



COLLEGE: COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL: SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAMME: CERTIFICATE IV IN ELECTRONICS ENGINEERING-STAGE 3

UNIT CODE: EEE424

TITLE: RADIO RECEIVERS & TRANSMITTERS

FINAL EXAMINATION – TRIMESTER 3, 2016

ROOM: AS PER TIMETABLE

TIME: 2 HOURS 10 MINUTES

INSTRUCTIONS TO STUDENTS

1. You are allowed 10 minutes extra reading time during which you are NOT to write.
2. Begin each SECTION on a fresh page and use both sides of the sheet.
3. Write your candidate number at the top of each attached sheet.
4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with a string.
5. For all sheets of paper on which rough/draft work has been done, cross it through and ATTACH these to your answer scripts.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. Use of programmable calculator(s) is prohibited.
8. **ANSWER ALL QUESTIONS**
9. Show all working where necessary.
10. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE EXAM ROOM.**

SECTION A**MULTIPLE CHOICE****(10 MARKS)**

Write the correct answer beside the question number in the answer sheet.

1. Varactor diodes are used for tuning by _____.
 - a) capacitance adjustment through a reverse bias diode
 - b) temperature compensation of diodes
 - c) capacitance adjustment through forward bias
 - d) all of the above

2. The radio receiver that simply consists of an RF amplifier, detector, and audio amplifier is known as:
 - a) a selective receiver
 - b) a sensitive receiver
 - c) a superheterodyne receiver
 - d) a TRF receiver

3. Noise is usually clipped by _____.
 - a) phase detectors
 - b) amplifiers
 - c) limiter circuits
 - d) ARC circuits

4. The basic difference between the block diagram of an AM receiver and FM receiver is that:
 - a) an FM receiver does not use the superheterodyne design
 - b) an FM receiver uses a limiter and discriminator instead of a diode detector
 - c) an FM receiver cannot ever use automatic gain control
 - d) an FM receiver must use automatic frequency control

5. A standard IF frequency in FM receivers is:
 - a) 10.7 MHz
 - b) 4.5 MHz
 - c) 9.0 MHz
 - d) 455 kHz

6. A transceiver is:
 - a) a transmitter that transmits digital data signals
 - b) a transmitter and receiver in a single package
 - c) a receiver that receives digital data signals
 - d) a transmitter that can be tuned to several bands of frequencies

7. A transmission line terminated with a short has a VSWR of:
 - a) 0.
 - b) Infinity.
 - c) +1.
 - d) -1.

8. A term used to describe variations in signal strength that occur at a receiver during the time a signal is being received is known as:
 - a) fading
 - b) bouncing
 - c) skipping
 - d) refraction

9. An antenna created by taking a quarter-wavelength section of open wire line and bending each conductor outward 90 degrees is called:
 - a) A Marconi antenna.
 - b) A vertical antenna.
 - c) A dipole antenna.
 - d) All of the above.

10. Any non-driven element of an antenna array such as a Yagi is called a:
 - a) Director
 - b) Reflector
 - c) Lobe
 - d) parasitic element.

SECTION B

(90 MARKS)

There are 5 questions in this section and all are compulsory.

QUESTION 1:

(20 MARKS)

1. What is a tunnel diode? (2 marks)
2. State an application of varactor diode? (1 mark)
3. Identify the following diagrams: (4 marks)

a.	
b.	
c.	
d.	

- 4.
- 5.
- 6.

4. What are waveguides? (2 marks)
5. Wave propagation through a waveguide may be classified into two broad categories. What are the two categories? (2 marks)
6. A cavity resonator with an open end functions as a/an _____ antenna, sending or receiving RF energy to/from the direction of the open end. (1 mark)
7. What is a magnetron? (2 marks)
8. A quartz crystal has the following values: $R_s = 6.4\Omega$, $C_s = 0.09972\text{pF}$ and $L_s = 2.546\text{mH}$. If the capacitance across its terminal, C_p is measured at 28.68pF , calculate the fundamental oscillating frequency of the crystal and its secondary resonance frequency. (6 marks)

Hint:

$$f = \frac{1}{2\pi \sqrt{L_s C_s}}$$

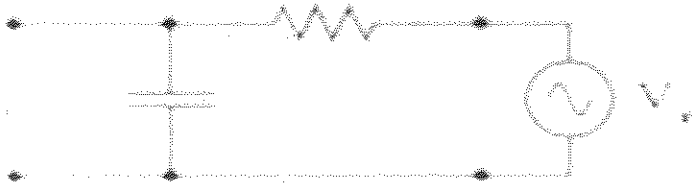
$$f_p = \frac{1}{2\pi \sqrt{L_s \left(\frac{C_p C_s}{C_p + C_s} \right)}}$$

Question 2

(15 MARKS)

1. Explain the function of Automatic Frequency Control (AFC)? (2 marks)
2. What is Automatic phase control? (2 marks)
3. Explain the two main types of filters? (2 marks)
4. How do the following filters work in terms of frequency: (4 marks)
 - a. Low pass filters
 - b. high pass filters
 - c. band-pass filters
 - d. band- reject filters
5. What is a Surface Acoustic Wave and where are these devices used? (1.5 marks)
6. Explain comb filters and state an application of it? (1.5 marks)

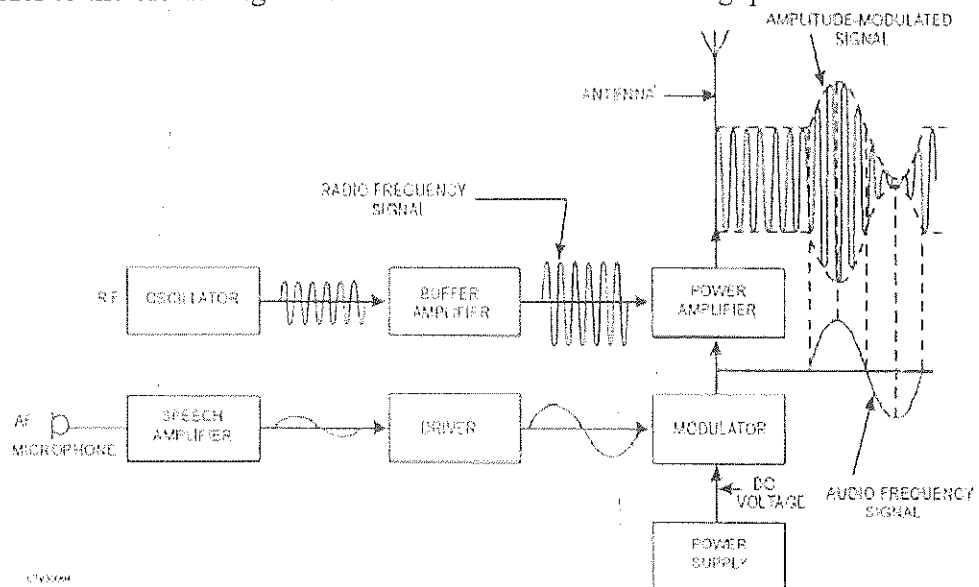
7. Identify what type of filter this circuit is, and calculate its cutoff frequency given a resistor value of $1\text{ k}\Omega$ and a capacitor value of $0.22\text{ }\mu\text{F}$: (2 marks)



Question 3

(25 MARKS)

- Radio equipment can be divided into three broad categories: transmitting equipment, receiving equipment, and terminal equipment. Explain the purpose of these three equipment? (3 marks)
- Continuous-wave transmitter (CW) is one of the oldest and least complicated forms of communications. Two advantages of CW are a narrow bandwidth, which requires less power out, and clarity; even under high noise conditions. What is the major disadvantage of CW transmitter? (2 marks)
- Refer to the block diagram below and answer the following questions:

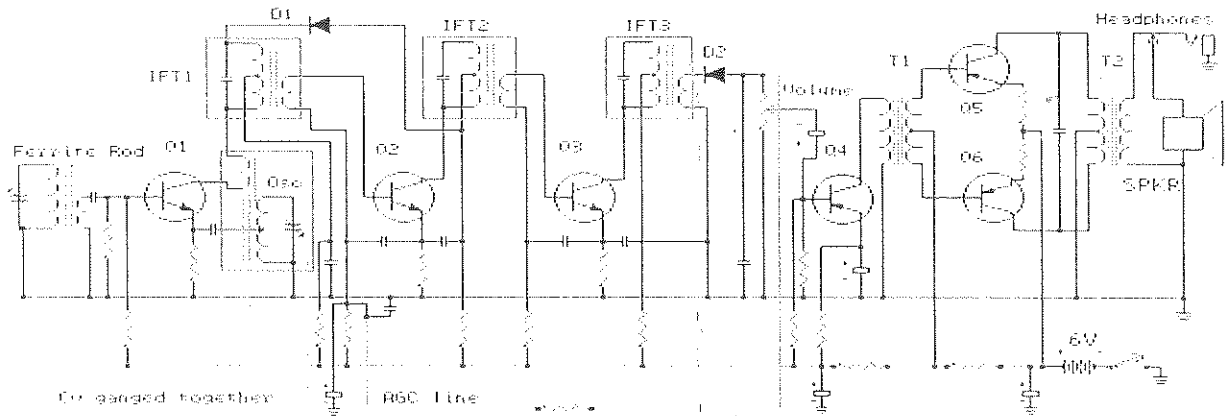


- What block diagram is shown above? (2 marks)
 - Explain the purpose of microphone, driver & modulator, and power amplifier. (3 marks)
- Sketch and label clearly a block diagram of an SSB transmitter? (5 marks)
 - Draw the block diagram of a FM superheterodyne receiver and sketch the waveforms at each stage? (10 marks)

Question 4

(15 MARKS)

1. Refer to the diagram below and answer the questions that follow?



- a. Name the circuit? (1 mark)
- b. What are the input and output? (2 marks)
- c. What are the input device and output device? (2 marks)
- d. Describe how the circuit keeps the output constant if ever the input signal fluctuates? (3 marks)
- e. How many transducers are there in the circuit and state the function? (3 marks)
- f. Describe the purpose of the 1st two stages of the whole circuit? (4 marks)

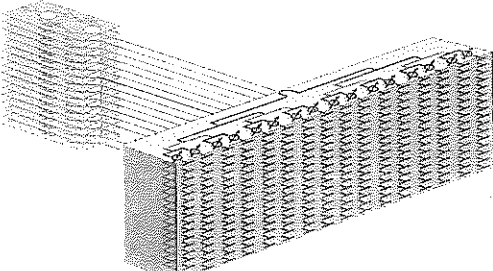
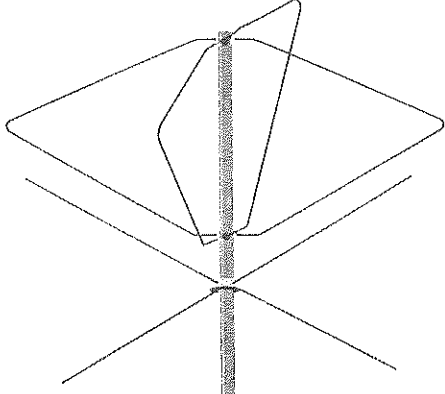
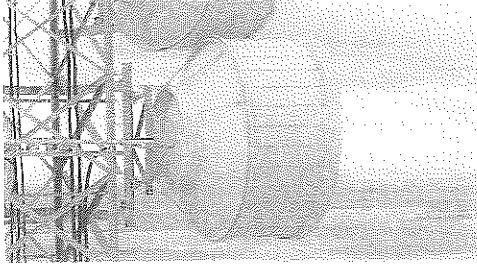
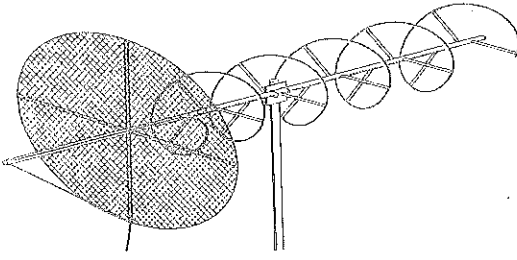
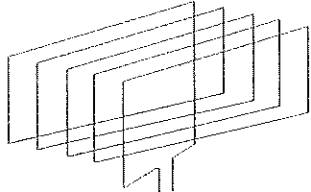
Question 5

(15 MARKS)

- 1. A transmission line with a characteristic impedance of 50Ω is delivering power to a 150Ω load. Calculate the SWR and determine the minimum voltage reading if the maximum voltage is 30V. (3 marks)
- 2. Calculate the physical length of a half-wave dipole antenna for a 100 MHz transmitter. (2 marks)
- 3. Determine the Q of an antenna with a bandwidth of 0.6 MHz that is cut for a frequency of 30 MHz. (2 marks)
- 4. An antenna is radiating 500 watts and has a 6-dB gain over a reference antenna. How much power must the reference antenna radiate in order to be equally effective in the most preferred direction? (3 marks)

5. Identify the following antennas:

(5 marks)

a.	
b.	
c.	
d.	
e.	

*****THE END*****