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Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

## **NATIONAL CERTIFICATE**

### **RADIO THEORY N2**

(11040862)

**8 April 2020 (X-paper)**  
**09:00–12:00**

**This question paper consists of 5 pages and 1 formula sheet.**

171Q1A2008

**DEPARTMENT OF HIGHER EDUCATION AND TRAINING**  
**REPUBLIC OF SOUTH AFRICA**  
NATIONAL CERTIFICATE  
RADIO THEORY N2  
TIME: 3 HOURS  
MARKS: 100

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**INSTRUCTIONS AND INFORMATION**

1. Answer all the questions.
  2. Read all the questions carefully.
  3. Number the answers according to the numbering system used in this question paper.
  4. Start each question on a new page.
  5. Use only a black or blue pen.
  6. Write neatly and legibly.
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**QUESTION 1**

- 1.1 Explain the term *frequency* with reference to a sine wave. (2)
- 1.2 An alternating voltage has a maximum value of 200 V.  
Calculate the RMS and average values of the voltage. (4)
- 1.3 Name FOUR circuits where capacitors can be used. (4)
- 1.4 A series resonant circuit consisting of a 10  $\Omega$  resistor, a 20 mH inductor and a 68  $\mu\text{F}$  capacitor.  
Calculate the:
- 1.4.1 Resonate frequency (2)
- 1.4.2 Inductive reactance at resonance (2)
- 1.4.3 Total impedance of the circuit (2)
- 1.4.4 Q-factor using the two methods (4)
- [20]**

**QUESTION 2**

- 2.1 State THREE precautions when using a DC ampere meter. (3)
- 2.2 Calculate the series multiplier resistor needed to enable a moving-coil meter with a full-scale deflection current of 120 mA and a coil resistance of 150  $\Omega$  to measure 100 V at full scale. (3)
- 2.3 The front panel of an oscilloscope has various controls. These controls are used to display one cycle of a waveform to be measured.  
State the function of each of the following controls:
- 2.3.1 Vertical position control (1)
- 2.3.2 Focus control (2)
- 2.3.3 Time/division control (2)
- 2.4 An oscilloscope displays an AC signal that covers six vertical divisions. The volts/division control is set to 5 V/division.  
Calculate the:
- 2.4.1 Peak-to-peak voltage
- 2.4.2 Peak voltage (2 × 2) (4)
- [15]**

**QUESTION 3**

- 3.1 Draw a circuit diagram to show full-wave rectification using two diodes. Include only a transformer and a load resistor. The diagram must also show the input and output waveforms. (6)
- 3.2 Name TWO conditions that must be met to allow current to flow across a PN-junction. 株式会社 (2)
- 3.3 Give the typical barrier potential for silicon and germanium diodes. (2)
- [10]**

**QUESTION 4**

- 4.1 Two or more amplifier stages are coupled together to increase the overall gain of the system.  
Draw a neat, labelled circuit diagram showing the transformer coupling method. 株式会社 (9)
- 4.2 Give FOUR advantages of transistors when compared to electronic valves. (4)
- 4.3 Briefly explain negative feedback in amplifiers. (2)
- [15]**

**QUESTION 5**

- 5.1 Briefly explain *mutual inductance*. (2)
- 5.2 Name THREE types of speakers. 株式会社 (3)
- 5.3 Make a neat, labelled drawing of a ribbon microphone and give ONE advantage thereof. (5)
- [10]**

**QUESTION 6**

- 6.1 Name FIVE properties that an oscillator must have before it is selected to be used in a radio receiver. (5)
- 6.2 Make a neat, labelled block diagram of a tuned radio-frequency receiver. 株式会社 (5)
- [10]**

**QUESTION 7**

- 7.1 List FIVE steps to follow when finding a fault in a radio receiver. (5)
- 7.2 Make a neat, labelled sketch of the construction of a moving coil pick-up as found in a record player. 株式会社 (5)
- [10]**

**QUESTION 8**

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (8.1–8.10) in the ANSWER BOOK.

- 8.1 The total capacitance of two capacitors increases when connected in series.
- 8.2 The Q-factor of a circuit only applies when the circuit is at resonance. 株式会社
- 8.3 A pointer oscillates about the final resting point when a meter is underdamped.
- 8.4 Semiconductor material that has been doped is referred to as extrinsic material.
- 8.5 Collector current is equal to the sum of the emitter and base currents.
- 8.6 The class of amplifier is determined by the type of DC bias applied.
- 8.7 A ribbon microphone operates on the piezoelectric effect. 株式会社
- 8.8 For good bass response speakers are mounted on a flat board called a baffle.
- 8.9 The ability of a receiver to receive one frequency and reject all other frequencies is called sensitivity. 株式会社
- 8.10 Oscillators use negative feedback.

(10 × 1) [10]

**TOTAL: 100**

**FORMULA SHEET**

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \dots \quad C_T = C_1 + C_2 + \dots$$

$$R_T = R_1 + R_2 + \dots \quad \frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

$$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \dots \quad L_T = L_1 + L_2 + \dots$$

$$R_{SH} = \frac{I_m \times R_m}{I_T - I_m} \quad R_S = \frac{V}{I_m} - R_m$$

$$\tau = R \times C \quad Q = C \times V$$

$$X_L = 2\pi f L \quad X_C = \frac{1}{2\pi f C}$$

$$Z = \sqrt{R^2 + X_L^2} : \quad Z = \sqrt{R^2 + X_C^2} : \quad Z = \sqrt{R^2 + (X_L \approx X_C)^2}$$

$$I_T = \frac{V_T}{X_L} : \quad I_T = \frac{V_T}{X_C} : \quad I_T = \frac{V_T}{Z}$$

$$V_R = I \times R : \quad V_L = I \times X_L : \quad V_C = I \times X_C$$

$$\cos \theta = \frac{R}{Z}$$

$$f_r = \frac{1}{2\pi \sqrt{LC}} \quad Q = \frac{1}{R} \sqrt{\frac{L}{C}} \quad Q = \frac{X_L}{R}$$

$$V = I \times R \quad I = \frac{V}{R}$$

$$\text{Frequency} = \frac{1}{\text{Period}}$$

$$\text{RMS voltage} = 0,707 \times \text{peak}$$

$$\text{Average voltage} = 0,637 \times \text{peak}$$