ROYAL CIVIL SERVICE COMMISSION BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2024 EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALISATION PAPER FOR ELECTRONICS AND COMMUNICATION ENGINEERING

Date : October 5, 2024

Total Marks : 100

Writing Time : 150 minutes (2.5 hours)

Reading Time : 15 minutes (prior to writing time)

GENERAL INSTRUCTIONS:

1. Write your Registration Number clearly and correctly on the Answer Booklet.

- 2. The first 15 minutes is to check the number of pages of Question Paper, printing errors, clarify doubts and to read the instructions. You are NOT permitted to write during this time.
- 3. This paper consists of **TWO SECTIONS**, namely SECTION A & SECTION B:
 - **SECTION A** has two parts: Part I 30 Multiple Choice Questions

Part II - 4 Short Answer Questions

All questions under SECTION A are COMPULSORY.

- **SECTION B** consists of two Case Studies. Choose only **ONE** case study and answer the questions of your choice.
- 4. All answers should be written on the Answer Booklet provided to you. Candidates are not allowed to write anything on the question paper. If required, ask for additional Answer Booklet.
- 5. All answers should be written with correct numbering of Section, Part and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating the Section, Part and Question Number will NOT be evaluated and no marks will be awarded.
- 6. Begin each Section and Part in a fresh page of the Answer Booklet.
- 7. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
- 8. Use of any other paper including paper for rough work is not permitted.
- 9. You must hand over the Answer Booklet to the Invigilator before leaving the examination hall.
- 10. This paper has **7 printed pages**, including this instruction page.

GOOD LUCK

SECTION A

PART I: Multiple Choice Questions (30 marks)

Choose the correct answer and write down the letter of your chosen answer in the Answer Booklet against the question number e.g. 31 (d). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

- 1. Which of the following is a type of non-volatile memory?
 - a) RAM
 - b) ROM
 - c) Cache
 - d) Register
- 2. What does "LED" stand for in electronics?
 - a) Light Emitting Device
 - b) Low Energy Device
 - c) Light Emitting Diode
 - d) Light Energy Diode
- 3. Which of the following components is used to store electrical energy in an electric field?
 - a) Resistor
 - b) Inductor
 - c) Capacitor
 - d) Transformer
- 4. In a transistor, the region between the emitter and collector is called:
 - a) Base
 - b) Gate
 - c) Drain
 - d) Source
- 5. Which modulation technique is used for transmitting digital data over analog communication channels?
 - a) Amplitude Modulation (AM)
 - b) Frequency Modulation (FM)
 - c) Phase Modulation (PM)
 - d) Quadrature Amplitude Modulation (QAM)
- 6. What is the primary purpose of a diode in electronic circuits?
 - a) To amplify signals
 - b) To rectify AC to DC
 - c) To filter signals
 - d) To oscillate signals

- 7. Which of the following is a digital logic gate?
 - a) Transformer
 - b) Diode
 - c) AND gate
 - d) Capacitor
- 8. Which type of memory is typically used for the main memory in a computer system?
 - a) ROM
 - b) EEPROM
 - c) SRAM
 - d) DRAM
- 9. The speed of light in vacuum is approximately:
 - a) $3 \times 10^{6} \text{ m/s}$
 - b) $3 \times 10^{7} \text{ m/s}$
 - c) $3 \times 10^8 \text{ m/s}$
 - d) $3 \times 10^{9} \text{ m/s}$
- 10. In a frequency modulation (FM) system, the frequency deviation is proportional to:
 - a) Amplitude of the modulating signal
 - b) Frequency of the modulating signal
 - c) Phase of the modulating signal
 - d) None of the above
- 11. What is the purpose of an operational amplifier in electronic circuits?
 - a) To amplify voltage
 - b) To store charge
 - c) To convert AC to DC
 - d) To regulate voltage
- 12. In an AC circuit, the power factor is the ratio of:
 - a) Real power to apparent power
 - b) Apparent power to real power
 - c) Real power to reactive power
 - d) Reactive power to apparent power
- 13. Which of the following is used to measure electrical resistance?
 - a) Voltmeter
 - b) Ammeter
 - c) Ohmmeter
 - d) Wattmeter

- 14. Which device is used to increase or decrease AC voltage?
 - a) Diode
 - b) Capacitor
 - c) Transformer
 - d) Resistor
- 15. In a digital communication system, what does the term "bit rate" refer to?
 - a) The number of bits transmitted per second
 - b) The number of bytes transmitted per second
 - c) The number of signals transmitted per second
 - d) The number of channels transmitted per second
- 16. Which type of semiconductor is created by adding pentavalent impurities?
 - a) Intrinsic semiconductor
 - b) P-type semiconductor
 - c) N-type semiconductor
 - d) Compound semiconductor
- 17. Which of the following communication modes allows data transmission in both directions simultaneously?
 - a) Simplex
 - b) Half-duplex
 - c) Full-duplex
 - d) Multiplex
- 18. What is the primary function of a relay in an electronic circuit?
 - a) To store energy
 - b) To act as a switch
 - c) To amplify signals
 - d) To filter signals
- 19. In an RC circuit, what does "RC" stand for?
 - a) Resistor-Capacitor
 - b) Reactive-Capacitive
 - c) Real-Current
 - d) Resistance-Conductance
- 20. The main advantage of using fiber optic cables over copper cables is:
 - a) Lower cost
 - b) Higher bandwidth
 - c) Easier installation
 - d) Higher resistance to electrical interference

- 21. Which of the following is a unipolar device?
 - a) Diode
 - b) Bipolar Junction Transistor (BJT)
 - c) Field-Effect Transistor (FET)
 - d) Thyristor
- 22. In a communication system, noise is most likely to affect the signal during which of the following processes?
 - a) Modulation
 - b) Transmission
 - c) Reception
 - d) Demodulation
- 23. What is the primary purpose of a capacitor in an electronic circuit?
 - a) To store energy in an electric field
 - b) To convert AC to DC
 - c) To amplify signals
 - d) To control the frequency of oscillation
- 24. Which modulation technique is used for transmitting digital data over analog systems?
 - a) Amplitude Modulation (AM)
 - b) Frequency Modulation (FM)
 - c) Pulse Code Modulation (PCM)
 - d) Phase Modulation (PM)
- 25. In a superheterodyne receiver, what is the function of the mixer?
 - a) To amplify the received signal
 - b) To filter the received signal
 - c) To convert the received signal to an intermediate frequency
 - d) To demodulate the received signal
- 26. Which type of antenna is most commonly used for satellite communication?
 - a) Dipole antenna
 - b) Yagi-Uda antenna
 - c) Parabolic dish antenna
 - d) Loop antenna
- 27. The Nyquist rate is defined as:
 - a) Twice the highest frequency present in the signal
 - b) Half the highest frequency present in the signal
 - c) The same as the highest frequency present in the signal
 - d) Four times the highest frequency present in the signal

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- 28. Which of the following components is used to isolate different sections of a circuit?
 - a) Resistor
 - b) Capacitor
 - c) Transformer
 - d) Inductor
- 29. In an RC circuit, what is the time constant (τ) defined as?
 - a) R + C
 - b) R * C
 - c) R/C
 - d) C/R
- 30. Which of the following describes the main function of an operational amplifier (op-amp)?
 - a) To rectify AC signals
 - b) To filter signals
 - c) To amplify voltage
 - d) To convert digital signals to analog

PART II – Short Answer Questions [20 marks]

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks.

- 1. What is the purpose of a rectifier in an electronic circuit? How does an Analog-to-Digital Converter (ADC) work?
- 2. What is the function of an inductor in an electronic circuit? How does a capacitor store energy?
- 3. What is a transistor used for in electronic circuits? How does an operational amplifier (op-amp) work?
- 4. What is an oscillator used for in electronics? How do you measure the frequency of a signal using an oscilloscope?

SECTION B: Case Study (50 marks)

Choose either CASE I or CASE II from this section. Each case study carries 50 marks.

CASE I

Describe in detail the implementation of an Integrated Communication System for a Smart City?

CASE II

How can we implement an IoT-based Smart Parking System in an Urban Area? The project should include assessment, infrastructure requirements, applications.

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