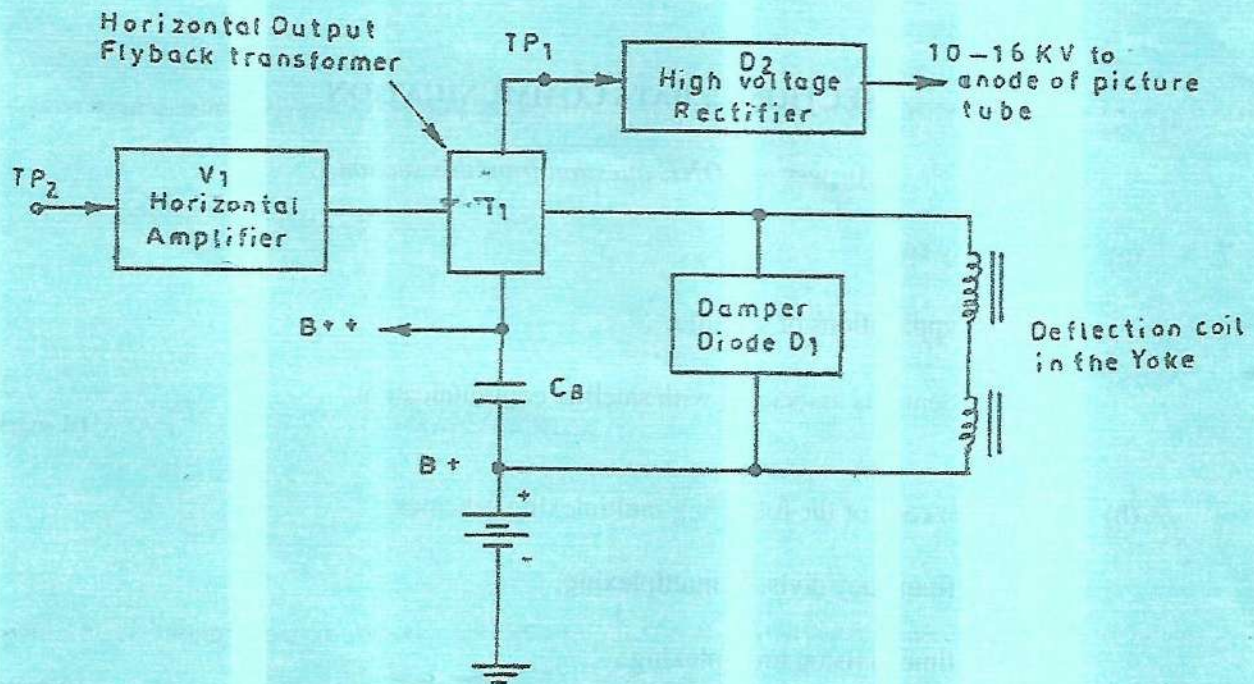


Fig.3

- (i) state the functions of the damper diode;
- (ii) sketch the waveforms at TP₁ and TP₂;

(6 marks)

6. (a) State any **two** faults for each of the following symptoms in a TV receiver:

- (i) horizontal keystoneing;
- (ii) no raster, sound normal;
- (iii) picture rolls.

(6 marks)

(b) Draw a labelled diagram of a vidicon TV camera.

(6 marks)

(c) An analogue TV system with a total of 625 lines per frame loses 40 lines during vertical blanking. The TV has a resolution factor of 0.69 and takes $52 \mu S$ to scan one pixel. Determine the:

- (i) vertical resolution;
- (ii) horizontal resolution;
- (iii) video bandwidth.

(8 marks)

SECTION C: DATA COMMUNICATION

Answer any ONE question from this section.

7. (a) State any two:

- (i) applications of satellite;
- (ii) demerits associated with satellite communication.

(4 marks)

(b) Describe each of the following multiplexing schemes:

- (i) frequency division multiplexing;
- (ii) time division multiplexing.

(6 marks)

- (c) For the binary code 1010, sketch the waveforms for:
- (i) amplitude shift keying;
 - (ii) phase-shift keying;
 - (iii) frequency shift keying.
- (6 marks)
- (d) With the aid of a block diagram, describe fibre optic communication. (4 marks)
8. (a) List the layers of the OSI model in a descending order. (7 marks)
- (b) Describe the concept of token ring as used in LAN architecture. (3 marks)
- (c) Draw a labelled block diagram showing the concept of Broadband Integration Services Digital Network (BISDN). (4 marks)
- (d) With the aid of sketches, differentiate between serial and parallel data transmission. (6 marks)

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