THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

083

RADIO AND TV SERVICING
(For Both School and Private Candidates)

Time: 3 Hours ***Monday, 10th October 2011 p.m.***

Instructions

1. This paper consists of sections A, B and C.
2. Answer **all** the questions in sections A and B and **three (3)** questions from section C.
3. Calculators are **not** allowed in the examination room.
4. Cellular phones are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

This paper consists of 6 printed pages.

SECTION A (10 marks)

Answer **all** questions in this section.

1. For each of the items (i) – (x), choose the correct answer from among the given alternatives and write its letter beside the item number.

(i) What will happen if a radio wave is passed through an ionized medium in the presence of magnetic field?
A Distortion of wave will result
B A false wave ionization will be created
C Magnetic field will split wave into two components
D Magnetic field will split wave into four components
E Wave will follow the elliptical path.

(ii) The main function of the RF amplifier in a super heterodyne receiver is to
A provide improved tracking
B permit better adjacent channel rejection
C increase the tuning range of the receiver
D improve the rejection of the image frequency
E reduce the effect of noise at low modulation depth.

(iii) Which of the following is a donor impurity element?
A Aluminium B Boron C Phosphorous D Indium E Thallium.

(iv) Which of the following types of semiconductor is electrically positive?
A Intrinsic B Extrinsic C P-type D N-type E NP-type.

(v) The colour picture can be obtained by appropriately combining
A Red, green and blue B Red, yellow and green C Red, black and blue
D Red, white and black E Red, violet and green.

(vi) Which one of the following should be observed before trouble shooting any electrical equipment?
A Type of the equipment and its number B Broken wires and poor connection
C Loose parts and manufacturing date D Soldered and welded components
E Origin of the equipment and its life span.

(vii) Vacuum tubes in a radio transmitter are used to
A generate high power radio waves B record radio programmes
C provide lighting inside the studio D provide power frequency range
E rectify radio supply voltage.

(viii) For the signal to be observed on the screen of an oscilloscope, it is applied
A across its Y-plates B to the horizontal amplifier C to the trigger circuit
D across its X-plates E between vertical deflecting plates.

(ix) Which of the following will help to stabilize the frequency of an oscillator?

A Increasing transistor gain
B Eliminating triggered pulses
C Use of automatic biasing
D Use of a tuned circuit
E Use of higher positive d.c voltage.

(x) When emitter junction is forward biased and collector junction is reverse biased, the PNP transistor will operate in

A active region
B cut-off region
C saturation region
D inverted region
E inactive region.

SECTION B (30 marks)

Answer **all** questions in this section.

2. Draw the symbols of the following components.
(a) Choke (b) IC timer 555 (c) Potentiometer **(03 marks)**

3. Briefly explain three advantages of digital instruments over analogue instruments. **(03 marks)**

4. Sketch the wave forms of the load current and voltage for silicon rectifier circuit in the figure below. Show the peak values. **(03 marks)**

5. (a) What is the difference between a junction diode and a photodiode? **(01 mark)**
(b) Draw the NPN and PNP transistors and specify their leads. **(02 marks)**

6. (a) What is a radio system? **(01 mark)**
(b) Give the function of the following sections in a radio receiver. **(02 marks)**
(i) Tunner section
(ii) Detector (demodulator) section.

7. (a) Draw a transfer characteristic curve for a common emitter mode of a transistor. **(01 mark)**
(b) A transistor is biased with a constant base current of 10 microamperes and the value of beta ($\beta_{d.c}$) at the operating point is 124. Find the collector current. **(02 marks)**

8. Briefly explain three different methods in which radio waves travel from transmitter aerial to the receiver aerial. **(03 marks)**

9. (a) Explain what is meant by the term *'modulation'*. **(01 mark)**
(b) Explain two possible effects of transmitting audio frequency signals directly without modulation. **(02 marks)**

10. (a) Define the word *'decibel'* as used in electronics and electrical circuits. **(01 mark)**
(b) Express in decibel a power of 10 W with reference to standard power levels of 1 mW and 100 W. **(02 marks)**

11. Express mathematically three kinds of gain as applied in the amplifier. **(03 marks)**

SECTION C (60 marks)

Answer **three (3)** questions from this section.

12. (a) For the circuit shown in Figure 1, determine its quiescent point. **(08 marks)**

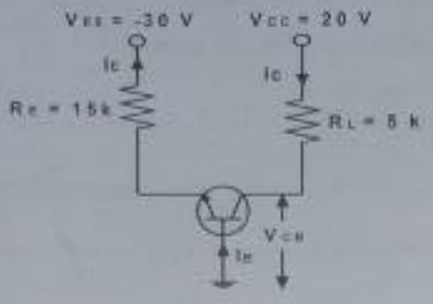

Figure 1

(b) A transistor used as a class A audio frequency power amplifier takes a collector bias current of 5 mA from 10 V supply. When a sinusoidal signal is applied to the amplifier the collector voltage varies between -2 V and -18 V and the collector current is between -8 mA and -2 mA. Calculate the
(i) d.c power taken from the supply. **(02 marks)**
(ii) a.c power output. **(02 marks)**
(iii) collector efficiency. **(02 marks)**

(c) Identify each device shown below and explain its function in an electronic circuit. **(06 marks)**

(i) (ii) (iii) (iv) (v) (vi)

13. (a) Consider the circuit below.

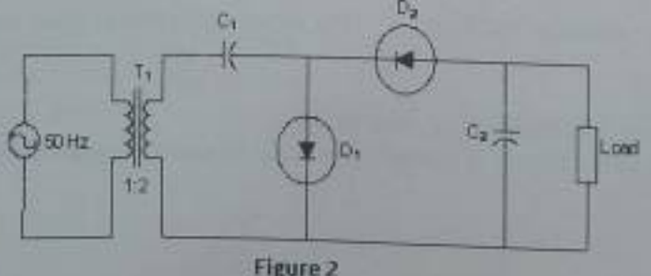

Figure 2

(i) What type of circuit is represented in Figure 2? **(01 mark)**
(ii) Give the function of the circuit shown in Figure 2? **(02 marks)**
(iii) With the help of diagrams explain how the circuit works? **(05 marks)**
(iv) Sketch the input and output waveform filtered by a shunt capacitor C_2. **(02 marks)**

(b) (i) If the peak voltage across the primary winding of transformer is 340 V, what voltage would you expect across C_2? **(04 marks)**
(ii) What will the polarity of the voltage across C_2 be? **(01 mark)**
(iii) If D_1 is an open circuit, how will the output voltage from the circuit be affected? **(01 mark)**

(c) A half-wave rectifier has a peak output voltage of 12.2 V at 50 Hz and feeds a resistive load of 100 Ω. Determine
(i) the value of the shunt capacitor to give one percent ripple factor and **(02 marks)**
(ii) the resulting d.c voltage across the load resistor. **(02 marks)**

14. (a) What is meant by tuning in receivers? **(01 mark)**

(b) Briefly explain the function of the following circuits in a super heterodyne AM receiver.
(i) R.F amplifier (ii) I.F amplifier (iii) Audio amplifier (iv) Mixer (v) Antenna **(05 marks)**

(c) (i) What is an automatic gain control (AGC)? **(01 mark)**
(ii) Describe the function of AGC in a radio receiver. **(02 marks)**
(iii) The intermediate frequency (I.F) of the receiving system is usually a compromise; it should be neither low nor high, nor in a certain range between the two. Explain the effects of choosing inappropriate intermediate frequency in particular system. **(08 marks)**

(d) Figure 3 is the tuned circuit of the receiver showing some signals hitting the aerial from different stations. Masanja was tuning to a station on the receiver. By varying the setting of C, he can alter the resonant frequency (R.F) of the circuit to the frequency of the wanted signal. What station will the receiver tune to, when L = 200 μH and tuning capacitor C is set to a capacitance of 5.07 pF? **(03 marks)**

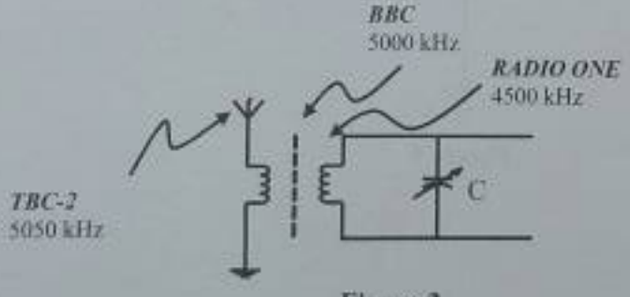

Figure 3

15. (a) Draw a well-labeled block diagram of feedback loop of amplifier. **(02 marks)**
(b) Give five advantages of negative feedback amplifier. **(05 marks)**

(c) In the series-parallel feedback amplifier shown in Figure 4, calculate
(i) open-loop gain of the amplifier **(02 marks)**
(ii) gain of the feedback network **(01 mark)**

(iii) closed-loop gain of the amplifier **(03 marks)**
(ii) sacrifice factor, S **(02 marks)**

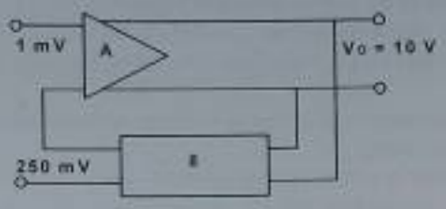

Figure 4

(d) An amplifier having a gain of 500 without feedback has an overall negative feedback applied which reduces the gain to 100.
(i) Calculate the fraction of output voltage feedback. **(02 marks)**
(ii) Due to ageing of components, the gain without feedback falls by 20%, calculate the percentage fall in gain without feedback. **(03 marks)**

16. (a) (i) Describe the effect of rise in temperature on resistance of metallic conductors and non-conductors (insulators). Give four examples of material which fall under each category. **(06 marks)**
(ii) One of the resistors in your circuit is defective, you want to replace it, but the value of that resistor is not indicated at the printed circuit board. How are you going to obtain the value of the resistor so that you can replace with the proper value? **(01 mark)**

(b) In principle a transistor can be considered as being made up of two diodes joined as shown in Figure 5.
(i) What type of transistor is represented by the diagram? **(01 mark)**
(ii) Assume that the device is a low power transistor that has less leakage between the junctions. With the aid of a diagram, show six different arrangements of checking if the transistor is in order by using an ohmmeter. **(12 marks)**

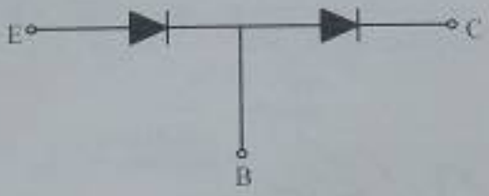

Figure 5