

**END SEMESTER EXAMINATION (Theory)**

**ACADEMIC YEAR:** 2023 - 2024

**DEPARTMENT:** ELECTRICAL AND ELECTRONICS ENGINEERING

**PROGRAM:** ELECTRONICS AND TELECOMMUNICATIONS TECHNOLOGY

**RTQF LEVEL & YEAR:** L6 & Y2

**SEMESTER:** TWO

**MODULE TITLE:** BROADCASTING TOWERS OPERATION

**MODULE CODE:** ETTBT601

**CREDIT UNITS:** 8

**DATE:** .....

**DURATION:** 90 min.

**MAXIMUM MARKS:** 25

**Question one**

Write short note on the following terms: Transmitter, Receiver, Power amplifier, Audio Processor, Transceiver. Please use proper handwriting. **5marks**

**Question two**

What are the visual inspection requirements? **2marks**

**Question three**

Explain the steps involved in Air Conditioning cycle. **3marks**

**Question four**

Explain the interoperability between the power systems on a broadcasting tower (BTS). **3marks**

**Question five**

In a tabulated form, provide a comprehensive comparison between a transceiver and a transmitter, consider these points to avoid the out of scope: function, where they are used, communication style, signals dealt with. **2marks**

### **Question six**

Write comprehensive note on the function of Broadcasting Towers parts involved in call set up until two parties communicates effectively. **3marks**

### **Question seven**

Differentiate between RAN and transmission referring to a Broadcasting Towers equipment. **2marks**

### **Question eight**

List the steps involved in physical inspection of air conditioning. **2marks**

### **Question nine**

List the steps to create a comprehensive report and handover document for the work done by broadcasting tower operators in the field. **3marks**

*Success!*

## Marking guide

### Question one

#### ✓ Transmitters

A broadcast transmitter is an electronic device which radiates radio waves modulated with information content intended to be received by the public. Examples are a radio broadcasting transmitter which transmits audio (sound) to broadcast radio receivers (radios) owned by the public, or a television transmitter, which transmits moving images (video) to television receivers (televisions). The term often includes the antenna which radiates the radio waves, and the building and facilities associated with the transmitter.

#### ✓ Receivers

In radio communications, a radio receiver, also known as a receiver, a wireless, or simply a radio, is an electronic device that receives radio waves and converts the information carried by them to a usable form. It is used with an antenna. The antenna intercepts radio waves (electromagnetic waves of radio frequency) and converts them to tiny alternating currents which are applied to the receiver, and the receiver extracts the desired information. The receiver uses electronic filters to separate the desired radio frequency signal from all the other signals picked up by the antenna, an electronic amplifier to increase the power of the signal for further processing, and finally recovers the desired information through demodulation.

#### ✓ Power amplifier

A radio-frequency power amplifier (RF power amplifier) is a type of electronic amplifier that converts a low-power radio-frequency signal into a higher-power signal. Typically, RF power amplifiers drive the antenna of a transmitter. Design goals often include gain, power output, bandwidth, power efficiency, linearity (low signal compression at rated output), input and output impedance matching, and heat dissipation.

#### ✓ Audio processor

The Audio Processor is a very important piece of equipment, usually the last one we use before audio is transmitted. It improves and optimizes the sound quality, thus giving it a unique sound with its own character.

#### ✓ Transceivers

Transceivers are mechanical devices that combine a radio transmitter and a radio receiver. It can both transmit and receive radio waves for communication purposes. The transceiver is part of the network

input card in a local area network. It can both send and receive messages over the network wire. But some types of networks need a receiver that is outside the network. The transceiver is built into mobile devices that use wireless transmission, such as smartphones and cell phones. It is a combination of transmitter and receiver in a single term. It can do both, transmit and receive radio waves for communication purpose, with the help of an antenna.

## Question two

- ✓ **Power level**
- ✓ **Signal Level**
- ✓ **Frequency**
- ✓ **Signal quality**

## Question three

1. Compressor: Compresses refrigerant gas, raising its temperature and pressure.
2. Condenser Coil: Releases heat from the refrigerant, causing it to condense into a liquid.
3. Expansion Valve: Regulates the flow of refrigerant into the evaporator coil.
4. Evaporator Coil: Absorbs heat from the indoor air, causing the refrigerant to evaporate.

Fan: Circulates indoor air over the evaporator coil to cool it down and then blows it back into the room.

An air conditioner works by removing heat from indoor air and expelling it outside, creating a cooler indoor environment. It draws warm air from the room and passes it over **evaporator** coils containing a refrigerant that absorbs the heat, causing the refrigerant to evaporate into a gas. This gas is then **compressed**, increasing its pressure and temperature. The hot, high-pressure gas is passed through **condenser** coils outside, where it releases heat to the outside air and condenses back into a liquid. The liquid refrigerant then passes through an **expansion valve**, reducing its pressure and temperature, making it ready to absorb heat again. This cycle repeats continuously, effectively cooling the indoor air and dehumidifying it, enhancing the cooling effect and comfort.

## Question four

Interoperability among the grid, generators, UPS, AVR, ATS and AC systems is essential for the seamless operation of Base Transceiver Stations (BTS). Each component plays a crucial role in maintaining a stable and reliable power supply, which is vital for uninterrupted communication services. The grid serves as the primary power source, while generators provide backup during outages, ensuring continuous operation. UPS systems offer immediate power during brief interruptions,

protecting sensitive equipment from voltage fluctuations managed by AVRs. ATS facilitates automatic switching between power sources, minimizing downtime. Additionally, AC units are critical for maintaining optimal operating temperatures, preventing overheating of equipment ensuring that BTS to operate efficiently and reliably, even in the face of power disturbances or environmental challenges.

## Question five

Transceiver	Transmitter
A transceiver, on the other hand, is a combination of a transmitter and a receiver in a single device.	Transmitter is a device that sends signals or information in the form of radio waves, electric currents or light, depending on the medium, to communicate with other devices or systems.
Transceiver is responsible for sending and receiving data.	It is primarily responsible for sending data.
Transceivers are commonly used in radios, cell phones and network devices like Wi-Fi routers.	Transmitters are commonly used in TV and AC remotes.
Transceivers are two- way communication devices.	Transmitters provide one way communication only.
It can do both, send and receive digital signals.	It is a component which generates radio frequency or radio waves.

## Question six

Broadcasting towers, or cell towers, play a crucial role in the mobile call setup process by **transmitting** and **receiving** signals between **mobile devices** and the **cellular network**. When a user initiates a call, the mobile device connects to the nearest base station, which communicates with a Mobile Switching Center (MSC) to route the call. The MSC checks the subscriber's location and routing information through systems like the Home and Visitor Location Registers (HLR and VLR).

The call is then established, and voice or data communication occurs via the **core network**, often involving handovers between towers if the user moves. Throughout this process, various technologies and protocols, such as SS7 or Diameter, and the **Radio Access Network** (RAN) ensure seamless call setup, connection, and communication, ultimately allowing effective interaction between the two parties.

## Question seven

- **RAN** deals with the **radio communication** at the tower level, managing the interface between the mobile devices and the base station. It is responsible for tasks like signal transmission, handovers, and mobility management.
- **Transmission**, on the other hand, is the **backhaul network** that connects the tower to the core network, ensuring that data and calls from users are transported effectively across long distances.

While RAN is about handling **local wireless communication**, transmission ensures that the data gets from the tower to the rest of the telecommunications infrastructure. Both are essential for the functionality of cellular networks.

## Question eight

The following are key steps involved in a thorough physical inspection of an AC:

### 1. Thermostat Check

**Functionality:** Ensure the thermostat is working correctly and set to the desired temperature.

**Calibration:** Verify that the thermostat accurately reflects the room temperature.

### 2. Refrigerant Levels

**Measurement:** Check the refrigerant levels to ensure they are within the recommended range.

**Leaks:** Inspect for any refrigerant leaks in the lines and connections.

### 3. Condenser and Evaporator Coils

**Condition:** Inspect the condenser and evaporator coils for dirt, debris, and damage.

**Cleaning:** Clean the coils to improve efficiency and prevent overheating.

### 4. Air Filters

**Inspection:** Check the air filters for dirt and clogs.

**Replacement:** Replace or clean the filters as needed to ensure proper airflow.

### 5. Electrical Components

**Connections:** Inspect all electrical connections for signs of wear or damage.

**Operation:** Test the operation of the blower motor, fan motor, and other electrical components.

### 6. Drainage System

**Drain Pan and Line:** Check the drain pan, drain line, and p-trap for blockages and proper drainage.

**Cleaning:** Clean the drainage system to prevent water damage and mold growth.

### 7. Airflow and Ductwork

**Airflow Measurement:** Measure the airflow to ensure it meets the system's specifications.

**Duct Inspection:** Inspect the ductwork for leaks, blockages, and insulation issues.

## **8. Overall System Performance**

**Cooling Capacity:** Measure the air temperature difference to determine the cooling capacity.

### **Question nine**

**The following are requirements for handing over to the next operator:**

#### **Equipment Status Report for Broadcasting Towers**

##### **Tower Structure and Integrity**

- **Inspection:** Regular inspections have been conducted to ensure the structural integrity of the towers. No significant damage or wear has been reported.
- **Maintenance:** Routine maintenance tasks, such as tightening bolts and checking for rust, have been completed.

##### **Antenna Systems**

- **Performance:** All antennas are functioning within optimal parameters. Signal strength and quality are consistent with expected levels.
- **Issues:** No major issues have been detected. Minor adjustments were made to improve alignment and signal reception.

##### **Transmission Equipment**

- **Transmitters:** All transmitters are operational and have been tested for efficiency. Power output levels are stable.
- **Backup Systems:** Backup transmitters are in place and have been tested to ensure they can take over in case of primary system failure.

##### **Power Supply**

- **Primary Power:** The primary power supply is stable with no interruptions reported.
- **Backup Power:** Backup generators and UPS systems are fully functional and have been tested regularly.

##### **Cooling Systems**

- **Status:** Cooling systems are operating efficiently, maintaining optimal temperatures for all equipment.
- **Maintenance:** Filters have been cleaned and replaced as needed. No issues with overheating have been reported.

- **Lighting Systems**

- **Monitoring and Control Systems**

- **Safety and Compliance**

- **Preparation by Outgoing Operator**

Documentation: Prepare a detailed report summarizing the activities of the shift, including any incidents, maintenance tasks, and operational status of the broadcasting towers.

Checklist: Use a checklist to ensure all tasks are completed and documented.

Equipment Status: Note the status of all equipment, including any issues or maintenance needs.

- **Handover Meeting**

Face-to-Face Communication: Conduct a face-to-face meeting with the incoming operator to discuss the shift report.

***End!***