ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2013
EXAMINATION CATEGORY: <u>TECHNICAL</u>

PAPER III: SUBJECT SPECIALIZATION PAPER for
ELECTRONICS & COMMUNICATIONS ENGINEERING

Date	: 14 October 2013
Total Marks	: 100
Examination Time	: 150 minutes (2.5 hours)
Reading Time	: 15 Minutes (prior to examination time)

GENERAL INSTRUCTIONS:

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

2. The first 15 minutes is being provided 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 and 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 under your choice.

4. 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 any or correct Section, Part and Question Number will NOT be evaluated and no marks would be awarded.

5. Begin each Section and Part in a fresh page of the Answer Booklet.

6. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.

7. Use of any other paper including paper for rough work is not permitted.

8. You are required to hand over the Answer Booklet to the Invigilator before leaving the examination hall.

9. This paper has **09** printed pages in all, 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 the correct answer chosen in the Answer Booklet against the question number. E.g. 31 (c). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. In integrated circuits, npn construction is preferred to pnp construction because

    a. npn construction is cheaper

    b. to reduce diffusion constant, n-type collector is preferred

    c. npn construction permits higher packing of elements

    d. p-type base is preferred

2. What transmission medium is best suited for high-capacity and minimal interference?

    a. Coaxial cable.

    b. Twisted pair copper wire.

    c. Satellite

    d. Optical Fiber

3. What is the total resistance of the circuit below?
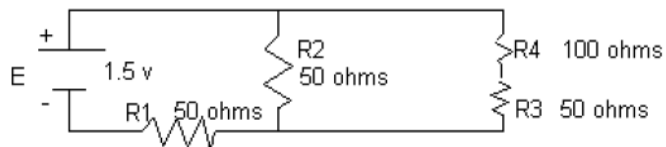
    a. 85.7 ohms

    b. 78.5 ohms.

    c. 80.7 ohms.

    d. 87.5 ohms

4. The range of frequencies of significant amplitude centered around a resonant frequency is called the_____?

    a. Signal-to-noise ratio

    b. Bandwidth

    c. Quality factor

    d. Carrier frequency

5. What is the current through R3 below?

R4 100Ohms

R2 50Ohms

R3 50Ohms

E   1.5 V

R1 50 Ohms
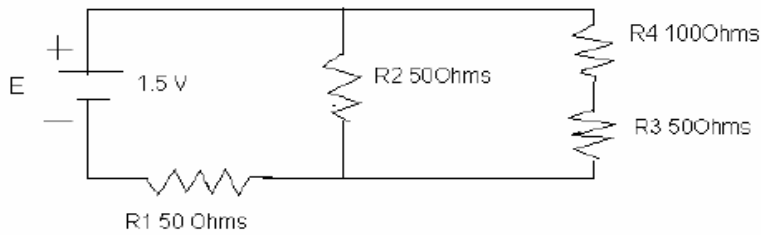
    a. 4 amps

    b. 0 .04 amps

    c. 0.004 amps

    d. 0.0004 amps

6. What are the steps followed to achieve Pulse Code Modulation?

    a. Sampling, quantizing, modulation

    b. Detecting, sampling, quantizing

    c. Sampling, quantizing, coding

    d. Coding, modulating, packetizing

7. In Quadrature Amplitude Modulation, (QAM), the carrier is modulated by:

    a. Amplitude

    b. Phase

    c. Both

    d. None of above

8. The device in a Vacuum Tube that allows a smaller signal to control a larger one is a:

    a. Filament

    b. Plate

    c. Grid

    d. Triode

9. The number of codes that an eight element ternary code can represent is:

    a. 256

    b. 6561

    c. 128

    d. 2187

10. The varactor diode is usually:

    a. Forward biased

   b. Reverse biased

    c. Unbiased

    d. None of above

11. A transmission line of characteristic impedance 50W is terminated by a 50W load. When excited by a sinusoidal voltage source at 10GHz, the phase difference between two points spaced 2mm apart on the line is found to be $\pi / 4$ radians. The phase velocity of the wave along the line is:

    a. 8 0.8×10 m/ s

    b. 8 1.2×10 m/ s

    c. 8 1.6×10 m/ s

    d. 8 3×10 m/ s

12. An analog signal is band-limited to 4 kHz, sampled at the Nyquist rate and the samples are quantized into 4 levels. The quantized levels are assumed to be independent and equally probable. If we transmit two quantized samples per second, the information rate is _____ bits / second.

    a. 1

    b. 2

    c. 3

    d. 4

13. The output Y in the circuit below is always '1' when
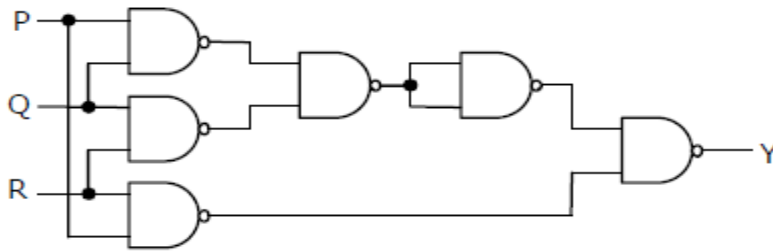
    a. Two or more of the inputs P, Q,R are '0'

    b. Two or more of the inputs P,Q,R are '1'

    c. Any odd number of the inputs P,Q,R is '0'

    d. Any odd number of the inputs P,Q,R is '1'

14. A transistor in common emitter mode has:

    a. High input resistance and low output resistance

    b. Medium input resistance and high output resistance

    c. Very low input resistance and a low output resistance

   d. High input resistance and a high output resistance

15. Drift current in the semiconductors depends upon

    a. Only the electric field

    b. Only the carrier concentration gradient

    c. Both the electric field and the carrier concentration

    d. Both the electric field and the carrier concentration gradient

16. A Zener diode, when used in voltage stabilization circuits, is biased in:

    a. Reverse bias region below the breakdown voltage

    b. Reverse breakdown region

    c. Forward bias region

    d. Forward bias constant current mode

17. For the transfer function $G(jw) = 5 + jw$, the corresponding Nyquist plot for positive frequency has the form:

a.

b.

c.

d.
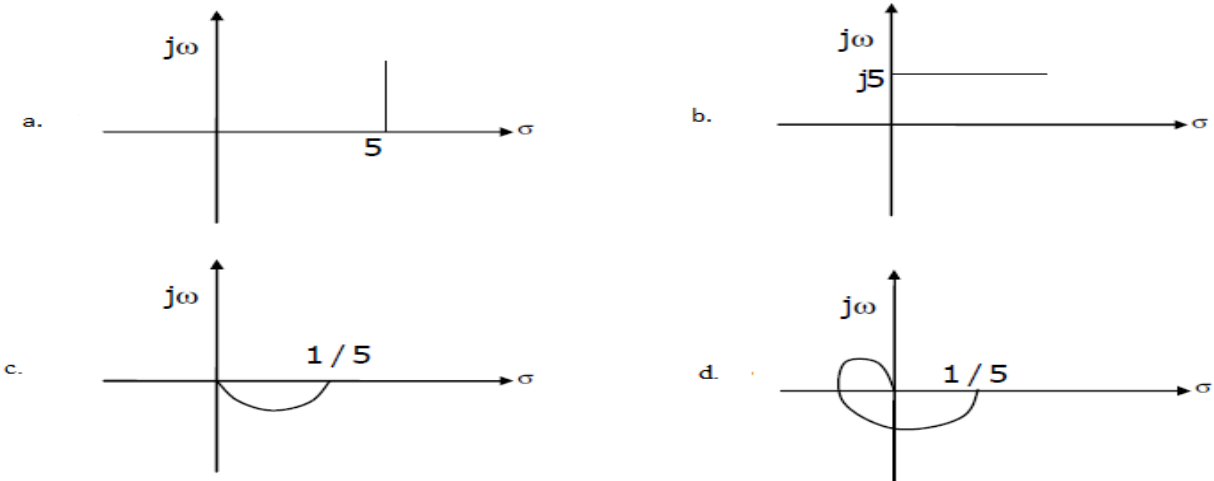
18. An intrinsic semiconductor at the absolute zero temperature

    a. Behaves like a metallic conductor

    b. Behaves like an insulator

    c. Has a large number of holes

    d. Has a large number of electrons

19. If a/b=0.25. What is the negative value of the reciprocal of the fraction a/b.

    a. -4

    b. -5

    c. -6

    d. -11

20. Which of the following diodes is operated in reverse bias mode?

    a. P-N junction

    b. Zener

    c. Tunnel

    d. None of above

21. Which of the following characterizes an analog quantity?

   a. Discrete levels represent changes in a quantity

   b. Its values follow a logarithmic response curve

   c. It can be described with a finite number of steps

   d. It has a continuous set of values over a given range

22. Which type of signal is represented by discrete values?

   a. Noisy signal

   b. Non-linear

   c. Analog

   d. Digital

23. A data conversion system may be used to interface a digital computer system to:

   a. An analog output device

   b. A digital output device

   c. An analog input device

   d. A digital printer

24. The NAND gate output will be low if the two inputs are

   a. 0 0

   b. 0 1

   c. 1 0

   d. 1 1

25. An atom's atomic number is determined by the number of:

   a. Neutrons minus protons

   b. Protons

   c. Electrons

   d. Neutrons

26. What is the binary equivalent of the decimal number 368?

    a. 101110000

    b. 110110000

    c. 111010000

    d. 111100000

27. Which of the following represent the symbol for battery?

a.

b.

c.

d.

28. The breakdown mechanism in a lightly doped p-n junction under reverse biased condition is called:

    a. Avalanche breakdown

    b. Zener breakdown

    c. Breakdown by tunnelling

    d. High voltage breakdown

29. Removing bypass capacitor across the emitter-leg resistor in a CE amplifier causes:

    a. Increase in current gain

    b. Decrease in current gain

    c. Increase in voltage gain

    d. Decrease in voltage gain.

30. When a step-input is given to an op-amp integrator, the output will be

    a. A ramp

    b. A sinusoidal wave

    c. A rectangular wave

    d. A triangular wave with dc bias.

PART – II : Short Answer Questions (20 marks)

Answer ALL the questions. Each question carries 5 marks.

1. Define Microwave and list down some the applications of Microwaves?

2. A RLC circuit has R = 25 Ω , L= 0.04 H and C = 0.01 μF. Calculate the resonance frequency. If 1 V source of the same frequency as the resonance frequency is applied to the circuit, calculate the frequencies at which voltage across L and C are maximum.

3. What are the advantages and disadvantages of negative feedback in amplifier?

4. What is meant by TDMA, how does it work?

SECTION B
Case Study

Choose either Case 1 or Case 2 from this Section. Each Case carries 50 marks.

CASE 1

Television broadcasting has been a very effective medium for information dissemination and mode of communication. The Royal government has recently announced its intention to introduce private television stations to offer choice of service in visual media. If you are hired to develop a comprehensive proposal to set up a television station, how would you do? Your proposal should include the technical details of the studio, transmission and radio spectrum specifications.

CASE 2

What is sampling? Describe sampling theorem and elaborate with example the spectrum view of sampling and reconstruction