

**ROYAL CIVIL SERVICE COMMISSION**  
**CIVIL SERVICE COMMON EXAMINATION (CSCE) 2008**  
**EXAMINATION CATEGORY: TECHNICAL**

**PAPER III: SUBJECT SPECILIZATION PAPER FOR ELECTRONIC AND**  
**COMMUNICATIONS ENGINEERING**

**Date** : 20/ 12 / 08  
**Total Marks** : 100  
**Examination Time** : 150 minutes  
**Reading Time** : 15 minutes

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**PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY**

- 1. This paper is contains two sections SECTION A and SECTION B.**
- 2. Part I of SECTION A consist 30 multiple choice questions. Each question carries one (1) point. All questions in Part I of SECTION A are compulsory.**
- 3. Part II of the SECTION A consist 5 short answer questions. Each short question carries five (5) points. Any four (4) questions are to be answered**
- 4. SECTION B consists of two (2) case studies. Each case study carries 50 points. Attempt one (1) case study only.**
- 5. Programmable calculators are not allowed to be used.**
- 6. Answer the questions neatly and legibly**
- 7. Please answer the questions on the answer paper.**
- 8. Please write your name and number clearly on the answer sheet.**
- 9. Just write the number of the answer for the Multiple choice questions**
- 10. This question papers has 10 pages excluding this page**
- 11. check to make sure that the required number of questions has been answered**

**All the best**

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**SECTION A**

**Part I (30 points)**

**Multiple Choice Questions (all questions to be answered)**

1. The following differential equation has  $3\frac{d^2y}{dt^2} + 4\left(\frac{dy}{dt}\right)^3 + y^2 + 2 = x$

- a) degree = 2, order = 1
- b) degree = 3, order = 2
- c) degree = 4, order = 3
- d) degree = 2, order = 3

**Answer : a**

2. A fair dice is rolled twice, the probability that an odd number follow even number is

- a)  $\frac{1}{2}$
- b)  $\frac{1}{6}$
- c)  $\frac{1}{3}$
- d)  $\frac{1}{4}$

**Answer : d**

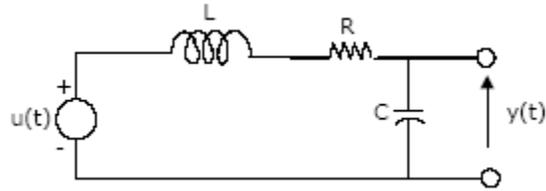
3. A solution of the following differential equation is given by

$$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$$

- a)  $y = e^{2x} + e^{-3x}$
- b)  $y = e^{2x} + e^{3x}$
- c)  $y = e^{-2x} + e^{3x}$
- d)  $y = e^{-2x} + e^{-3x}$

**Answer : b**

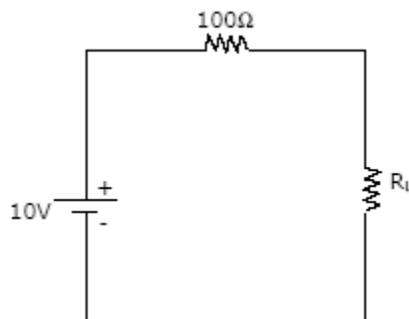
4. The condition on R, L, and C such that the step response  $y(t)$  in the figure has no oscillation, is



- a)  $R \geq \frac{1}{2} \sqrt{\frac{L}{C}}$   
 b)  $R \geq \sqrt{\frac{L}{C}}$   
 c)  $R \geq 2 \sqrt{\frac{L}{C}}$   
 d)  $R = \frac{1}{\sqrt{LC}}$

**Answer : c**

5. The maximum power that can be transferred to the load Resistor  $R_L$  from the voltage source in the given figure is



- a) 1 W  
 b) 10 W  
 c) 0.25 W  
 d) 0.5 W

**Answer: c**

6. A silicon PN junction at a temperature of  $20^{\circ}\text{C}$  has a reverse saturation current of 10 pico- Amperes (pA). The reverse saturation current at  $40^{\circ}\text{C}$  for the same bias is approximately,
- a) 30 pA
  - b) 40 pA
  - c) 50 pA
  - d) 60 pA

**Answer: b**

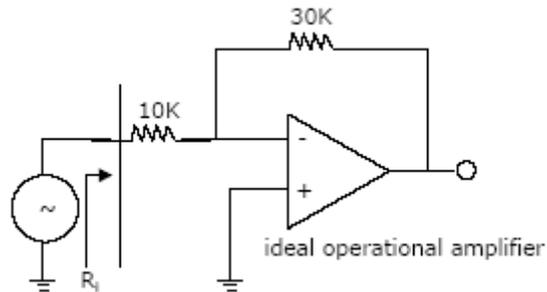
7. The primary reason for the widespread use of Silicon in semiconductor device technology is
- a) abundant of Silicon on the surface of the Earth
  - b) larger bandgap of Silicon in comparison to Germanium
  - c) favorable properties of Silicon- dioxide ( $\text{SiO}_2$ )
  - d) lower melting point

**Answer: c**

8. The effect of current shunt feedback in an amplifier is to
- a) increase the input resistance and decrease the output resistance
  - b) increase both input and output resistances
  - c) decrease both input and output resistances
  - d) decrease the input resistance and increase the output resistance

**Answer: d**

9. The input resistance  $R_i$  of the amplifier shown in the figure below is



- a)  $\frac{30}{4} k\Omega$
- b)  $10k\Omega$
- c)  $40 k\Omega$
- d) infinite

**Answer: b**

10. Despite the presence of negative feedback, control systems still have problem of instability because the

- a) component used have nonlinearities
- b) dynamic equations of the subsystems are not known exactly
- c) mathematical problem involves approximations
- d) system has large negative phase angle at high frequencies

**Answer: d**

11. In a pulse transmission system, the error rate

- a) is independent of noise at S/N ratio above 20 db
- b) increases as S/N ratio increases
- c) increases as S/N ratio decreases
- d) decreases as S/N ratio increases

**Answer: c**

12. A duplexer is a device used

- a) to feed more than one receivers from a single antenna
- b) to connect two transmitters to the same antenna
- c) to connect a receiver and a transmitter to the same antenna
- d) to connect receiver to the same antenna

**Answer: c**

13. In a transmission line terminated with a load equal to the characteristic impedance, the reflection coefficient is

- a) plus zero
- b) minus one
- c) zero
- d) infinity

**Answer: c**

14. A carrier is simultaneously modulated by two sine waves with modulation indices of 0.3 and 0.4, the total modulation index is

- a) 0.1
- b) 0
- c) 0.5
- d) Cannot be calculated

**Answer: c**

15. In television, 4:3 represents

- a) interlace ratio
- b) maximum horizontal deflection
- c) aspect ratio
- d) ratio of the two diagonals

**Answer: c**

16. A half –wave dipole used at a frequency of 300 MHz has a length of

- a) 10 metres
- b) 3 metres
- c) 1 metres
- d) 5 metres

**Answer: d**

17. Radar antennas are usually

- a) Dipoles
- b) Parabolic dishes
- c) Helical antennas
- d) Directional antenna

**Answer: c**

18. Which of the following antenna gives circular polarization

- a) Yagi –Uda
- b) Parabolic
- c) Helical
- d) Dipole

**Answer: c**

19. Television receiver antennas are usually

- a) Loops
- b) Yagi antennas
- c) Parabolic dishes
- d) None of above

**Answer: b**

20. Television broadcast generally uses

- a) line of sight propagation
- b) ionospheric propagation
- c) ground wave propagation
- d) None of above

**Answer: a**

21. The uplink and downlink frequencies are made different in satellite links to
- a) reduce transmission power
  - b) increase the isolation between the satellite transmitter and receiver
  - c) reduce antenna size
  - d) None of above

**Answer: b**

22. Propagation in VHF band is by
- a) ground waves
  - b) space waves
  - c) sky waves
  - d) None of above

**Answer: b**

23. An amplitude modulate wave is
- a) the sum of the carrier and the modulating wave
  - b) the difference between the carrier and the modulating wave
  - c) the product of the carrier and the modulating wave
  - d) sum of the carrier and its product with modulating signal

**Answer: d**

24. For TV broadcast, picture signal is modulated in
- a) AM
  - b) FM
  - c) VSB
  - d) SSB

**Answer: c**

25. In FM, the frequency deviation is proportion to
- a) modulating frequency
  - b) amplitude of modulating signal
  - c) constant
  - d) None of above

**Answer: b**

26. In a receiver, the maximum contribution to noise is made by

- a) power supply unit
- b) power amplifier
- c) mixed stage
- d) None of above

**Answer: c**

27. In a telephone receiver, if a permanent magnet is not used then the sound output is

- a) lower
- b) zero
- c) higher
- d) No effect

**Answer: a**

28. The frequency deviation in a phase modulated signal is proportional to

- a) amplitude
- b) frequency
- c) both of the modulating signal
- d) None of above

**Answer: b**

29. A pure AC signal is called a

- a) sine wave
- b) square
- c) rectangular
- d) circle

**Answer: a**

30. A transistor is basically an amplifying device for

- a) Current
- b) Voltage
- c) Power
- d) None above

**Answer: a**

## SECTION A

### Part II (4 x5 = 20 points) Answer any four

1. An AM wave is represented by the expression  
$$v = 5 (1+0.6 \cos 6280 t) \sin 211 \times 10^4 t \text{ volts}$$
  - (i) What are the minimum and maximum amplitudes of the AM wave?
  - (ii) What frequency components are contained in the modulated wave and what is the amplitude of each component?
2. The two-cavity Klystron is a widely used microwave amplifier operated by the principles of velocity and current modulation. Derive an expression for its maximum theoretical efficiency
3. Describe the operation of a reflex Klystron oscillator with sketches?
4. What is “effective length” of an antenna? Derive an expression for it?
5. List the advantages of Single Side Band (SSB) transmission over conventional double side band system?

## SECTION B (50 Points)

### Answer one (1) question only

1. Assume that you are just recruited by Tashi cell to study their network and to work on the network expansion throughout the country. In this view write a report on how the cellular mobile technology used by Tashi cell works, radio spectrum used and suggest possible recommendation for its network improvement. The report should also consist of building national backhaul network and the installation of the international gateway. It is important to include diagrams to explain the network with traffic calculation and various other cellular mobile technology terminologies.

2. If you are hired as a consultant by the Etho-Metho Cable TV, Thimphu to design a cable TV network in Gasa from scratch. How would you do? Explain in detail the equipment required with diagrams. The details should start from setting up a head end and actually distributing the subscriber lines.