

**ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2020
EXAMINATION CATEGORY: TECHNICAL**

**PAPER III: SUBJECT SPECIALISATION PAPER FOR ELECTRONICS AND
COMMUNICATION ENGINEERING**

Date	: February 27, 2021
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 the 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 QuestionsAll 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 on 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.

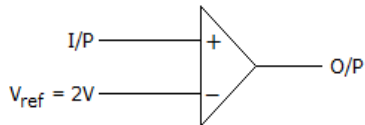
GOOD LUCK!

SECTION A

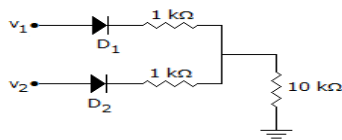
PART I: Multiple Choice Questions [30 marks]

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.

- To prevent a DC return between source and load, it is necessary to use
 - resistor between source and load.
 - inductor between source and load.
 - capacitor between source and load.
 - both (a) or (b).
- If the input to the ideal comparator shown in the figure is a sinusoidal signal of 8 V (peak to peak) without any DC component, then the output of the comparator has a duty cycle of



- $\frac{1}{2}$
 - $\frac{1}{3}$
 - $\frac{1}{6}$
 - $\frac{1}{12}$
- A half wave diode circuit using ideal diode has an input voltage $20 \sin \omega t$ volts. Then average and rms values of output voltage are:
 - $\frac{10}{\pi}$ v and 10 v
 - $\frac{20}{\pi}$ v and 10 v
 - $\frac{10}{\pi}$ v and 5 v
 - $\frac{20}{\pi}$ v and 5 v
- In figure $v_1 = 8$ V and $v_2 = 4$ V. Which diode will conduct?



- D_2 only
- D_1 only
- Both D_1 and D_2
- Neither D_1 nor D_2

5. In a BJT circuit, a *pnp* transistor is replaced by *npn* transistor. To analyse the new circuit
 - a) all calculations done earlier have to be repeated.
 - b) replace all calculated voltages by reverse values.
 - c) replace all calculated currents by reverse values.
 - d) replace all calculated voltages and currents by reverse values.

6. A transponder is a satellite equipment which
 - a) receives a signal from Earth station and amplifies.
 - b) changes the frequency of the received signal.
 - c) retransmits the received signal.
 - d) does all of the above-mentioned functions.

7. The sharing of a communication satellite by many geographically dispersed Earth station, the term DAMA means
 - a) Demand-Assigned Multiple Access.
 - b) Decibel Attenuated Microwave Access.
 - c) Digital Analog Master Antenna.
 - d) Dynamically-Assigned Multiple Access.

8. To make antenna more directional, either its size must be increased or
 - a) the number of its feed horns must be increased.
 - b) the frequency of its transmission must be increased.
 - c) its effective isotropic radiated power (EIRP) must be increased.
 - d) its footprint must be increased.

9. Radio broadcasting is an example of
 - a) Space multiplexing
 - b) Time multiplexing
 - c) Frequency multiplexing
 - d) None of the above

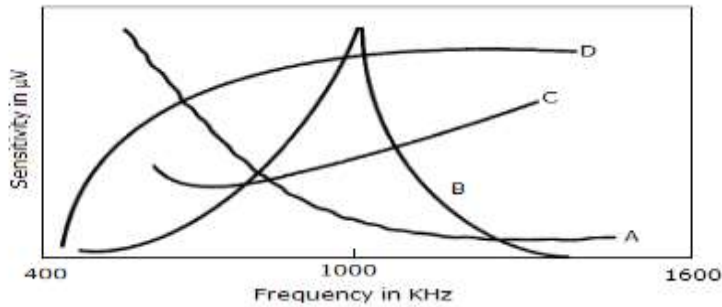
10. The quality of a space-link is measured in terms of the _____ ratio.
 - a) C/N
 - b) S/N
 - c) G/T
 - d) EIRP

11. The most effective anti-jamming technique is
 - a) Frequency hopping
 - b) Spread-spectrum modulation
 - c) Frequency multiplexing
 - d) Time multiplexing

12. For global communication, the number of satellites needed is
 - a) 1
 - b) 3
 - c) 5
 - d) 10

13. The different access methods which permit many satellite users to operate in parallel through a single transponder without interfering with each other as
- Frequency Division Multiple Access (FDMA).
 - Time Division Multiple Access (TDMA).
 - Code Division Multiple Access (CDMA).
 - All of the above.
14. Shannon's Law relates
- Antenna gain to frequency
 - Noise power to bandwidth
 - Information-carrying capacity to s/n ratio
 - Transmission losses to noise
15. A modem is
- a form of commutator.
 - a device for digitizing speech.
 - a circuit used for suppressing microwave interference.
 - an electronic circuit which carries out modulation and demodulation of a carrier frequency.
16. A telephone user while talking to a person via a satellite has to wait for reply for about _____ millisecond.
- 100
 - 270
 - 470
 - 540
17. Phase modulation is commonly used for data transmission mainly because
- phase can be varied from $+180^\circ$ to 180° .
 - it is resistant to the effects of noise.
 - demodulation is very easy.
 - it gives highest data rates that can be transmitted over a given channel.
18. The echo heard by a telephone user on a satellite channel can be removed by using
- A vocoder
 - A multiplexer
 - Echo suppressor
 - Digital techniques
19. A duplexer is a device used to
- feed more than one receiver from a single antenna.
 - connect two transmitters to the same antenna.
 - connect a receiver and a transmitter to the same antenna.
 - None of these.
20. The RF amplifiers are used in radio receivers for
- improved image frequency rejection.
 - improved rejection of adjacent unwanted signals.
 - prevention of re-radiation of the local oscillator through the antenna of the receiver.
 - All of the above.

21. The sensitivity curve of a standard receiver is represented by



- a) Curve A
 - b) Curve B
 - c) Curve C
 - d) Curve D
22. It is known that noise phase modulates the FM wave. As the noise side band frequency approaches the carrier frequency, the noise amplitude
- a) will increase.
 - b) will decrease.
 - c) will remain constant.
 - d) will reduce to negligible value.
23. In a communication system, noise is most likely to affect the signal
- a) at the transmitter.
 - b) in the channel.
 - c) in the information source.
 - d) at the destination.
24. A notch filter is sometimes used in communication receivers to
- a) reduce receiver gain at some specific frequency.
 - b) increase receiver gain at some specific frequency.
 - c) made selectivity more precise.
 - d) spread the bandwidth.
25. 2's complement of binary number 0101 is
- a) 1011
 - b) 1111
 - c) 1101
 - d) 1110
26. Which of these are universal gates?
- a) Only NOR
 - b) Only NAND
 - c) Both NOR and NAND
 - d) NOR, NAND, OR

27. A mod 4 counter will count
- From 0 to 4
 - From 0 to 3
 - From any number n to $n + 4$
 - None of the above
28. In radar systems, PRF stands for
- Power Return Factor
 - Pulse Return Factor
 - Pulse Repetition Frequency
 - Pulse Response Factor
29. When the antenna diameter of a radar system is doubled, the maximum range will
- be doubled.
 - become four times.
 - be halved.
 - decrease to one fourth.
30. The maximum range of a transmitter depends on
- its frequency.
 - its power.
 - both its frequency and power.
 - None of the above.

PART II – Short Answer Questions [20 marks]

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

- What is “Internet of Things (IoT)”? Give four applications of IoT.
- What is Modulation and where is it applied?
- Define feedback? Explain different types of feedback used in the communications system.
- What do you understand by term AM and FM? Where do we use them?

SECTION B: Case Study [50 marks]

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

CASE I

Due to high altitude and rugged terrain, the people Lunana geog has been suffering from poor quality of mobile communication service. Besides poor quality, some of the residents of Lunana geog cannot access mobile service, they need to go to mountain top to receive mobile signal. The telecom operator has used terrestrial wireless communication network to provide mobile service to Lunana geog.

Despite repetitive request to the telecom operator, the mobile quality of service has not improved. Therefore, the Gasa Dzongkhag Administration decided to conduct an internal study to find out an alternative way to enhance the quality as well as coverage of the mobile service for Lunana geog. You are hired as the consultant to carry out this study.

1. Explain the drawbacks of the terrestrial wireless communication network.
2. What would be the best alternative technology choice? Give reasons for the choice of this technology.
3. Explain with clear network diagram on how this alternative technology will work.
4. Explain the advantages and disadvantages of the choice of your technology.

CASE II

For your final examination, you are required to make a presentation on communication system. Kindly explain in detail the following communications system with clear network diagrams:

1. Radar Communication system
2. Optical Communication System
3. Radio Communication System
4. Duplex communications system
5. Digital Communication system

TASHI DELEK