10

WRITTEN TEST

ELECTRONIC

Test Booklet No.

Name of Applicant .... Answer Sheet No. ....

Application ID : .... Signature of Applicant : ....

Date of Examination: .... Signature of the Invigilator(s)

1. ....

Time of Examination : ....

2. ....

Duration : 1 Hour] **[Maximum Marks : 50**

IMPORTANT INSTRUCTIONS

(i) The question paper is in the form of Test-Booklet containing **50 (Fifty)** questions. All questions are compulsory. Each question carries four answers marked (A), (B), (C) and (D), out of which only one is correct.

(ii) On receipt of the Test-Booklet (Question Paper), the candidate should immediately check it and ensure that it contains all the pages, i.e., **50** questions. Discrepancy, if any, should be reported by the candidate to the invigilator immediately after receiving the Test-Booklet.

(iii) A separate Answer-Sheet is provided with the Test-Booklet/Question Paper. On this sheet there are **50** rows containing four circles each. One row pertains to one question.

(iv) The candidate should write his/her Application number at the places provided on the cover page of the Test-Booklet/Question Paper and on the Answer-Sheet and NOWHERE ELSE.

(v) No second Test-Booklet/Question Paper and Answer-Sheet will be given to a candidate. The candidates are advised to be careful in handling it and writing the answer on the Answer-Sheet.

(vi) For every correct answer of the question **One (1) mark will be awarded.** For every unattempted question, Zero (0) mark shall be awarded. **There is no Negative Marking.**

(vii) Marking shall be done only on the basis of answers responded on the Answer-Sheet.

(viii) To mark the answer on the Answer-Sheet, candidate should **darken** the appropriate circle in the row of each question with Blue or Black pen.

(ix) For each question only **one** circle should be **darkened** as a mark of the answer adopted by the candidate. If more than one circle for the question are found darkened or with one black circle any other circle carries any mark, the question will be treated as cancelled.

(x) The candidates should not remove any paper from the Test-Booklet/Question Paper. Attempting to remove any paper shall be liable to be punished for use of unfair means.

(xi) Rough work may be done on the blank space provided in the Test-Booklet/Question Paper only.

(xii) *Mobile phones (even in Switch-off mode) and such other communication/programmable devices are not allowed inside the examination hall.*

(xiii) No candidate shall be permitted to leave the examination hall before the expiry of the time.

DO NOT OPEN THIS QUESTION BOOKLET UNTIL ASKED TO DO SO.

1. For the transfer function of a physical two-port network

(i) All the zeros must lie only in the left half of s-plane

(ii) The poles may lie anywhere in the s-plane

(iii) The poles lying on the imaginary axis must be simple

(iv) A pole may lie at origin

(A) (i) & (ii)

(B) (ii) & (iv)

(C) (iii) & (iv)

(D) (i) & (iv)

2. The impedance function of a parallel RLC circuit has pole located at $-3 \pm j4$ rad/sec. If the values of L = 1 H, the values of R & C are

(A) $\frac{25}{4}\ \Omega$ and $\frac{1}{5}$ F

(B) $\frac{25}{6}\ \Omega$ and $\frac{1}{25}$ F

(C) $\frac{25}{3}\ \Omega$ and $\frac{1}{36}$ F

(D) $\frac{25}{3}\ \Omega$ and $\frac{1}{28}$ F

3. The circuit as shown in Fig. 1. What is the status of diode whether forward biased or reverse biased. The current through ideal diode equals

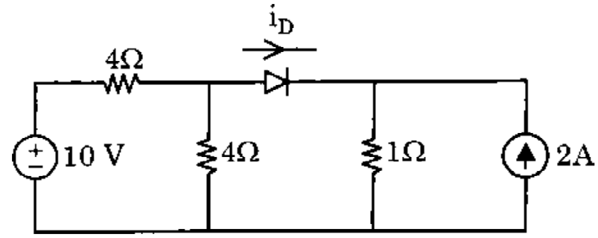

Fig.1

(A) Forward biased & 0 A

(B) Reverse biased & 4A

(C) Forward biased & 1 A

(D) none of these

4. A network contains only independent current source and resistor. If the value of all resistor are doubled, the value of then node voltage

(A) will become half

(B) will remain unchanged

(C) will become double

(D) Cannot be determined unless the circuit configuration and the value of the registers are known.

5. For the circuit as shown in Fig.2, the Thevenin's Resistance and Voltage across the terminal A and B is

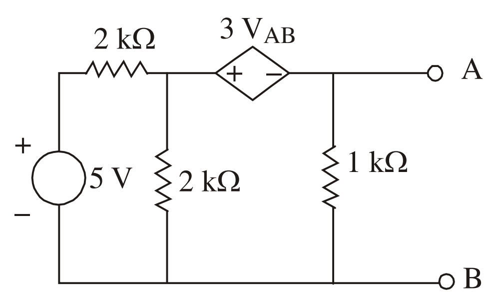

Fig. 2

(A) 0.5 kΩ & 12.5 V

(B) 0.2 kΩ & 0.5 V

(C) 1 kΩ & 0.25 V

(D) 0.11 k? & 0.5 V

6. For the circuit as shown in Fig. 3, the current I is

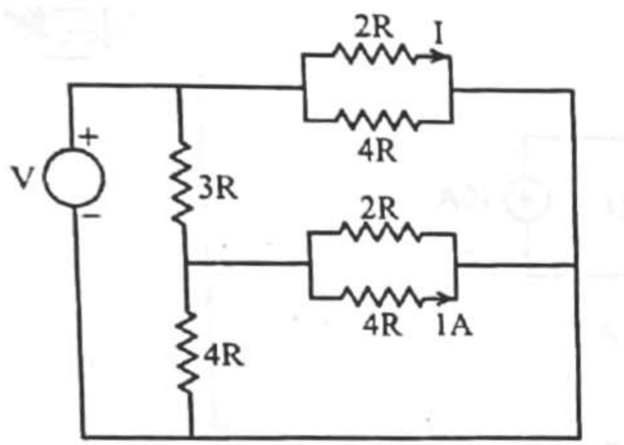

Fig. 3

(A) independent due to inadequate data

(B) Zero

(C) 4A

(D) 8 A

7. The short-circuit admittance matrix is a two-port network is $\begin{bmatrix} 0 & -\frac{1}{2} \\ \frac{1}{2} & 0 \end{bmatrix}$. The two-port network is

(A) non-reciprocal and passive

(B) non-reciprocal and active

(C) reciprocal and passive

(D) reciprocal and active

8. The impedance parameters Z_{11} and Z_{12} of the two-port network as shown in Fig. 4 are

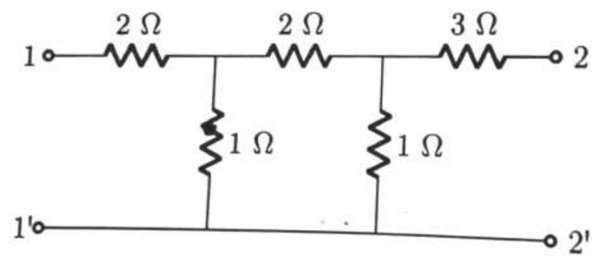

Fig.4

(A) Z_{11} = 2.75 Ω and Z_{12} = 0.25 Ω

(B) Z_{11} = 3 Ω and Z_{12} = 0.5 Ω

(C) Z_{11} = 3 Ω and Z_{12} = 0.25 Ω

(D) Z_{11} = 2.25 Ω and Z_{12} = 0.5 Ω

9. The Fourier Transform of $\left(\frac{1}{2}\right)^{n-1} u(n-1)$ is

(A) $\dfrac{e^{-j\omega}}{1-\left(\frac{1}{2}\right)e^{-j\omega}}$

(B) $\dfrac{e^{j\omega}}{1-\left(\frac{1}{2}\right)e^{j\omega}}$

(C) $\dfrac{e^{-j\omega}}{1-\left(\frac{1}{2}\right)e^{j\omega}}$

(D) $\dfrac{e^{j\omega}}{1-\left(\frac{1}{2}\right)e^{-j\omega}}$

10. $y(n) = x(n^2) + x(-n)$ is for

(A) dynamic, nonlinear, non causal and time variant system

(B) static, linear, non causal and time variant system

(C) dynamic, nonlinear, causal and time invariant system

(D) static, non-linear, non causal and time variant system

11. For a non causal system $h(n)$ excited by non causal input $x(n)$, the output $y(n)$ is given by

(A) $\sum_{k=-\infty}^{\infty} x(k)h(n-k)$

(B) $\sum_{k=0}^{\infty} x(k)h(n-k)$

(C) $\sum_{k=-\infty}^{n} x(k)h(n-k)$

(D) $\sum_{k=0}^{n} x(k)h(n-k)$

12. Solution of $[x(n) = \{\delta(n+2) - \delta(n) + \delta(n-2)\}]*[h(n) = \{\delta(n) + \delta(n-1)\}]$ is

(A) $\{1, 1, -1, -\underset{\uparrow}{2}, 1, 1\}$

(B) $\{1, 1, -\underset{\uparrow}{1}, 1, -1\}$

(C) $\{1, 1, -1, -\underset{\uparrow}{1}, 1, 1\}$

(D) $\{1, 1, -\underset{\uparrow}{1}, 1, 0\}$

13. Which sequence cannot be the inverse Z-transform of $\left(\frac{1}{1-3z^{-1}} - \frac{1}{1-4z^{-1}}\right)$

(A) $3^n u(n) - 4^n u(n)$

(B) $-3^n u(-n-1) - 4^n u(-n-1)$

(C) $3^n u(n) + 4^n u(-n-1)$

(D) $-3^n u(-n-1) - 4^n u(-n)$

14. In overlap-add method, the __________ regions are added and the _______ region are retained

(A) overlapped, overlapped

(B) non overlapped, overlapped

(C) overlapped, non overlapped

(D) non overlapped, non overlapped

15. A series RL circumstantially relaxed. A step voltage is applied to the circuit. If τ is the time constant of the circuit, the voltage across R and L will be same at time 'τ' equal to

(A) $\tau \log_e (2)$

(B) $\tau \log_e (1/2)$

(C) $\frac{1}{\tau} \log_e (2)$

(D) $\frac{1}{\tau} \log_e \left(\frac{1}{2}\right)$

16. The electron concentration in silicon decreases linearly from 10^{16} cm^{-3} to 10^{15} cm^{-3} over a distance of 0.10 cm. The cross-sectional area of the sample is 0.05 cm^2. The electron diffusion coefficient, D_n is given by 25 cm^2/sec. The diffusion current in silicon will be

(A) 0.36 mA

(B) 18 mA

(C) 3.6 mA

(D) 1.8 mA

17. A silicon p^+n junction has doping concentration of $N_a = 10^{18}$ cm^{-3} and $N_d = 5 \times 10^{15}$ cm^{-3}. The cross-sectional area of the junction is $A = 5 \times 10^{-5}$ cm^2. What will be the junction capacitance for the applied reverse voltage, $V_R = 3V$

(A) 2.605 nF

(B) 1.04 nF

(C) 0.005 nF

(D) 0.521 pF

18. Consider an MOS structure with p-type silicon and $N_a = 6 \times 10^{15}$ cm^{-3}. If the gate is aluminium then the metal semiconductor work function difference, ϕ_{ms} of the MOS structure will be

(A) –2.256 V

(B) –0.944 V

(C) 7.344 V

(D) 4.144 V

19. The phenomenon known as "Early Effect" in a bipolar transistor refers to a reduction of base-width caused by

(A) Electron-hole recombination at base

(B) The forward biasing of emitter-base junction

(C) The early removal of stored base charge during saturation to cut off switching

(D) The reverse biasing of base-collector junction

20. The common short circuit current gain β of a transistor

(A) is a monotonically increasing function of collector current I_C

(B) is a monotonically decreasing function of I_C

(C) increasing with I_C, for low I_C reaches a maximum and then decrease with further increase in I_C

(D) is not a function of I_C

21. The built-in-potential (diffusion potential) in a pn junction

(i) increases with increase in temperature

(ii) increases with increase in doping in the doping levels of two sides

(iii) is equal to the average of the Fermi-levels of the two sides

(iv) is equal to the difference in the Fermi-level of two sides

Which of the following statement is correct

(A) (i), (ii) & (iv)

(B) (i) & (ii)

(C) (ii) & (iii)

(D) (i) & (iv)

22. The current gain of the transistor as shown in Fig. 5 is β = 125. The Q-point values (I_{CQ} & V_{CEQ}) are

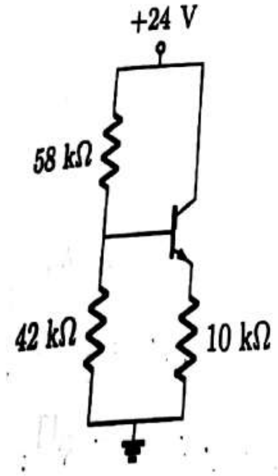

Fig. 5

(A) 0.418 mA & 20.4 V

(B) 0.913 mA & 16.23 V

(C) 0.913 mA &14.8 V

(D) 0.418 mA & 18.43 mV

23. The collector to emitter cut-off current (I_{CEO}) to base cut-off current (I_{CBO}). As α is the CB current gain of the transistor

(A) $I_{CEO} = I_{CBO}$

(B) $I_{CEO} = \alpha I_{CBO}$

(C) $I_{CEO} = \dfrac{I_{CBO}}{1+\alpha}$

(D) $I_{CEO} = \dfrac{I_{CBO}}{1-\alpha}$

24. A two stage amplifier is related to have an upper cut-off frequency of 2MHz and a lower cut-off frequency of 30 Hz. The upper and lower cut-off frequencies of individual stages are

(A) 3 MHz, 20 Hz

(B) 4 MHz, 60 Hz

(C) 3 MHz, 60 Hz

(D) 4 MHz, 20 Hz

25. Consider the following statements regarding the circuit as shown in Fig.6

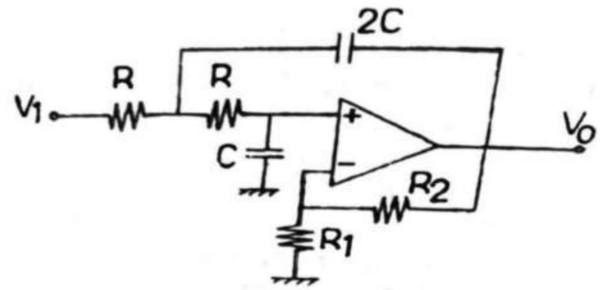

Fig.6

(i) The circuit represents an active low pass filter

(ii) The circuit represents a second order active filter

(iii) The circuit has a cut-off rate of 40 dB per decade

(A) (i), (ii) & (iii) are correct

(B) (i) & (ii) are correct

(C) Only (i) is correct

(D) (ii) & (iii) are correct

26. An op-amp has an open loop gain of 10^5 and an open loop cut-off frequency of 10 Hz. If this op-amp is connected as an amplifier with a closed loop gain of 100, then the new upper cut-off frequency is

(A) 100 kHz

(B) 1000 kHz

(C) 10 Hz

(D) 10 kHz

27. Three identical amplifiers with each one having a voltage gain of 50, input resistance of 1 kΩ and output resistance of 250 Ω are cascaded. The opened circuit voltages gain of the combined amplifier is

(A) 98 dB

(B) 51 dB

(C) 53 dB

(D) 102 dB

28. For small signal ac operation, a practical forward biased diode can be modelled as:

(A) a resistance and a capacitance in series

(B) an ideal diode and resistance in parallel

(C) a resistance and an ideal diode in series

(D) a resistance

29. The circuit as shown in Fig. 7 produces the output sequence

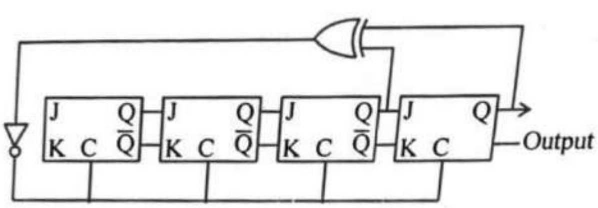

Fig. 7

(A) 1111 1111 0000 0000

(B) 1111 0000 1111 1111

(C) 1111 0001 0001 1010

(D) 1010 1010 1010 1010

30. The minimised form of logical expression $\overline{A}\,\overline{B}\,\overline{C} + \overline{A}\,B\,\overline{C} + \overline{A}\,B\,C + A\,B\,\overline{C}$

(A) $A\overline{C} + B\overline{C} + \overline{A}B$

(B) $\overline{A}C + \overline{B}C + \overline{A}B$

(C) $\overline{A}\,\overline{C} + B\overline{C} + \overline{A}B$

(D) $A\overline{C} + \overline{B}C + A\overline{B}$

31. What are the values of x and y in the expression $(235)_x = (565)_{10} = (1065)_y$

(A) 8, 16

(B) 16, 8

(C) 6, 16

(D) 12, 8

32. Consider the following statements

(i) TTL has high switching speed and good fan out capability

(ii) ECL has least propagation delay

(iii) I^2L uses multicollector transistor

(iv) NMOS has more silicon area

Which of the statements given above are correct

(A) (i) & (ii)

(B) (ii), (iii) & (iv)

(C) (ii) & (iv)

(D) (i), (ii) & (iii)

33. The open loop transfer function of unity feedback control system is given by:

$$G(s) = \frac{k(s+0.1)}{s(sT_1+1)(sT_2+1)}$$

For the system to be stable the range of k is

(A) $0 < k < \left(\frac{1}{T_1} + \frac{1}{T_2}\right)$

(B) $k > \left(\frac{1}{T_1} + \frac{1}{T_2}\right)$

(C) $0 < k < T_1T_2$

(D) $k > T_1T_2$

34. The unit step response of a unity feedback system whose open loop transfer is

$$G(s) = \frac{2s+1}{s^2}$$

(A) $2e^{-t} - te^{-t}$

(B) $2e^{-t} + te^{t}$

(C) $1 + e^{-t} + t^2e^{-t}$

(D) $1 - e^{-t} + te^{-t}$

35. The number of roots of the equation lie in right-half s-plane

$s^6 + 2s^5 + 8s^4 + 15s^3 + 20s^2 + 16s + 16 = 0$

(A) 02

(B) 03

(C) 04

(D) None of these

36. The magnitude-frequency response of a control system is given in Fig. 8. The values of 1 and 2 are respectively

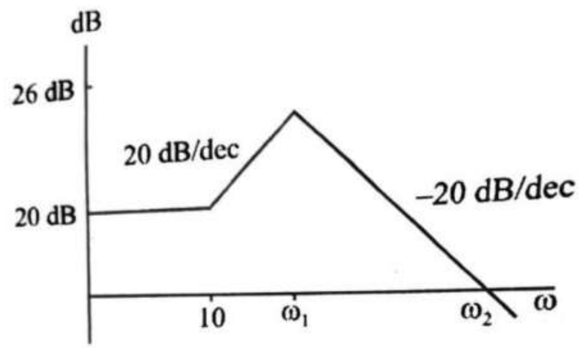

Fig. 8

(A) 20 & 400

(B) 100 & 400

(C) 20 & 200

(D) 10 & 200

37. For the system $\dot{X} = \begin{bmatrix} 2 & 3 \\ 0 & -5 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$ which of the following statement is true

(A) The system is controllable but unstable

(B) The system is uncontrollable and unstable

(C) The system is uncontrollable and stable

(D) The system is controllable and stable

38. The non-valid power spectral density function of a real random process is

(A) $\delta(\omega+\omega_0) - \delta(\omega-\omega_0)$

(B) $\frac{\omega^2}{\omega^2+16}$

(C) $\delta(\omega) + \frac{\omega^2}{\omega^2+16}$

(D) $\frac{\omega^2}{\omega^2+25}$

39. A system have the transfer function

$$|H(\omega)|^2 = \frac{1}{1+\left(\frac{\omega}{W}\right)^4}$$

where W is a real constant. The noise bandwidth of the system is

(A) $\frac{1}{2\sqrt{2}}\pi W$

(B) $\frac{1}{3}\pi W\sqrt{2}$

(C) $\frac{1}{6}\pi W\sqrt{2}$

(D) $\frac{1}{\sqrt{2}}\pi W$

40. A random process consists of three sample function $X(t, s_1) = 2$, $X(t, s_2) = 2 \cos t_1$ and $X(t, s_3) = 3 \sin t$ each occurring with equal probability. The process is

(A) First order stationary

(B) Ergodic

(C) Non stationary

(D) Wide-sense stationary

41. Which one of the following statements regarding the threshold effect in demodulators is correct?

(A) It is exhibited by all demodulators when the input signal-to-noise ratio is low

(B) It is the rapid fall in the output signal-to-noise ratio when the input signal-to-noise ratio falls below a particular value

(C) It is the property exhibited by all AM-suppressed carrier coherent demodulators

(D) It is the property exhibited by correlation receivers

42. Which one of the following statements is correct?

(A) AGC in radio receivers will keep the total signal output fairly constant but the noise component will be reduced; with a result, the S/N ratio will improve

(B) AGC in radio receivers is a linear operation with respect to both signals and noise

(C) AGC operation is independent of the filter components used in the AGC circuit

(D) Sudden changes in the output while tuning, which may cause damage to the components avoidable features of AGC

43. The message bit sequence input to DPSK modulator is 110011. The carrier phase during the reception of the first two message bits is $\pi\pi$. The carrier phase for remaining four message bit is

(A) $\pi\pi 0\pi$

(B) $00\pi\pi$

(C) $0\pi\pi\pi$

(D) $\pi\pi 00$

44. In a digital communication system employing Frequency Shift Keying (FSK), the 0 and 1 bit are represented by sine waves of 10 kHz and 25 kHz respectively. The waveforms are orthogonal for a bit interval of

(A) 200 μ sec

(B) 150 μ sec

(C) 250 μ sec

(D) 300 μ sec

45. Consider the following communication systems

(i) Telephony

(ii) Radio Communication

(iii) Microwave Communication

(iv) Optical Communication

Choose the correct sequence :

(A) (ii), (iv), (iii), (i)

(B) (iii), (iv), (i), (ii)

(C) (i), (ii), (iii), (iv)

(D) (iv), (ii), (i), (iii)

46. The autocorrelation function of an energy signal has

(A) no symmetry

(B) even symmetry

(C) odd symmetry

(D) conjugate symmetry

47. Which one of the following sets of equations is independent of Maxwell's equations?

(A) Two curl equations

(B) Two divergence equations

(C) Both the curl and divergence equations

(D) Two curl equations combined with the continuity equation

48. A TEM wave impinges obliquely on a dielectric-dielectric boundary with $\varepsilon_{r1} = 2$ and $\varepsilon_{r2} = 1$. The angle of incidence for total reflection is

(A) 30^0

(B) 45^0

(C) 60^0

(D) 90^0

49. The lowest frequency at which a uniform plane wave incident from region 1 onto the boundary at $z = 0$ will have no reflection is

(A) 2.96 GHz

(B) 4.38 Ghz

(C) 1.18 GHz

(D) 590 MHz

50. In an air-filled waveguide, a TE mode operating at

6 GHz has $E_y = 15 \sin\left(\frac{2\pi x}{a}\right) \cos\left(\frac{\pi x}{b}\right)$

$\sin(\omega t - 12z)$ V/m

The cut-off frequency and intrinsic impedance is

(A) 4.189 GHz & 35.72 Ω

(B) 5.973 GHz & 3978 Ω

(C) 8.438 GHz & 1989 Ω

(D) 7.946 GHz & 71.44 Ω

ROUGH WORK