(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

**(MPH/PHD/URS–EE–2019)**

# Electronics & Communication Engg.

Code **A**

Sr. No. 10001

**SET–"X"**

**Time : 1¼ Hours** **Total Questions : 100** **Max. Marks : 100**

Roll No. _____ (in figure) _____ (in words)

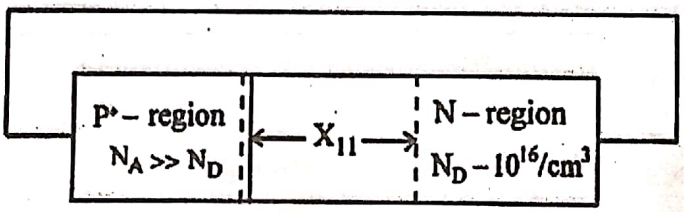
Name : _____ Father's Name : _____

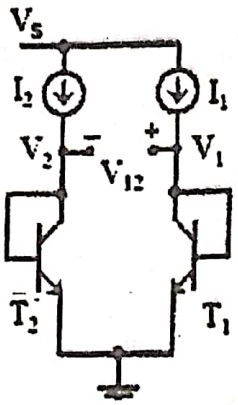
Mother's Name : _____ Date of Examination : _____

(Signature of the candidate) (Signature of the Invigilator)

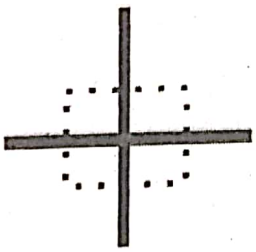
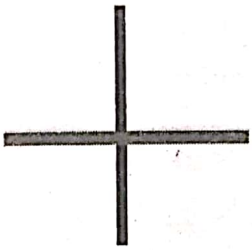
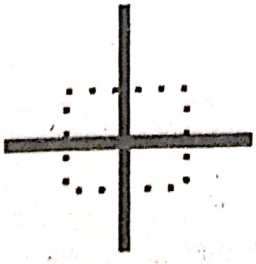
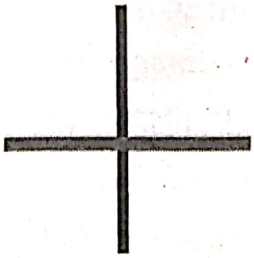
**CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.**

1. All questions are compulsory.
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / misbehaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A,B,C and D code will be got uploaded on the university website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E. Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers **MUST NOT** be ticked in the Question book-let.
6. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. Use only Black or Blue <u>BALL POINT PEN</u> of good quality in the OMR Answer-Sheet.
8. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

| Question No. | Questions |
|---|---|
| 1. | A silicon bar is doped with donor impurities $N_D = 2.25 \times 10^{15}$ atoms/cm$^3$. Given the intrinsic carrier concentration of silicon at T = 300 K is $n_i = 1.5 \times 10^{10}$ cm$^{-3}$. Assuming complete impurity ionization, the equilibrium electron and hole concentrations are<br>(1) $n_0 = 1.5 \times 10^{16}$ cm$^{-3}$, $p_0 = 1.5 \times 10^{5}$ cm$^{-3}$<br>(2) $n_0 = 1.5 \times 10^{10}$ cm$^{-3}$, $p_0 = 1.5 \times 10^{15}$ cm$^{-3}$<br>(3) $n_0 = 2.25 \times 10^{15}$ cm$^{-3}$, $p_0 = 1.5 \times 10^{10}$ cm$^{-3}$<br>(4) $n_0 = 2.25 \times 10^{15}$ cm$^{-3}$, $p_0 = 1 \times 10^{5}$ cm$^{-3}$ |
| 2. | Consider an abrupt PN junction (at T = 300 K) shown in the figure below. The depletion region width $X_n$ on the N-side of the junction is 0.2 μm and the permittivity of silicon ($\varepsilon_{si}$) is $1.044 \times 10^{-12}$ F/m. At the junction, the approximate value of the peak electric field (in kV/cm) is<br>  <br>(1) 25.40 (2) 28.32<br>(3) 30.66 (4) 32.42 |
| 3. | When a silicon diode having a doping concentration of $N_A = 9 \times 10^{16}$ cm$^{-3}$ on p-side and $N_D = 1 \times 10^{16}$ cm$^{-3}$ on n-side is reverse biased, the total depletion width is found to be 3 μm. Given that the permittivity of silicon is $1.044 \times 10^{-12}$ F/m, the depletion width on the p-side and the maximum electric field in the depletion region, respectively, are<br>(1) 2.7 μm and $2.3 \times 10^5$ V/cm (2) 0.3 μm and $4.15 \times 10^5$ V/cm<br>(3) 0.3 μm and $0.42 \times 10^5$ V/cm (4) 2.1 μm and $0.42 \times 10^5$ V/cm |

| Question No. | Questions |
|---|---|
| 4. | For the circuit shown below, $I_1 = 80$ mA and $I_2 = 4$mA. Transistors $T_1$ and T are identical. Assume that the thermal voltage $V_T$ is 26 mV at 27°C. A 50°C, the value of the voltage $V_{12} = V_1 - V_2$ (in mV) is _____.<br>  <br><br>(1) 87.14 (2) 83.15<br>(3) 84.12 (4) 81.13 |
| 5. | The internal quantum efficiency of LEDs decrease exponentially when th temperature<br>(1) decreases (2) increases<br>(3) remains constant (4) none of these |
| 6. | Which of the following is/are true<br>(i) Graphene is an extremely thin three dimensional form of carbon.<br>(ii) In aqueous solution, graphene can bind negatively charged ion.<br>(1) Only 1 (2) Only 2<br>(3) Both 1 and 2 (4) Neither 1 nor 2 |
| 7. | Carbon nano tubes can store<br>(1) Nitrogen (2) Carbondioxide<br>(3) Hydrogen (4) Peroxides |

| Question No. | Questions |
|---|---|
| 8. | What does the 'Chirality'(n, m) denote for carbon nanotubes<br>(1) the chirality is single walled or multi-walled.<br>(2) the CNT is insulating or metallic.<br>(3) A direction that the graphene sheet is rolled up to form a tube.<br>(4) A direction that the CNT extends along |
| 9. | Graphene epitaxial growth by thermal annealing of SiC is completed by<br>(1) Silicon sublimation during annealing, while carbon atoms remain on the surface.<br>(2) Segregation to condense a carbon layer on top of surface.<br>(3) An oxidation process to remove silicon atoms.<br>(4) A reduction process to rearrange carbon atoms on the surface. |
| 10. | Which one of the following is most famously known as solar grade silicon<br>(1) Crystalline Silicon (2) Crushed Silicon<br>(3) Powdered Silicon (4) Silicon |
| 11. | nMOS devices are formed in<br>(1) p-type substrate of high doping level<br>(2) n-type substrate of low doping level<br>(3) p-type substrate of moderate doping level<br>(4) n-type substrate of high doping level |
| 12. | Speed power product is measured as the product of<br>(1) gate switching delay and gate power dissipation<br>(2) gate switching delay and gate power absorption<br>(3) gate switching delay and net gate power<br>(4) gate power dissipation and absorption |
| 13. | In nMOS fabrication, etching is done using<br>(1) plasma (2) hydrochloric acid<br>(3) sulphuric acid (4) sodium chloride |

| Question No. | Questions |
|---|---|
| 14. | Heavily doped polysilicon is deposited using<br>(1) chemical vapour decomposition<br>(2) chemical vapour deposition<br>(3) chemical deposition<br>(4) dry deposition |
| 15. | In CMOS fabrication, the photoresist layer is exposed to<br>(1) visible light (2) ultraviolet light<br>(3) infrared light (4) fluorescent |
| 16. | P-well doping concentration and depth will affect the<br>(1) threshold voltage (2) $V_{ss}$<br>(3) $V_{dd}$ (4) $V_{gs}$ |
| 17. | Few parts of photoresist layer is removed by using<br>(1) acidic solution (2) neutral solution<br>(3) pure water (4) diluted water |
| 18. | Which color is used for implant<br>(1) red (2) blue<br>(3) green (4) yellow |
| 19. | How is nMOS depletion mode transistor represented<br>(1)  (2)  <br>(3)  (4)  |

| Question No. | Questions |
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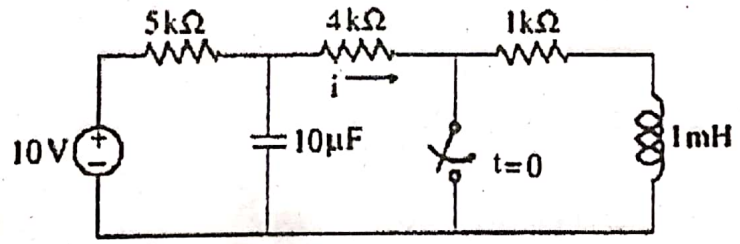
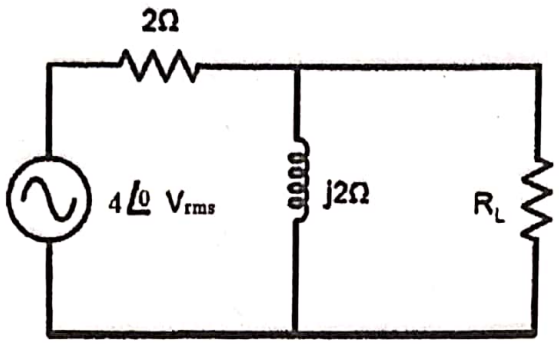
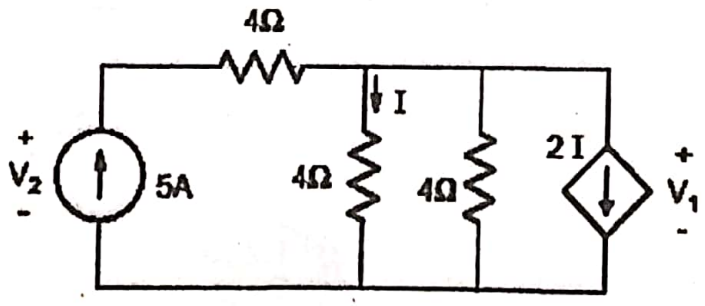
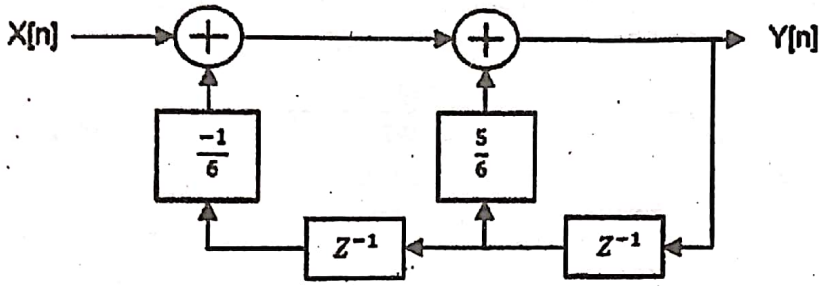
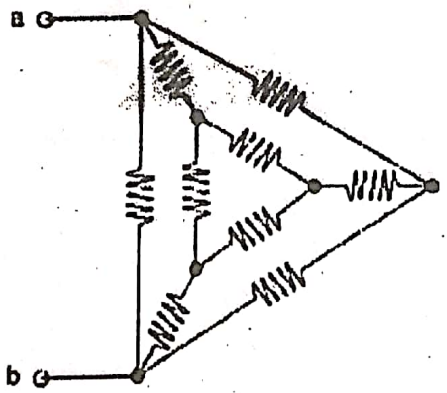
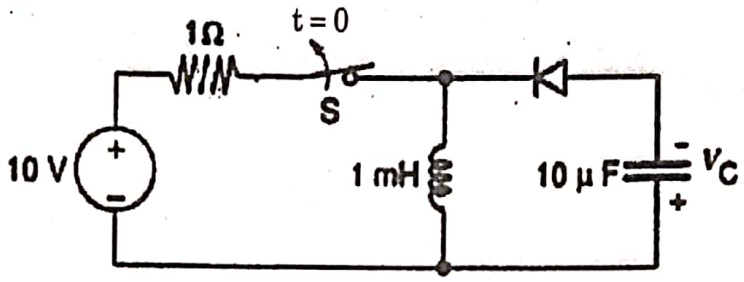
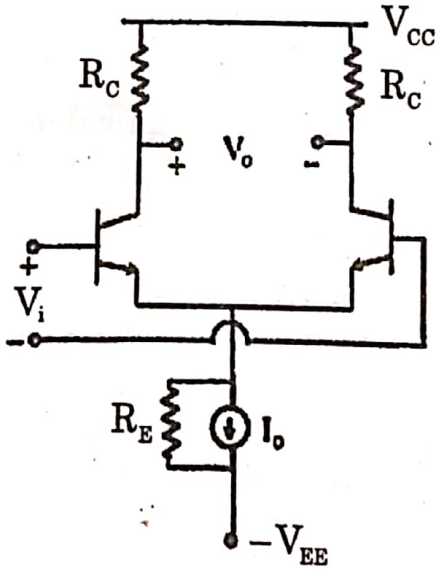
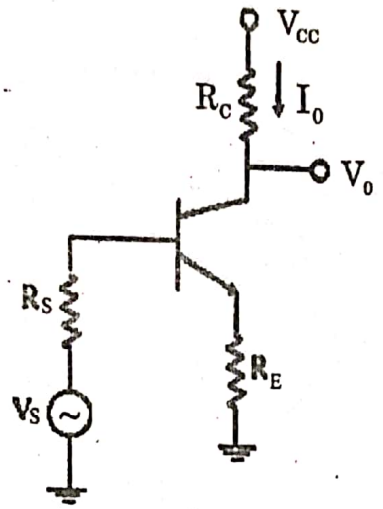
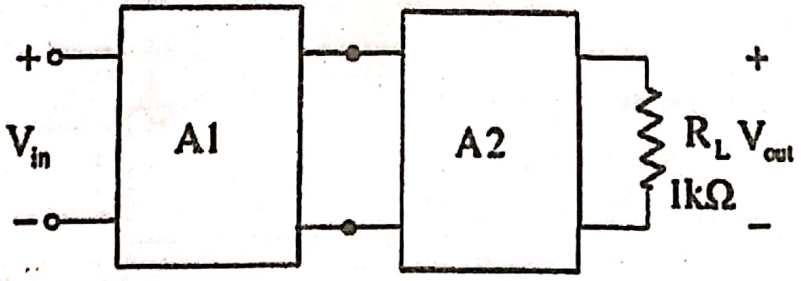
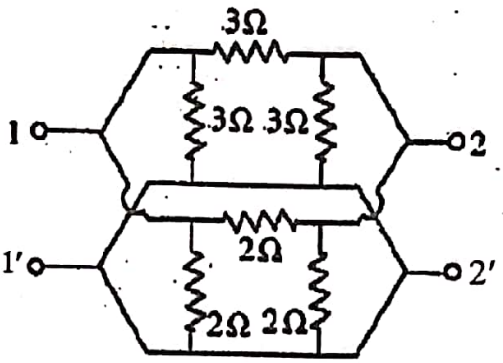
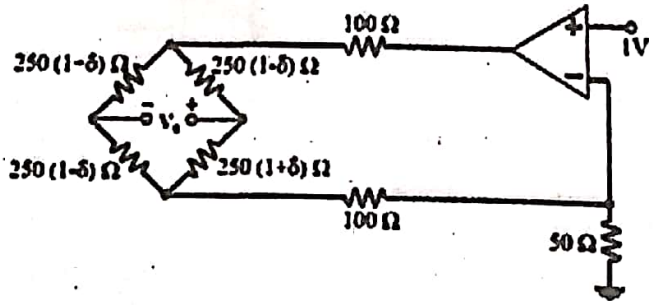
| 20. | In CMOS inverter, transistor is a switch having<br>(1) infinite on resistance (2) finite off resistance<br>(3) buffer (4) infinite off resistance |
| 21. | Norton's theorem states that a complex network connected to a load can be replaced with an equivalent impedance<br>(1) in series with a current source<br>(2) in parallel with a voltage source<br>(3) in series with a voltage source<br>(4) in parallel with a current source |
| 22. | In the figure shown below, the ideal switch has been open for a long time. If it is closed at t = 0, then the magnitude of the current (in mA) through the 4kΩ resistor at t = 0+ is _____ .<br>  <br><br>(1) 1 Amp (2) 1.2 Amp<br>(3) 1.5 Amp (4) 2 Amp |
| 23. | The Boolean expression converted into the canonical product of sum (POS) form is<br>$F(X, Y, Z) = \overline{X}\,Y\overline{Z} + X\overline{Y}\,\overline{Z} + XY\overline{Z} + XYZ$<br>(1) $(X+Y+Z)\,(X+Y+\overline{Z})\,(X+\overline{Y}+\overline{Z})\,(\overline{X}+Y+\overline{Z})$<br>(2) $(X+\overline{Y}+Z)\,(\overline{X}+Y+\overline{Z})\,(\overline{X}+\overline{Y}+Z)(\overline{X}+\overline{Y}+\overline{Z})$<br>(3) $(X+Y+Z)\,(\overline{X}+Y+\overline{Z})\,(X+\overline{Y}+Z)(\overline{X}+\overline{Y}+\overline{Z})$<br>(4) $(X+\overline{Y}+\overline{Z})\,(\overline{X}+Y+Z)\,(\overline{X}+\overline{Y}+Z)(X+Y+Z)$ |

| Question No. | Questions |
|---|---|
| 24. | In the given circuit, the maximum power (in Watts) that can be transferred to the load $R_L$ is _____ .<br>  <br><br>(1) 1.649 (2) 3.283<br>(3) 2.832 (4) 3.123 |
| 25. | In the given circuit, the values of $V_1$ and $V_2$ respectively are<br>  <br><br>(1) 15V, 35V (2) 10V, 30V<br>(3) 5V, 25V (4) 0V, 20V |
| 26. | An FIR system is described by the system function<br>$$H(z) = 1 + 1 + \frac{7}{2}z^{-1} + \frac{3}{2}z^{-2}$$<br>The system is<br>(1) maximum phase (2) minimum phase<br>(3) mixed phase (4) zero phase |

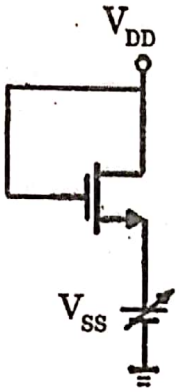
| Question No. | Questions |
|---|---|
| 27. | The input-output relationship of a causal stable LTI system is given as<br>$Y[n] = \alpha y[n-1] + \beta x[n]$<br>If the impulse response h[n] of this system satisfies the condition<br>$\sum_{n=0}^{\infty} h(n) = 2$<br>the relationship between $\alpha$ and $\beta$ is<br>(1) $\alpha = 1 - \beta/2$ (2) $\alpha = 1 + \beta/2$<br>(3) $\alpha = 2\beta$ (4) $\alpha = -2\beta$ |
| 28. | For the discrete-time system shown in the figure, the poles of the system transfer function are located at<br>  <br><br>(1) 2, 3 (2) ½, 3<br>(3) ½, 1/3 (4) 2, 1/3 |
| 29. | In the given circuit, each resistor has a value equal to 1<br>  <br><br>What is the equivalent resistance across the terminals a and b<br>(1) 1/6 Ω (2) 1/3 Ω<br>(3) 9/20 Ω (4) 8/15 Ω |

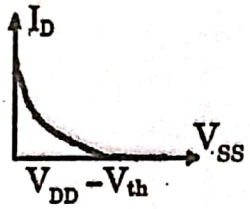
| Question No. | Questions |
|---|---|
| 30. | The switch S in the circuit shown has been closed for a long time. It is opened at time t = 0 and remains open after that. Assume that the diode has zero reverse current and zero forward voltage drop-<br>  <br><br>The steady state magnitude of the capacitor voltage V, (in volts) is _____<br>(1) 100 (2) 105<br>(3) 92 (4) 85 |
| 31. | In the differential amplifier shown in the figure, the magnitudes of the common-mode and differential-mode gains are $A_{cm}$ and $A_d$, respectively. If the resistance RE is increased, then<br>  <br><br>(1) $A_{cm}$ increases<br>(2) common-mode rejection ratio increases<br>(3) $A_d$ increases<br>(4) common-mode rejection ratio decreases |

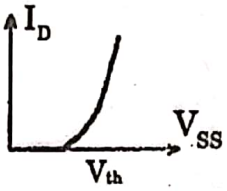
| Question No. | Questions |
|---|---|
| 32. | The feedback topology in the amplifier circuit (the base bias circuit is not shown for simplicity) in the figure is<br>  <br><br>(1) Voltage shunt feedback (2) Current series feedback<br>(3) Current shunt feedback (4) Voltage series feedback |
| 33. | A cascade connection of two voltage amplifiers A1 and A2 is shown in the figure. The open-loop gain $A_{v0}$, input resistance $R_{in}$, and output resistance $R_0$ for A1 and A2 are as follows :<br>  <br><br>A1 : $A_{v0} = 10$, $R_{in} = 10k\Omega$, $R_0 = 1\ k\Omega$<br>A2 : $A_{v0} = 5$, $R_{in} = 5k\Omega$, $R_0 = 200$<br>The approximate overall voltage gain $V_{out}/V_{in}$ is _____.<br>(1) 28.548 (2) 32.231<br>(3) 33.682 (4) 34.722 |

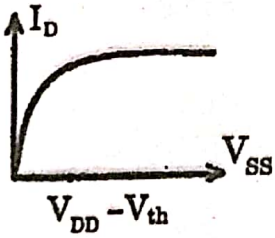
| Question No. | Questions |
|---|---|
| 34. | In the h-parameter model of the 2-port network given in the figure shown, the value of h22 (in S) is _____.<br>  <br><br>(1) 1.24 (2) 1.28<br>(3) 1.32 (4) 1.36 |
| 35. | In the circuit shown, assume that the opamp is ideal. The bridge output voltage $V_0$ (in mV) for $\delta = 0.05$ is<br>  <br><br>(1) 350 (2) 250<br>(3) 450 (4) 125 |

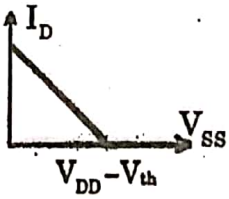
| Question No. | Questions |
|---|---|
| 36. | For the NMOSFET in the circuit shown, the threshold voltage is $V_{th}$, where $V_{th} > 0$. The source voltage $V_{SS}$ is varied from 0 to $V_{DD}$. Neglecting the channel length modulation, the drain current ID as a function of $V_{SS}$ is represented by which of the four options |




(1) 


(2) 


(3) 


(4) 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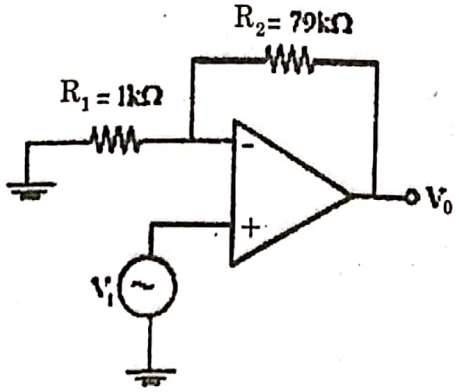
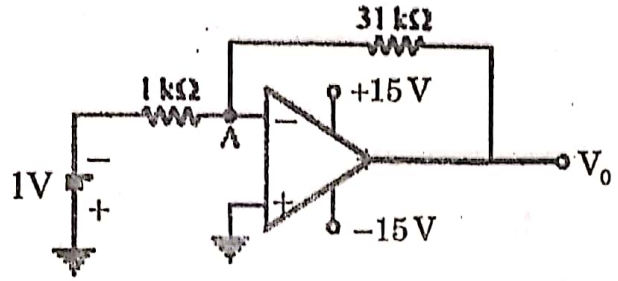
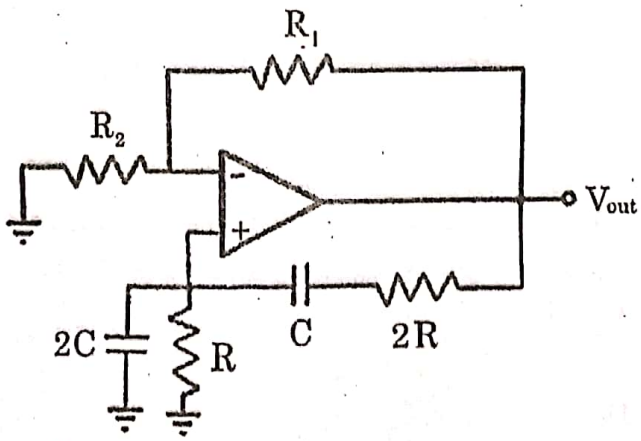
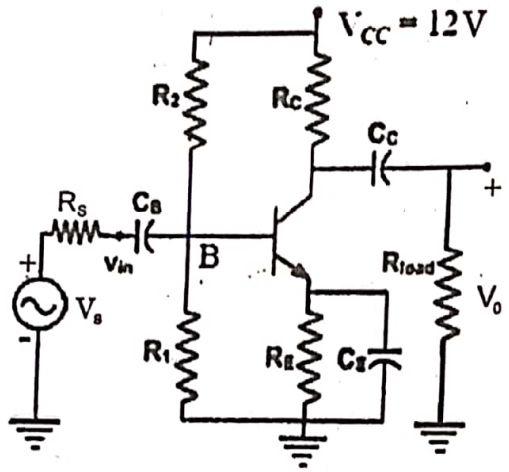
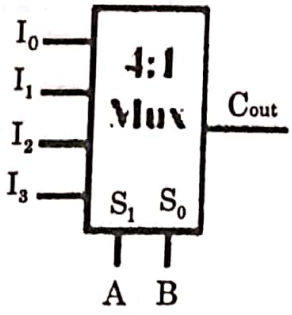
| 37. | To a Schmitt trigger in a non-inverting configuration an input triangular wave of $1V_p$ is applied. What will be the output waveform, if the upper and lower threshold voltages are 0.25 V |

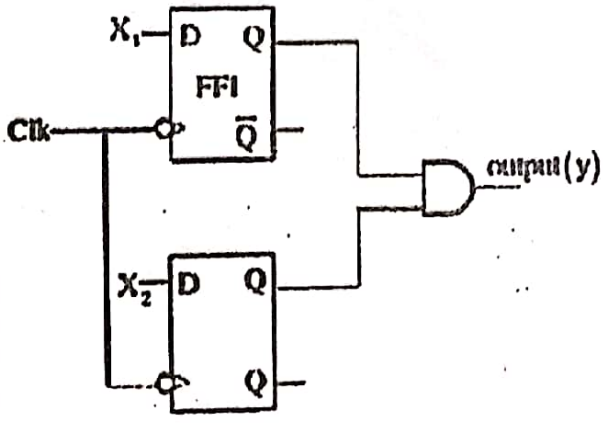
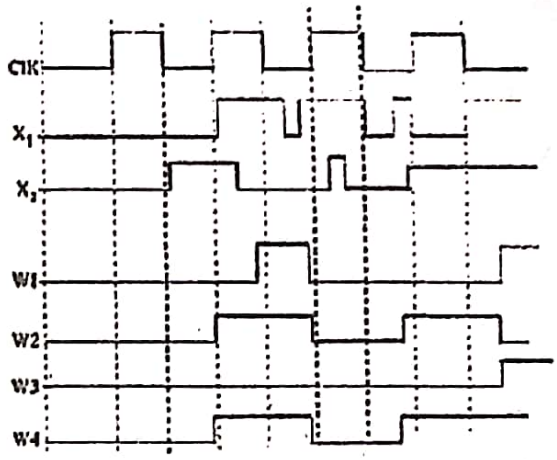
(1) Square Waveform (2) Pulse Waveform

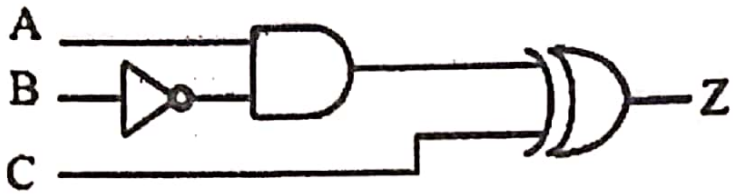
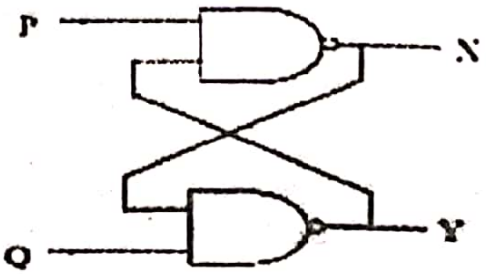
(3) Sawtooth Waveform (4) Triangular Waveform

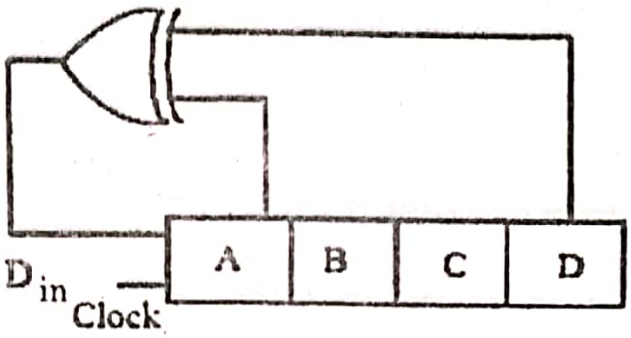
| Question No. | Questions |
|---|---|
| 38. | If $C_1$ and $C_2$ are the capacitance used in Colpitts oscillator the effective capacitance in the equation of frequency calculation is equal to _____.<br>(1) $\frac{\pi C_1 C_2}{C_1 + C_2}$ (2) $\frac{3C_1 C_2}{C_1 + C_2}$<br>(3) $\frac{C_1 C_2}{2\pi(C_1 + C_2)}$ (4) $\frac{C_1 C_2}{C_1 + C_2}$ |
| 39. | Recommended frequency range of Hartley oscillator is _____.<br>(1) 30 kHz to 30 MHz (2) 30 MHz to 300 MHz<br>(3) 20 kHz to 20 MHz (4) 0.5 kHz to 40 MHz |
| 40. | How the op-amp comparator should be chosen to get higher speed of operation<br>(1) Large Gain (2) High slew rate<br>(3) Wider bandwidth (4) None of the above |
| 41. | The amplifier circuit shown in the figure is implemented using a compensated operational amplifier (op-amp), and has an open-loop voltage gain A = $10^5$, and an open-loop cut-off $f_c$ frequency. The voltage gain of the amplifier at 15kHz, in V/V is _____.<br>  <br><br>(1) 44.3 (2) 45.2<br>(3) 54.6 (4) 34.7 |

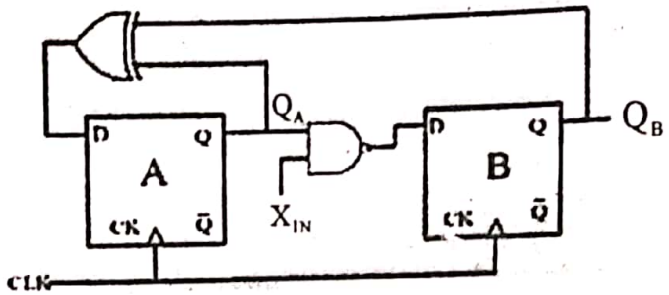
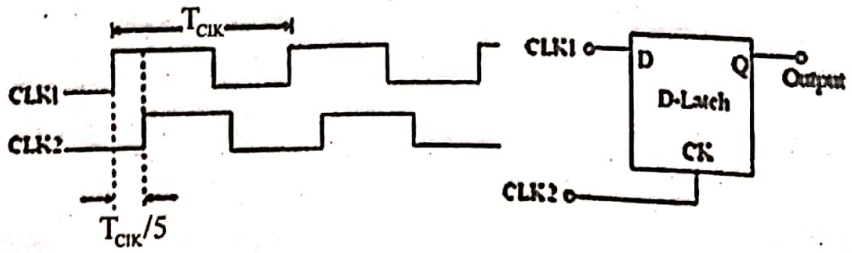
| Question No. | Questions |
|---|---|
| 42. | For the op-amp based circuit as shown below by assume the op-amp to be ideal the voltage (in volts, correct to one decimal place) at node A, connected to the negative input of the op-amp as indicated in the figure is<br>  <br><br>(1) 1.4 V (2) 2.0 V<br>(3) 0.5 V (4) 0.9 V |
| 43. | Bistable circuit is also known as<br>(1) Latch (2) Gate<br>(3) Flip-Flop (4) Bidirectional Circuit |
| 44. | A monostable multivibrator can also be termed as<br>(1) Full Astable multivibrator (2) Half Astable multivibrator<br>(3) Half Bistable multivibrator (4) Full Bistable multivibrator |
| 45. | The circuit shown in the figure has an ideal opamp. The oscillation frequency and the condition to sustain the oscillations, respectively, are<br>  <br><br>(1) 1/CR and $R_1 = R_2$ (2) 1/CR and $R_1 = 4R_2$<br>(3) 1/2 CR and $R_1 = R_2$ (4) 1/2 CR and $R_1 = 4R_2$ |

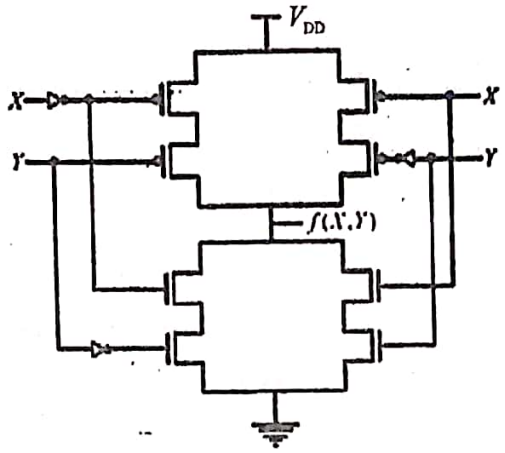
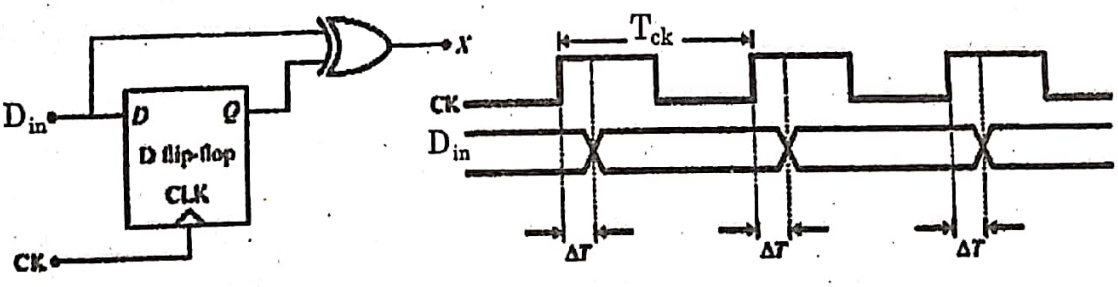
| Question No. | Questions |
|---|---|
| 46. | The voltage gain for the CE transistor amplifier shown below with $R_1$ = 10 kΩ, $R_2$= 20 kΩ, $R_c$= 4kΩ, $R_E$= 3.3 kΩ, β= 100, $R_L$= 10kΩ and $R_S$= 50Ω is   (1) 120 (2) –110 (3) 112 (4) –104 |
| 47. | A 4:1 multiplexer is to be used for generating the output carry of a full adder. A and B are the bits to be added while $C_{in}$ is the input carry and $C_{out}$ is the output carry. A and B are to be used as the select bits with A being the more significant select bit.   Which one of the following statements correctly describes the choice of signals to be connected to the inputs $I_0$, $I_1$, $I_2$ and $I_3$ so that the output is $C_{out}$ (1) $I_0 = 0, I_1 = C_{in}, I_2 = C_{in}$ and $I_3 = 1$ (2) $I_0 = 1, I_1 = C_{in}, I_2 = C_{in}$ and $I_3 = 1$ (3) $I_0 = 0, I_1 = 0, I_2 = 1$ and $I_3 = C_{in}$ (4) $I_0 = 0, I_1 = C_{in}, I_2 = 1$ and $I_3 = C_{in}$ |

| Question No. | Questions |
|---|---|
| 48. | An amplifier operating from +3V provide a 2.2V peak sine wave across a 100 ohm load when provided with a 0.2V peak sine wave as an input from which 1.0 mA current is drawn. The average current in each supply is measured to be 20mA. What is the amplifier efficiency<br>(1) 25.2% (2) 30.2%<br>(3) 20.2% (4) 35.2% |
| 49. | Which of the following is not true<br>(1) both transformer and amplifier can provide voltage gain.<br>(2) both transformer and amplifier can provide current gain.<br>(3) both transformer and amplifier can provide power gain.<br>(4) None of the above |
| 50. | FSK reception uses<br>(1) Correlation receiver and PLL (2) PLL only<br>(3) Correlation receiver only (4) None of the above |
| 51. | In the circuit shown, choose the correct timing diagram of the output(y) from the given waveforms W1, W2, W3 and W4<br>  <br><br>  <br><br>(1) W1 (2) W2<br>(3) W3 (4) W4 |

| Question No. | Questions |
|---|---|
| 52. | All the logic gates shown in the figure have a propagation delay of 20 ns Let A = C = 0 and B = 1 until time t = 0. At t = 0, all the inputs flip (i.e., A = C = 1 and B = 0) and remain in that state. For t > 0, output Z = 1 for a duration (in ns) of _____.<br>  <br>(1) 20 (2) 40<br>(3) 35 (4) 25 |
| 53. | In the latch circuit shown below, the NAND gates have non-zero, but unequa propagation delays. The present input condition is: P = Q = '0'. If the inpu condition is changed simultaneously to P = Q = '1', the outputs X and Y ar<br>  <br>(1) X = '1', Y = '1'<br>(2) either X = '1', Y = '0' or X = '0', Y = '1'<br>(3) either X = '1', Y = '1' or X = '0', Y = '0'<br>(4) X = '0', Y = '0' |

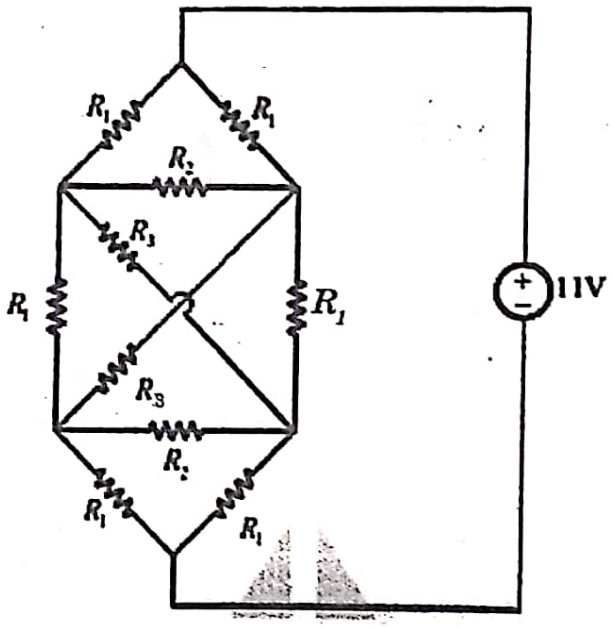
| Question No. | Questions |
|---|---|
| 54. | A 4-bit shift register circuit configured for right-shift operation, D→A, A→B, B→C, C→D is shown below. If the present state of the shift register is ABCD = 1101, the number of clock cycles required to reach the state ABCD = 1111 is _____.<br>  <br><br>(1) 10 (2) 11<br>(3) 12 (4) 8 |
| 55. | Which one of the following gives the simplified sum of products expression for the Boolean function $F= m_0 + m_1 + m_2 + m_3 + m_5$ where '$m_x$' are min terms corresponding to the inputs A, B and C with A as the MSB and C as the LSB<br>(1) $\overline{A}B+\overline{A}\,\overline{B}\,\overline{C}+A\overline{B}\,C$<br>(2) $\overline{A}\,\overline{C}+\overline{A}B+A\overline{B}\,C$<br>(3) $\overline{A}\,\overline{C}+A\overline{B}+A\overline{B}\,C$<br>(4) $\overline{A}BC+\overline{A}\,\overline{C}+A\overline{B}\,C$ |

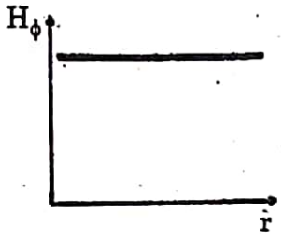
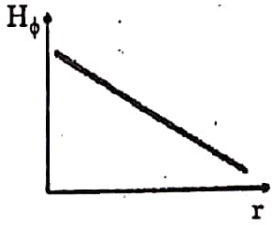
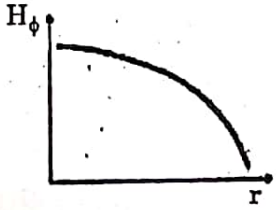
| Question No. | Questions |
|---|---|
| 56. | A Finite State Machine (FSM) is implemented using the D flip-flops A and B, and logic gates, as shown in the figure below. The four possible states of the FSM are $Q_A Q_B = 00, 01, 10$ and 11.<br>  <br>Assume that X1N is held at a constant logic level throughout the operation of the FSM. When the FSM is initialized to the state $Q_A Q_B = 00$ and clocked, after a few clock cycles, it starts cycling through<br>(1) all of the four possible states if $X_{1N} = 1$<br>(2) three of the four possible states if $X_{1N} = 0$<br>(3) only two of the four possible states if $X_{1N} = 1$<br>(4) only two of the four possible states if $X_{1N} = 0$ |
| 57. | Consider the D-Latch shown in the figure, which is transparent when its clock input CK is high and has zero propagation delay. In the figure, the clock signal CLK1 has a 50% duty cycle and CLK2 is a one-fifth period delayed version of CLK1. The duty cycle at the output latch in percentage is _____.<br>  <br>(1) 30%<br>(2) 28%<br>(3) 34%<br>(4) 32% |

| Question No. | Questions |
|---|---|
| 58. | The logic function $f(X, Y)$ realized by the given circuit is   (1) NOR (2) AND (3) XOR (4) NAND |
| 59. | In the circuit shown below, a positive edge-triggered D flip-flop is used for sampling input data $D_{in}$ using clock CK. The XOR gate outputs 3.3 volts for logic HIGH and 0 volts for logic LOW levels. The data bit and clock periods are equal and the value of $\Delta T/T_{CK} = 0.15$, where the parameters $\Delta T$ and $T_{CK}$ are shown in the figure. Assume that the flip-flop and the XOR gate are ideal. If the probability of input data bit ($D_{in}$) transition in each clock period is 0.3, the average value (in volts) of the voltage at node $X$, is _____.   (1) 1.5148 (2) 0.5148 (3) 0.8415 (4) 1.8415 |

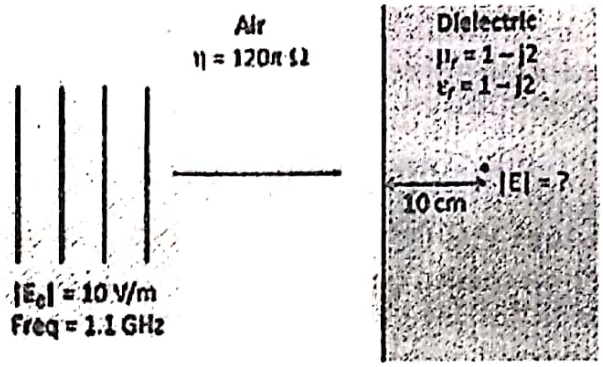
| Question No. | Questions |
|---|---|
| 60. | For programmable logic functions, which type of PLD should be used<br>(1) PLA (2) PAL<br>(3) CPLD (4) SLD |
| 61. | When 8051 wakes up then 0×00 is loaded to which register<br>(1) DPTR (2) SP<br>(3) PC (4) PSW |
| 62. | On power up, the 8051 uses which RAM locations for register R0-R7<br>(1) 00-2F (2) 00-7F<br>(3) 00-07 (4) 00-0F |
| 63. | In 8086 microprocessor during comparison operation, the result of comparing or subtraction is stored in<br>(1) memory (2) registers<br>(3) stack (4) none of the above |
| 64. | Which segment of the 8086 contains the actual assembly language instructions to be executed by the microprocessor<br>(1) Data Segment (2) Code Segment<br>(3) Stack Segment (4) Extra Segment |
| 65. | A random variable '$X$' takes values –0.5 and 0.5 with probabilities ¼ and ¾, respectively. The noisy observation of $X$ is $Y = X + Z$, where $Z$ has uniform probability density over the interval (–1, 1). $X$ and $Z$ are independent. If the MAP rule based detector outputs ^ X as<br>$\hat{X} = \begin{cases} -0.5, & Y < \alpha \\ 0.5, & Y \geq \alpha \end{cases}$<br>then the value of $\alpha$ (accurate to two decimal places) is _____.<br>(1) 0.5 (2) 0.25<br>(3) 0.4 (4) 0.7 |

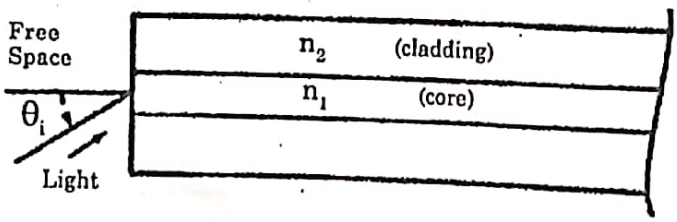
| Question No. | Questions |
|---|---|
| 66. | The phenomenon leading to avalanche breakdown in reverse biased diodes is known as _____.<br>(1) Auger recombination (2) Mode hopping<br>(3) Impact ionization (4) Extract ionization |
| 67. | Why VHF, UHF and microwave signals used in satellite communication<br>(1) More bandwidth<br>(2) More spectrum space<br>(3) Are not diffracted by ionosphere<br>(4) Economically viable |
| 68. | The free space model of propagation refers to<br>1. Unobstructed line of sight between transmitter and receiver.<br>2. Satellite communication systems and microwave line of sight radio links.<br>3. Propagation along the ground surface.<br>(1) 1 and 2 are correct<br>(2) 1 and 3 are correct<br>(3) 2 and 3 are correct<br>(4) All are correct |
| 69. | The material used to construct a variable reluctance stepper motor with salient poles is<br>(1) Paramagnetic (2) Ferromagnetic<br>(3) Diamagnetic (4) Non-magnetic |

| Question No. | Questions |
|---|---|
| 70. | Consider the network shown below with $R_1 = 1\Omega$, $R_2 = 2\Omega$ and $R_3 = 3\Omega$. The network is connected to a constant voltage source of 11V.<br>  <br><br>The magnitude of the current (in amperes, accurate to two decimal places) through the source is _____.<br>(1) 8 A (2) 6 A<br>(3) 7 A (4) 10 A |
| 71. | A rectangular waveguide of internal dimensions a × b(a > b), the cut-off frequency for the $TE_{11}$ mode is the arithmetic mean of the cut-off frequencies for $TE_{10}$ mode and $TE_{20}$ mode. If a = $\sqrt{5}$ cm the value of b(in cm) is _____.<br>(1) 1 cm (2) 2 cm<br>(3) 4 cm (4) 8 cm |

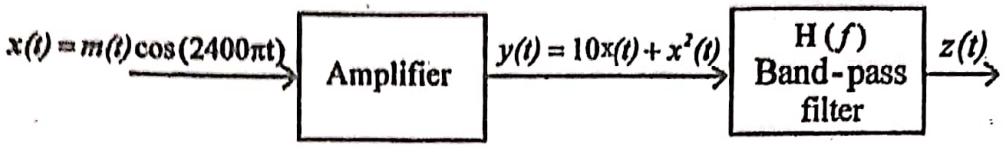
| Question No. | Questions |
|---|---|
| 72. | Consider a straight, infinitely long, current carrying conductor lying on the z-axis. Which one of the following plots (111 linear scale) qualitatively represents the dependence of $H_\phi$ oil r, where $H_\phi$ is the magnitude of the azimuthal component of magnetic field outside the conductor and r is the radial distance from the conductor<br>(1)  <br>(2)  <br>(3)  <br>(4)  |
| 73. | A helix is used in a travelling wave tube to<br>(1) Increase the speed of electron beam<br>(2) Decrease the speed of electron beam<br>(3) Increase the speed of electromagnetic wave along the axis of the tube<br>(4) Decrease the speed of electromagnetic wave along the axis of the tube |
| 74. | Which one of the following diodes provides high range of variable resistance<br>(1) PN Junction Silicon Diode (2) Schottky Diode<br>(3) Varactor Diode (4) PIN Diode |
| 75. | Which one of the following diodes will be most suitable for making high power transmitter<br>(1) PN Junction Diode (2) GUNN Diode<br>(3) Tunnel Diode (4) Schottky Diode |

| Question No. | Questions |
|---|---|
| 76. | Two identical transmitting and receiving antennas with gain of 15 dBi at 2.45 GHz are separated by a distance of 3 km. If the transmitted power is 20W, the power received will be<br>(1) –112.8 dBm (2) –78.4 dBm<br>(3) –52.8 dBm (4) –36.8 dBm |
| 77. | The phase velocity of electromagnetic waves in a hollow metal waveguide is<br>(1) Equal to group velocity<br>(2) Greater than velocity of light in free space<br>(3) Lesser than velocity of light in free space<br>(4) Equal to velocity of light in free space |
| 78. | A lossless $\lambda/2$ line having characteristic impedance = 70.7 Ω is terminated with 100 Ω. The input impedance of this line is<br>(1) 50Ω (2) 70.7Ω<br>(3) 100Ω (4) 200Ω |
| 79. | The electric field component of a plane wave travelling in a lossless dielectric medium is given by<br>$E(z, t) = 2 \cos(10^8 t - \frac{z}{\sqrt{2}})$ V/m. The wavelength (in m) for the wave is _____.<br>(1) 8.89 (2) 7.28<br>(3) 4.87 (4) 6.23 |

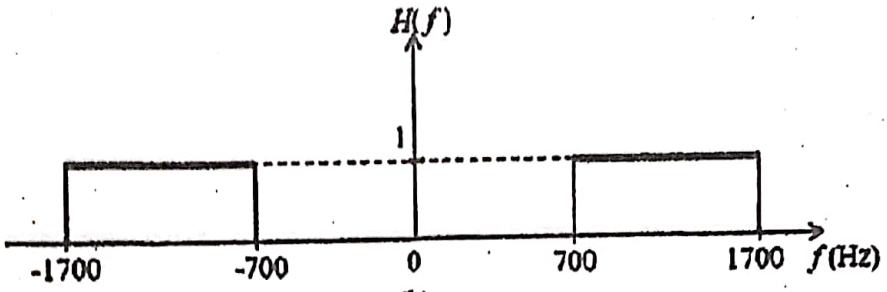
| Question No. | Questions |
|---|---|
| 80. | Consider a uniform plane wave with amplitude ($E_0$) of 10 V/m and 1.1 GHz frequency travelling in air, and incident normally on a dielectric medium with complex relative permittivity ($\varepsilon_r$) and permeability ($\mu_r$) as shown in the figure.<br>  <br>The magnitude of the transmitted electric field component (in V/m) after it has travelled a distance of 10 cm inside the electric region is _____.<br>(1) 0.2 (2) 0.3<br>(3) 0.1 (4) 0.4 |
| 81. | Consider sinusoidal modulation in an AM system. Assuming no over-modulation, the modulation index(μ) when the maximum and minimum values of the envelope, respectively, are 3V and 1 V, is _____.<br>(1) 1.0 (2) 0.5<br>(3) 1.5 (4) 2.0 |
| 82. | Coherent orthogonal binary FSK modulation is used to transmit two equi-probable symbol waveforms $S_1(t) = \alpha \cos 2\pi f_1 t$ and $S_2(t) = \alpha \cos 2\pi f_2 t$, where $\alpha = 4mV$. Assume an AWGN channel with two-sided noise power spectral density $N_0/2 = 0.5 \times 10^{-12}$ W/Hz. Using an optimal receiver and the relation<br>$$Q(v) = \frac{1}{\sqrt{2\pi}} \int_v^{\infty} e^{-v^2/2}\, du$$<br>the bit error probability for a data rate of 500 kbps is<br>(1) Q(2) (2) $Q(2\sqrt{2})$<br>(3) Q(4) (4) $Q(4\sqrt{2})$ |

| Question No. | Questions |
|---|---|
| 83. | A sinusoidal signal of 2 kHz frequency is applied to a delta modulator. The sampling rate and step-size $\Delta$ of the delta modulator are 20,000 sample per second and 0.1 V, respectively. To prevent slope overload, the maximum amplitude of the sinusoidal signal (in Volts) is<br>(1) $1/2\pi$ (2) $1/\pi$<br>(3) $2/\pi$ (4) $\pi$ |
| 84. | The transmitted signal in a GSM system is of 200 kHz bandwidth and 8 users share a common bandwidth using TDMA. If at a given time 12 users are talking in a cell, the total bandwidth of the signal received by the base station of the cell will be at least (in kHz) _____.<br>(1) 300 kHz (2) 400 kHz<br>(3) 450 kHz (4) 500 kHz |
| 85. | Light from free space is incident at an angle 0°, to the normal of the facet of a step-index large core optical fibre. The core and cladding refractive indices are $n_1 = 1.5$ and $n_2 = 1.4$, respectively. The maximum value of $\theta_i$ (in degrees) for which the incident light will be guided in the core of the fibre is _____.<br>  <br><br>(1) 35 (2) 32.58<br>(3) 34 (4) 37 |
| 86. | Consider the signal<br>$s(t) = m(t)\cos(2\pi f_c t) + m_1(t)\sin(2\pi f_c t)$<br>Where $m_1(t)$ denotes the Hilbert transform of m(t) and the bandwidth of m(t) is very small compared to $f_c$. The signal s(t) is a<br>(1) high-pass signal<br>(2) low-pass signal<br>(3) band-pass signal<br>(4) double sideband suppressed carrier signal |

| Question No. | Questions |
|---|---|
| 87. | In the system shown in Figure (a), m(t) is a low-pass signal with bandwidth W Hz. The frequency response of the band-pass filter H(f) is shown in Figure (b). If it is desired that the output signal z(t) = 10x(t). The maximum value of W (in Hz) should be strictly less than |




(a)

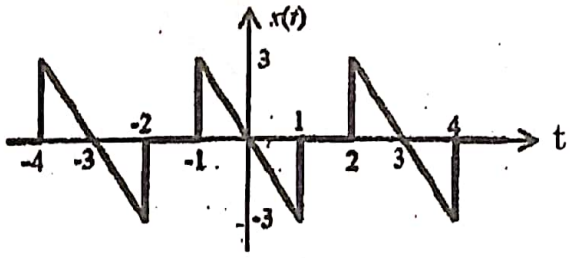



(b)

(1) 450 (2) 400

(3) 350 (4) 500

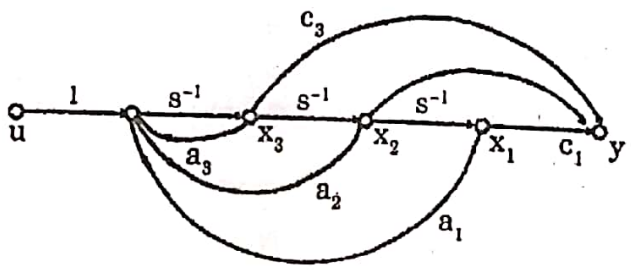
88. The waveform of a periodic signal x(t) is shown in the figure.




A signal g(t) is defined by $g(t) = x\left(\frac{t-1}{2}\right)$. The average power of g(t) is _____.

(1) 2 (2) 7

(3) 6 (4) 8

| Question No. | Questions |
|---|---|
| 89. | In a proportional temperature controller, if the quantity under the heater increases the offset will<br>(1) increases<br>(2) decreases<br>(3) remains unaffected<br>(4) increases first and then decreases after a threshold |
| 90. | If a Nyquist plot of $G(j\omega).H(j\omega)$ point for a closed loop system passes through (–2, j0) point in GH plane, what would be the value of gain margin of system in dB<br>(1) 0dB (2) 2.0201 dBs<br>(3) 4.021 dB (4) 6.0205 dB |
| 91. | Consider the state space system expressed by the signal flow diagram shown in the figure.<br>  <br><br>The corresponding system is<br>(1) always controllable (2) always observable<br>(3) always stable (4) always unstable |
| 92. | A TRIAC is equivalent to two SCRs in _____.<br>(1) parallel (2) series<br>(3) inverse parallel (4) none of the above |

| Question No. | Questions |
|---|---|
| 93. | The V-I Characteristics for a TRIAC in the first and third quadrants are essentially identical to those of _____ in the first quadrant.<br>(1) Transistor (2) SCR<br>(3) UJT (4) None of the above |
| 94. | A device that does not have gate terminal is _____.<br>(1) TRIAC (2) FET<br>(3) SCR (4) DIAC |
| 95. | In an unregulated power supply, if input ac voltage increases, the output voltage _____.<br>(1) Increases (2) Decreases<br>(3) Unchanged (4) Becomes zero |
| 96. | SMPS is based on the principle of _____.<br>(1) Phase control (2) Integral control<br>(3) Chopper (4) MOSFET |
| 97. | Piezoelectric crystals<br>(1) float on water<br>(2) dissolve in water<br>(3) are not soluble in water<br>(4) absorb water |
| 98. | Operation of a thermocouple is governed by<br>(1) Peltier effect (2) Seebeck effect<br>(3) Thomson Effect (4) All of the mentioned |

| Question No. | Questions |
|---|---|
| 99. | A spectrum analyser is used to measure<br>(1) frequency<br>(2) loss angle of dielectric<br>(3) harmonics<br>(4) insulating resistance |
| 100. | Oscilloscope is a _____.<br>(1) Ohmmeter (2) Ammeter<br>(3) Voltmeter (4) Multimeter |

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**(MPH/PHD/URS–EE–2019)**

# Electronics & Communication Engg.

Code **B**

Sr. No. 10002

**SET–"X"**

**Time : 1¼ Hours** **Total Questions : 100** **Max. Marks : 100**

Roll No. _____ (in figure) _____ (in words)

Name : _____ Father's Name : _____

Mother's Name : _____ Date of Examination : _____

(Signature of the candidate) (Signature of the Invigilator)

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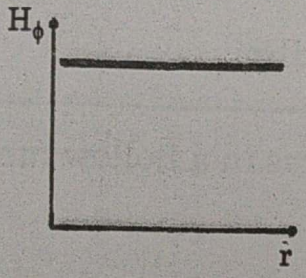
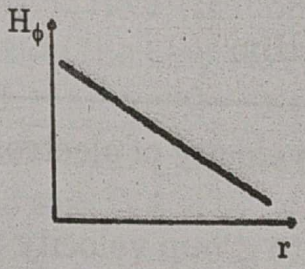
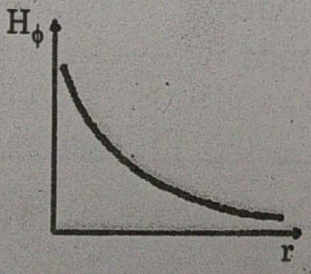
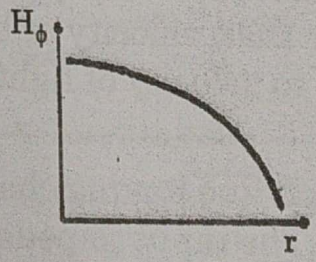
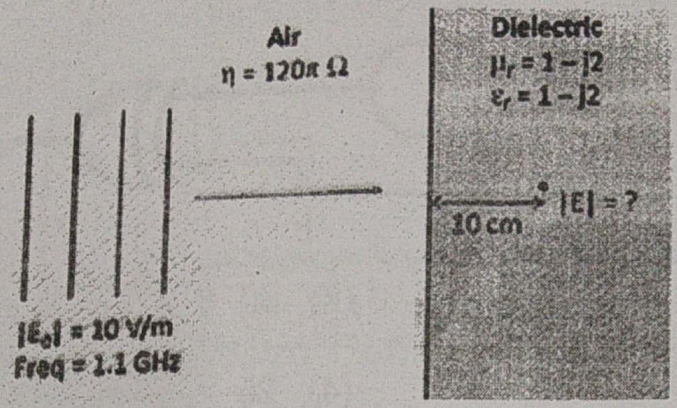
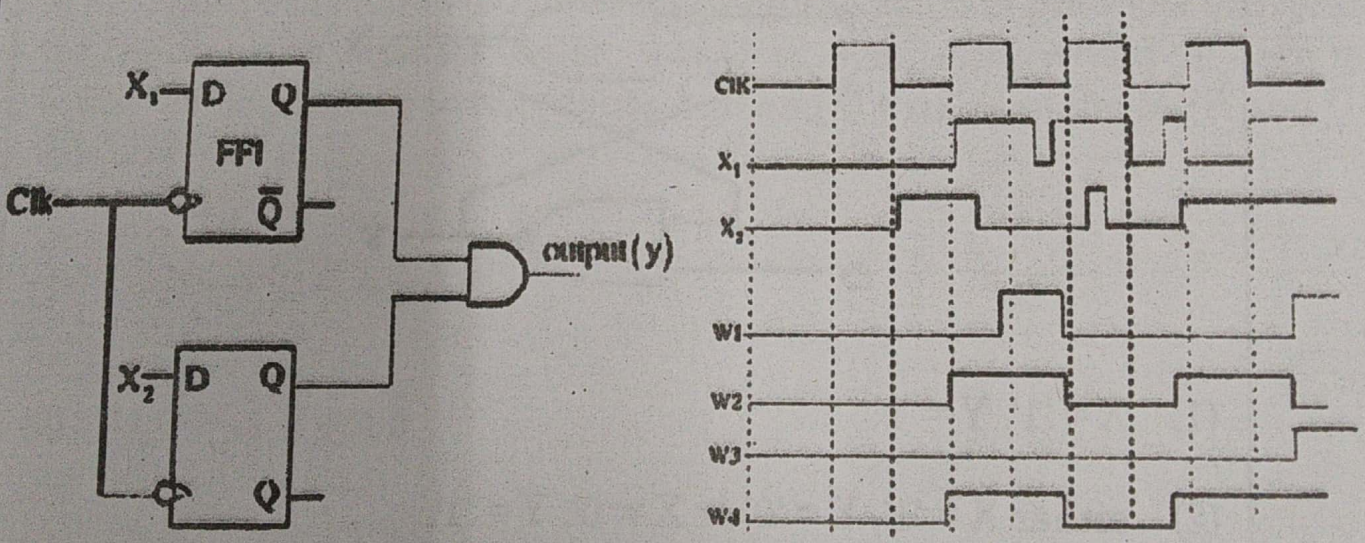
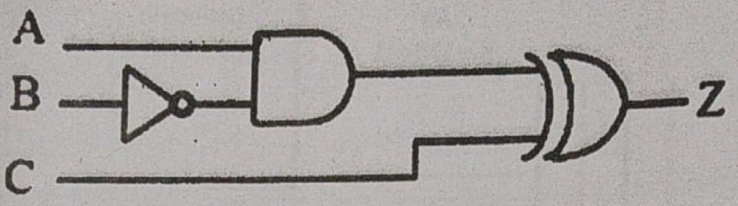
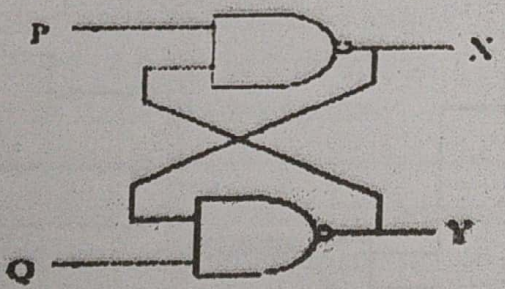
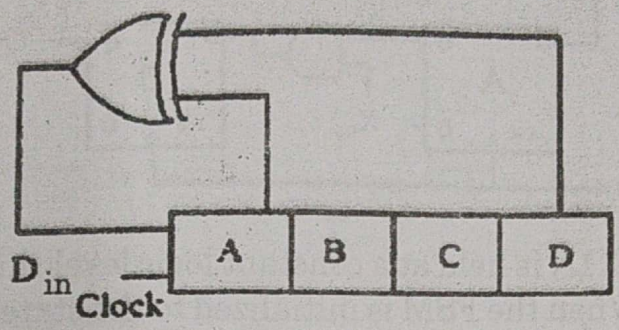
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / misbehaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A,B,C and D code will be got uploaded on the university website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E. Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers ***MUST NOT*** be ticked in the Question book-let.
6. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. Use only Black or Blue **BALL POINT PEN** of good quality in the OMR Answer-Sheet.
8. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

| Question No. | Questions |
|---|---|
| 1. | A rectangular waveguide of internal dimensions a × b(a > b), the cut-off frequency for the $TE_{11}$ mode is the arithmetic mean of the cut-off frequencies for $TE_{10}$ mode and $TE_{20}$ mode. If a = $\sqrt{5}$ cm the value of b(in cm) is _____.<br>(1) 1 cm (2) 2 cm<br>(3) 4 cm (4) 8 cm |
| 2. | Consider a straight, infinitely long, current carrying conductor lying on the z-axis. Which one of the following plots (111 linear scale) qualitatively represents the dependence of $H_\phi$ oil r, where $H_\phi$ is the magnitude of the azimuthal component of magnetic field outside the conductor and r is the radial distance from the conductor<br>(1)  <br>(2)  <br>(3)  <br>(4)  |
| 3. | A helix is used in a travelling wave tube to<br>(1) Increase the speed of electron beam<br>(2) Decrease the speed of electron beam<br>(3) Increase the speed of electromagnetic wave along the axis of the tube<br>(4) Decrease the speed of electromagnetic wave along the axis of the tube |

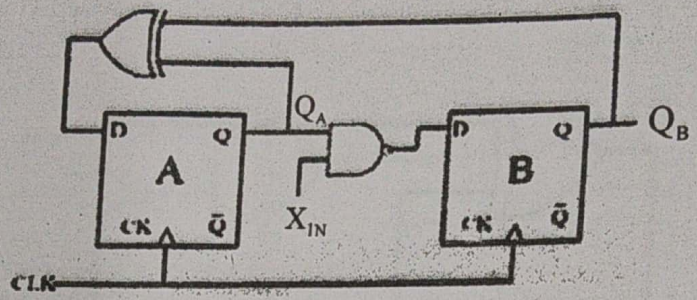
| Question No. | Questions |
|---|---|
| 4. | Which one of the following diodes provides high range of variable resistance<br>(1) PN Junction Silicon Diode (2) Schottky Diode<br>(3) Varactor Diode (4) PIN Diode |
| 5. | Which one of the following diodes will be most suitable for making high power transmitter<br>(1) PN Junction Diode (2) GUNN Diode<br>(3) Tunnel Diode (4) Schottky Diode |
| 6. | Two identical transmitting and receiving antennas with gain of 15 dBi at 2.45 GHz are separated by a distance of 3 km. If the transmitted power is 20W, the power received will be<br>(1) –112.8 dBm (2) –78.4 dBm<br>(3) –52.8 dBm (4) –36.8 dBm |
| 7. | The phase velocity of electromagnetic waves in a hollow metal waveguide is<br>(1) Equal to group velocity<br>(2) Greater than velocity of light in free space<br>(3) Lesser than velocity of light in free space<br>(4) Equal to velocity of light in free space |
| 8. | A lossless $\lambda/2$ line having characteristic impedance = 70.7 $\Omega$ is terminated with 100 $\Omega$. The input impedance of this line is<br>(1) 50$\Omega$ (2) 70.7$\Omega$ (3) 100$\Omega$ (4) 200$\Omega$ |
| 9. | The electric field component of a plane wave travelling in a lossless dielectric medium is given by<br>$E(z, t) = 2\cos(10^8 t - \frac{z}{\sqrt{2}})$ V/m. The wavelength (in m) for the wave is _____.<br>(1) 8.89 (2) 7.28 (3) 4.87 (4) 6.23 |

| Question No. | Questions |
|---|---|
| 10. | Consider a uniform plane wave with amplitude ($E_0$) of 10 V/m and 1.1 GHz frequency travelling in air, and incident normally on a dielectric medium with complex relative permittivity ($\varepsilon_r$) and permeability ($\mu_r$) as shown in the figure.<br>  <br>The magnitude of the transmitted electric field component (in V/m) after it has travelled a distance of 10 cm inside the electric region is _____.<br>(1) 0.2 (2) 0.3 (3) 0.1 (4) 0.4 |
| 11. | In the circuit shown, choose the correct timing diagram of the output(y) from the given waveforms W1, W2, W3 and W4<br>  <br>(1) W1 (2) W2<br>(3) W3 (4) W4 |

| Question No. | Questions |
|---|---|
| 12. | All the logic gates shown in the figure have a propagation delay of 20 ns. Let A = C = 0 and B = 1 until time t = 0. At t = 0, all the inputs flip (i.e., A = C = 1 and B = 0) and remain in that state. For t > 0, output Z = 1 for a duration (in ns) of _____.<br>  <br><br>(1) 20 (2) 40<br>(3) 35 (4) 25 |
| 13. | In the latch circuit shown below, the NAND gates have non-zero, but unequal propagation delays. The present input condition is: P = Q = '0'. If the input condition is changed simultaneously to P = Q = '1', the outputs X and Y are<br>  <br><br>(1) X = '1', Y = '1'<br>(2) either X = '1', Y = '0' or X = '0', Y = '1'<br>(3) either X = '1', Y = '1' or X = '0', Y = '0'<br>(4) X = '0', Y = '0' |

| Question No. | Questions |
|---|---|
| 14. | A 4-bit shift register circuit configured for right-shift operation, D→A, A→B, B→C, C→D is shown below. If the present state of the shift register is ABCD = 1101, the number of clock cycles required to reach the state ABCD = 1111 is _____.<br>  <br>(1) 10 (2) 11<br>(3) 12 (4) 8 |
| 15. | Which one of the following gives the simplified sum of products expression for the Boolean function F= $m_0 + m_1 + m_2 + m_3 + m_5$ where '$m_x$' are min terms corresponding to the inputs A, B and C with A as the MSB and C as the LSB<br>(1) $\overline{A}B + \overline{A}\,\overline{B}\,\overline{C} + A\overline{B}C$<br>(2) $\overline{A}\,\overline{C} + \overline{A}B + A\overline{B}C$<br>(3) $\overline{A}\,\overline{C} + A\overline{B} + A\overline{B}C$<br>(4) $\overline{A}BC + \overline{A}\,\overline{C} + A\overline{B}C$ |

| Question No. | Questions |
|---|---|
| 16. | A Finite State Machine (FSM) is implemented using the D flip-flops A and B, and logic gates, as shown in the figure below. The four possible states of the FSM are $Q_A Q_B = 00, 01, 10$ and 11. |




Assume that X1N is held at a constant logic level throughout the operation of the FSM. When the FSM is initialized to the state $Q_A Q_B = 00$ and clocked, after a few clock cycles, it starts cycling through

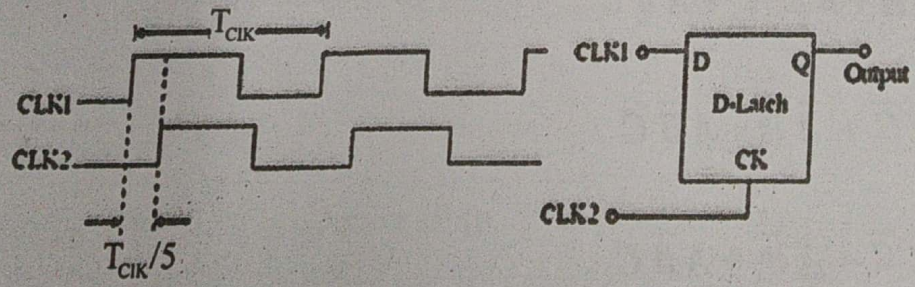
(1) all of the four possible states if $X_{IN} = 1$

(2) three of the four possible states if $X_{IN} = 0$

(3) only two of the four possible states if $X_{IN} = 1$

(4) only two of the four possible states if $X_{IN} = 0$

**17.** Consider the D-Latch shown in the figure, which is transparent when its clock input CK is high and has zero propagation delay. In the figure, the clock signal CLK1 has a 50% duty cycle and CLK2 is a one-fifth period delayed version of CLK1. The duty cycle at the output latch in percentage is _____.

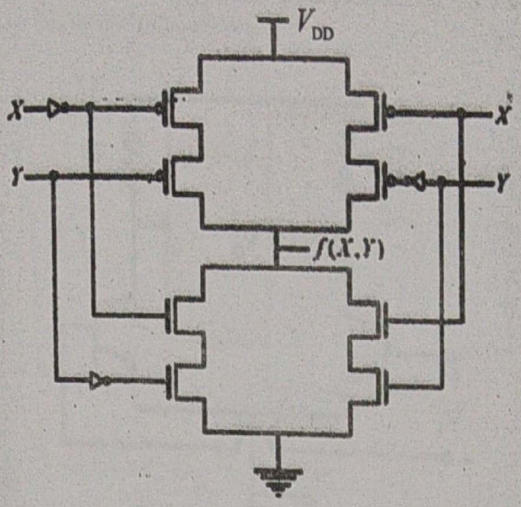
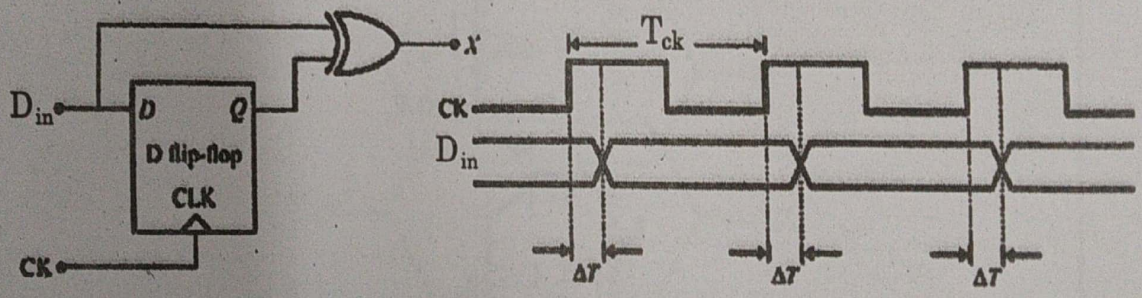



(1) 30%

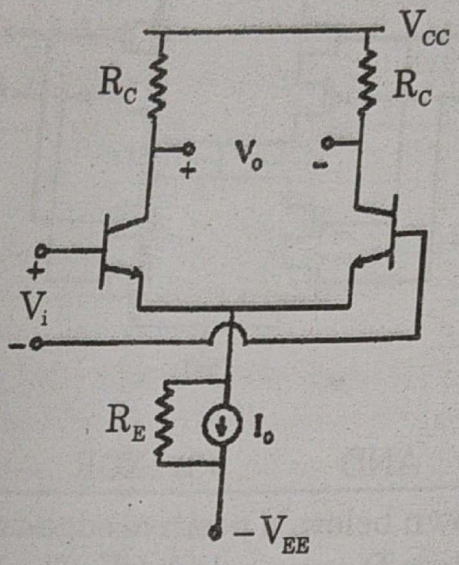
(2) 28%

(3) 34%

(4) 32%

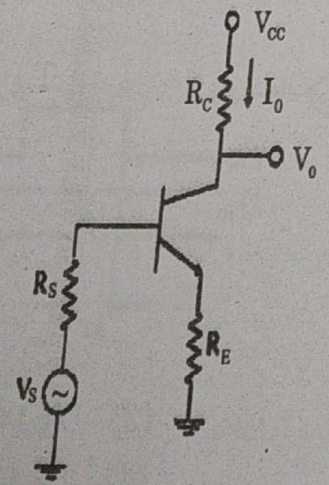
| Question No. | Questions |
|---|---|
| 18. | The logic function $f(X, Y)$ realized by the given circuit is   (1) NOR (2) AND (3) XOR (4) NAND |
| 19. | In the circuit shown below, a positive edge-triggered D flip-flop is used for sampling input data $D_{in}$ using clock CK. The XOR gate outputs 3.3 volts for logic HIGH and 0 volts for logic LOW levels. The data bit and clock periods are equal and the value of $\Delta T/T_{CK} = 0.15$, where the parameters $\Delta T$ and $T_{CK}$ are shown in the figure. Assume that the flip-flop and the XOR gate are ideal. If the probability of input data bit ($D_{in}$) transition in each clock period is 0.3, the average value (in volts) of the voltage at node $X$, is _____   (1) 1.5148 (2) 0.5148 (3) 0.8415 (4) 1.8415 |
| 20. | For programmable logic functions, which type of PLD should be used (1) PLA (2) PAL (3) CPLD (4) SLD |

| Question No. | Questions |
|---|---|
| 21. | In the differential amplifier shown in the figure, the magnitudes of the common-mode and differential-mode gains are $A_{cm}$ and $A_d$, respectively. If the resistance RE is increased, then |

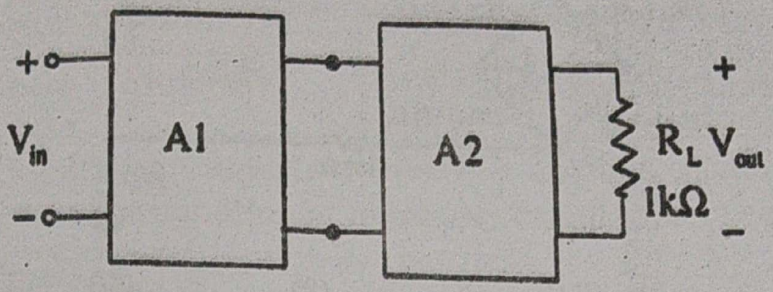
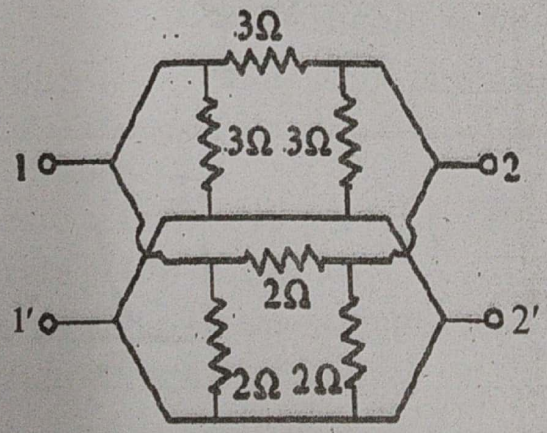


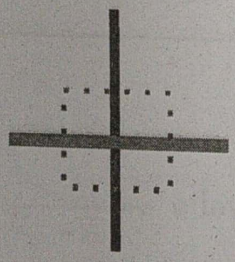
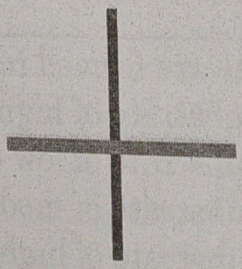
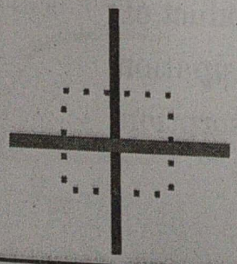
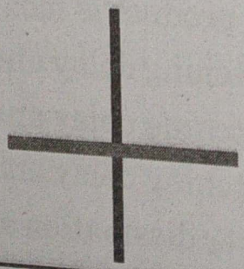

(1) $A_{cm}$ increases (2) common-mode rejection ratio increases
(3) $A_d$ increases (4) common-mode rejection ratio decreases

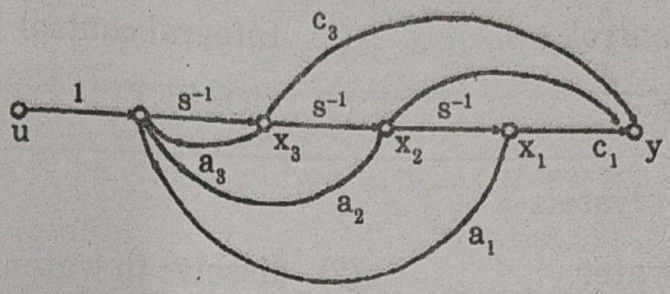
**22.** The feedback topology in the amplifier circuit (the base bias circuit is not shown for simplicity) in the figure is




(1) Voltage shunt feedback (2) Current series feedback
(3) Current shunt feedback (4) Voltage series feedback

| Question No. | Questions |
|---|---|
| 23. | A cascade connection of two voltage amplifiers A1 and A2 is shown in the figure. The open-loop gain $A_{v0}$, input resistance $R_{in}$, and output resistance $R_0$ for A1 and A2 are as follows :<br>  <br><br>A1 : $A_{v0} = 10$, $R_{in} = 10k\Omega$, $R_0 = 1\,k\Omega$<br>A2 : $A_{v0} = 5$, $R_{in} = 5k\Omega$, $R_0 = 200$<br>The approximate overall voltage gain $V_{out} / V_{in}$ is _____.<br>(1) 28.548 (2) 32.231<br>(3) 33.682 (4) 34.722 |
| 24. | In the h-parameter model of the 2-port network given in the figure shown, the value of h22 (in S) is _____.<br>  <br><br>(1) 1.24 (2) 1.28<br>(3) 1.32 (4) 1.36 |

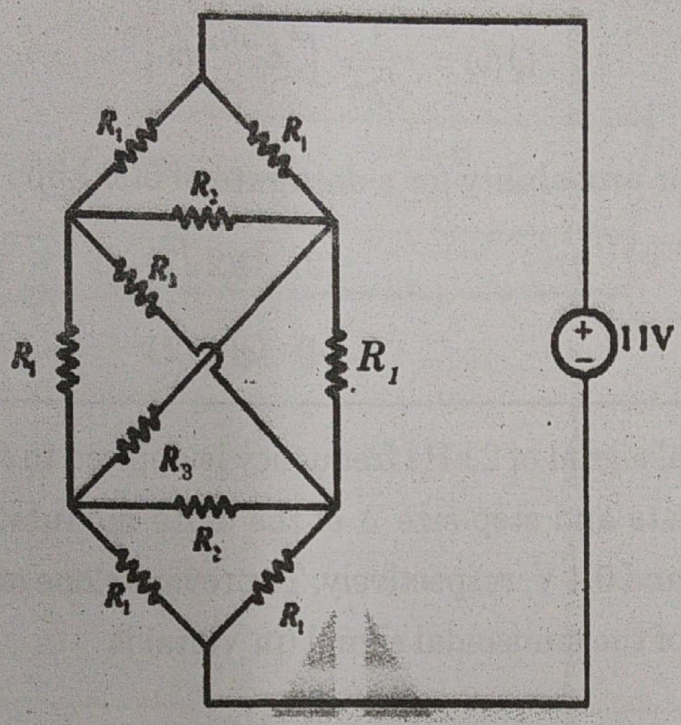
| Question No. | Questions |
|---|---|
| 33. | In nMOS fabrication, etching is done using<br>(1) plasma (2) hydrochloric acid<br>(3) sulphuric acid (4) sodium chloride |
| 34. | Heavily doped polysilicon is deposited using<br>(1) chemical vapour decomposition<br>(2) chemical vapour deposition<br>(3) chemical deposition<br>(4) dry deposition |
| 35. | In CMOS fabrication, the photoresist layer is exposed to<br>(1) visible light (2) ultraviolet light<br>(3) infrared light (4) fluorescent |
| 36. | P-well doping concentration and depth will affect the<br>(1) threshold voltage (2) $V_{ss}$<br>(3) $V_{dd}$ (4) $V_{gs}$ |
| 37. | Few parts of photoresist layer is removed by using<br>(1) acidic solution (2) neutral solution<br>(3) pure water (4) diluted water |
| 38. | Which color is used for implant<br>(1) red (2) blue (3) green (4) yellow |
| 39. | How is nMOS depletion mode transistor represented<br>(1)  (2)  <br>(3)  (4)  |

| Question No. | Questions |
|---|---|
| 40. | In CMOS inverter, transistor is a switch having<br>(1) infinite on resistance (2) finite off resistance<br>(3) buffer (4) infinite off resistance |
| 41. | Consider the state space system expressed by the signal flow diagram shown in the figure.<br>  <br><br>The corresponding system is<br>(1) always controllable (2) always observable<br>(3) always stable (4) always unstable |
| 42. | A TRIAC is equivalent to two SCRs in _____.<br>(1) parallel (2) series<br>(3) inverse parallel (4) none of the above |
| 43. | The V-I Characteristics for a TRIAC in the first and third quadrants are essentially identical to those of _____ in the first quadrant.<br>(1) Transistor (2) SCR<br>(3) UJT (4) None of the above |
| 44. | A device that does not have gate terminal is _____.<br>(1) TRIAC (2) FET<br>(3) SCR (4) DIAC |

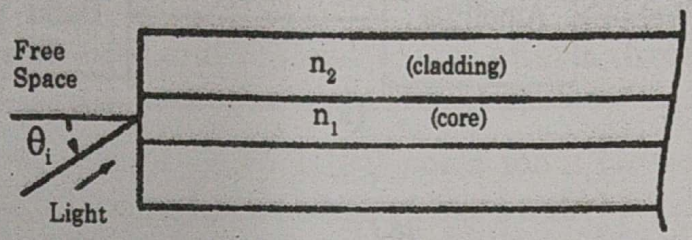
| Question No. | Questions |
|---|---|
| 45. | In an unregulated power supply, if input ac voltage increases, the output voltage _____.<br>(1) Increases (2) Decreases<br>(3) Unchanged (4) Becomes zero |
| 46. | SMPS is based on the principle of _____.<br>(1) Phase control (2) Integral control<br>(3) Chopper (4) MOSFET |
| 47. | Piezoelectric crystals<br>(1) float on water (2) dissolve in water<br>(3) are not soluble in water (4) absorb water |
| 48. | Operation of a thermocouple is governed by<br>(1) Peltier effect (2) Seebeck effect<br>(3) Thomson Effect (4) All of the mentioned |
| 49. | A spectrum analyser is used to measure<br>(1) frequency (2) loss angle of dielectric<br>(3) harmonics (4) insulating resistance |
| 50. | Oscilloscope is a _____.<br>(1) Ohmmeter (2) Ammeter<br>(3) Voltmeter (4) Multimeter |
| 51. | When 8051 wakes up then 0×00 is loaded to which register<br>(1) DPTR (2) SP<br>(3) PC (4) PSW |

| Question No. | Questions |
|---|---|
| 52. | On power up, the 8051 uses which RAM locations for register R0-R7<br>(1) 00-2F (2) 00-7F<br>(3) 00-07 (4) 00-0F |
| 53. | In 8086 microprocessor during comparison operation, the result of comparing or subtraction is stored in<br>(1) memory (2) registers<br>(3) stack (4) none of the above |
| 54. | Which segment of the 8086 contains the actual assembly language instructions to be executed by the microprocessor<br>(1) Data Segment (2) Code Segment<br>(3) Stack Segment (4) Extra Segment |
| 55. | A random variable '$X$' takes values –0.5 and 0.5 with probabilities ¼ and ¾, respectively. The noisy observation of $X$ is $Y = X + Z$, where $Z$ has uniform probability density over the interval (–1, 1). $X$ and $Z$ are independent. If the MAP rule based detector outputs ^ X as<br>$\hat{X} = \begin{cases} -0.5, & Y < \alpha \\ 0.5, & Y \geq \alpha \end{cases}$<br>then the value of $\alpha$ (accurate to two decimal places) is _____.<br>(1) 0.5 (2) 0.25<br>(3) 0.4 (4) 0.7 |
| 56. | The phenomenon leading to avalanche breakdown in reverse biased diodes is known as _____.<br>(1) Auger recombination<br>(2) Mode hopping<br>(3) Impact ionization<br>(4) Extract ionization |

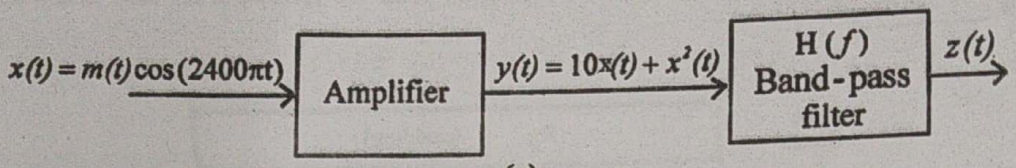
| Question No. | Questions |
|---|---|
| 57. | Why VHF, UHF and microwave signals used in satellite communication<br>(1) More bandwidth<br>(2) More spectrum space<br>(3) Are not diffracted by ionosphere<br>(4) Economically viable |
| 58. | The free space model of propagation refers to<br>1. Unobstructed line of sight between transmitter and receiver.<br>2. Satellite communication systems and microwave line of sight radio links.<br>3. Propagation along the ground surface.<br>(1) 1 and 2 are correct<br>(2) 1 and 3 are correct<br>(3) 2 and 3 are correct<br>(4) All are correct |
| 59. | The material used to construct a variable reluctance stepper motor with salient poles is<br>(1) Paramagnetic<br>(2) Ferromagnetic<br>(3) Diamagnetic<br>(4) Non-magnetic |

| Question No. | Questions |
|---|---|
| 60. | Consider the network shown below with $R_1 = 1\Omega$, $R_2 = 2\Omega$ and $R_3 = 3\Omega$. The network is connected to a constant voltage source of 11V.<br>  <br><br>The magnitude of the current (in amperes, accurate to two decimal places) through the source is _____.<br>(1) 8 A (2) 6 A<br>(3) 7 A (4) 10 A |
| 61. | Consider sinusoidal modulation in an AM system. Assuming no over-modulation, the modulation index(μ) when the maximum and minimum values of the envelope, respectively, are 3V and 1 V, is _____.<br>(1) 1.0 (2) 0.5<br>(3) 1.5 (4) 2.0 |

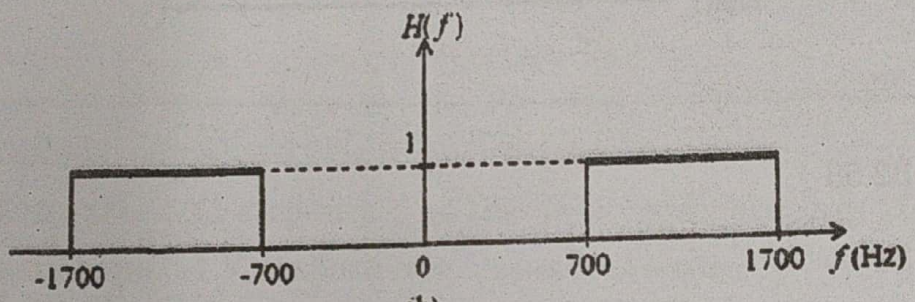
| Question No. | Questions |
|---|---|
| 62. | Coherent orthogonal binary FSK modulation is used to transmit two equi-probable symbol waveforms $S_1(t) = \alpha cos\ 2\pi f_1 t$ and $S_2(t) = \alpha cos 2\pi f_2 t$, where $\alpha = 4mV$. Assume an AWGN channel with two-sided noise power spectral density $N_0/2 = 0.5 \times 10^{-12}$ W/Hz. Using an optimal receiver and the relation $$Q(v) = \frac{1}{\sqrt{2\pi}} \int_v^{db} e^{-v^2/2}\, du$$ the bit error probability for a data rate of 500 kbps is<br>(1) Q(2) (2) $Q(2\sqrt{2})$<br>(3) Q(4) (4) $Q(4\sqrt{2})$ |
| 63. | A sinusoidal signal of 2 kHz frequency is applied to a delta modulator. The sampling rate and step-size $\Delta$ of the delta modulator are 20,000 sample per second and 0.1 V, respectively. To prevent slope overload, the maximum amplitude of the sinusoidal signal (in Volts) is<br>(1) $1/2\pi$ (2) $1/\pi$<br>(3) $2/\pi$ (4) $\pi$ |
| 64. | The transmitted signal in a GSM system is of 200 kHz bandwidth and 8 users share a common bandwidth using TDMA. If at a given time 12 users are talking in a cell, the total bandwidth of the signal received by the base station of the cell will be at least (in kHz) _____.<br>(1) 300 kHz<br>(2) 400 kHz<br>(3) 450 kHz<br>(4) 500 kHz |

| Question No. | Questions |
|---|---|
| 65. | Light from free space is incident at an angle 0°, to the normal of the facet of a step-index large core optical fibre. The core and cladding refractive indices are $n_1 = 1.5$ and $n_2 = 1.4$, respectively. The maximum value of $\theta_i$ (in degrees) for which the incident light will be guided in the core of the fibre is _____.<br>  <br><br>(1) 35<br>(2) 32.58<br>(3) 34<br>(4) 37 |
| 66. | Consider the signal<br>$$s(t) = m(t)\cos(2\pi f_c t) + m_1(t)\sin(2\pi f_c t)$$<br>Where $m_1(t)$ denotes the Hilbert transform of m(t) and the bandwidth of m(t) is very small compared to $f_c$. The signal s(t) is a<br>(1) high-pass signal<br>(2) low-pass signal<br>(3) band-pass signal<br>(4) double sideband suppressed carrier signal |

| Question No. | Questions |
|---|---|
| 67. | In the system shown in Figure (a), m(t) is a low-pass signal with bandwidth W Hz. The frequency response of the band-pass filter H(f) is shown in Figure (b). If it is desired that the output signal z(t) = 10x(t). The maximum value of W (in Hz) should be strictly less than |




(a)

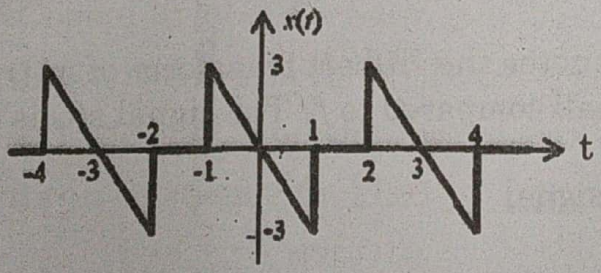



(b)

(1) 450 (2) 400

(3) 350 (4) 500

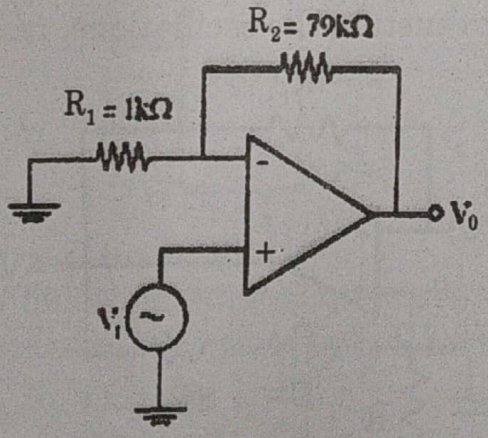
**68.** The waveform of a periodic signal x(t) is shown in the figure.

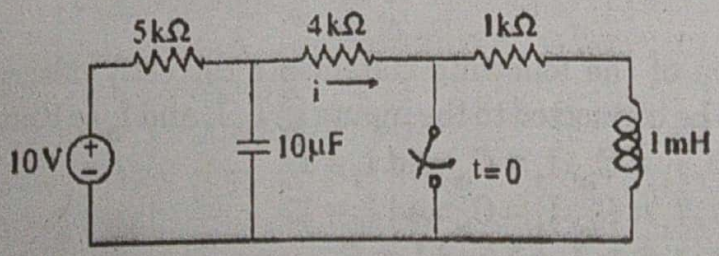


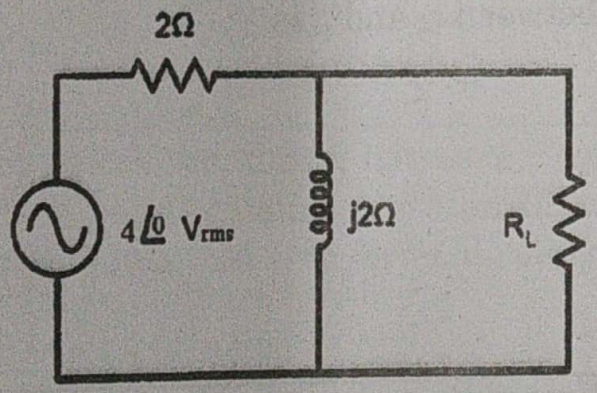
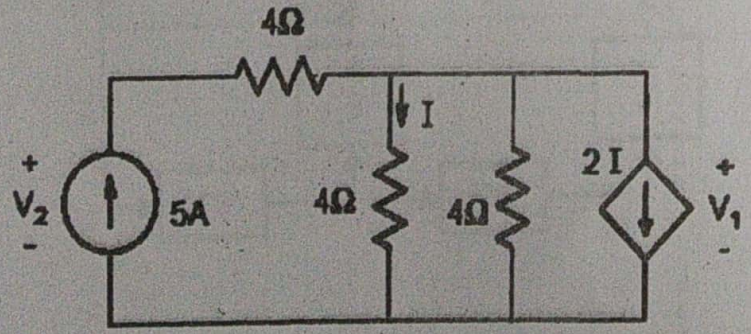

A signal g(t) is defined by $g(t) = x\left(\frac{t-1}{2}\right)$. The average power of g(t) is _____

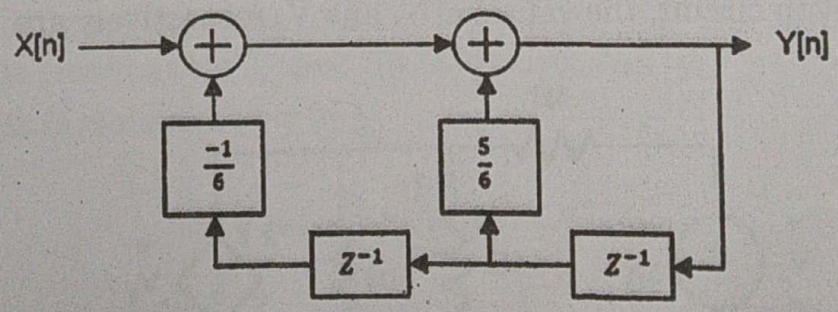
(1) 2 (2) 7

(3) 6 (4) 8

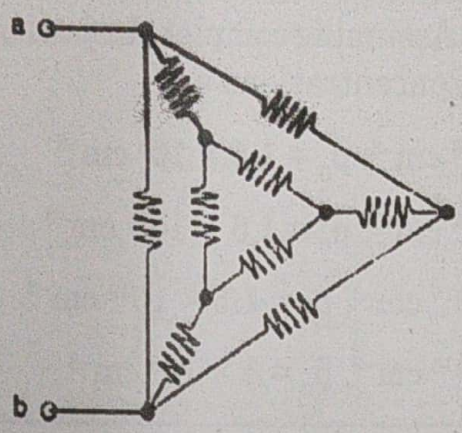
| Question No. | Questions |
|---|---|
| 69. | In a proportional temperature controller, if the quantity under the heater increases the offset will<br>(1) increases<br>(2) decreases<br>(3) remains unaffected<br>(4) increases first and then decreases after a threshold |
| 70. | If a Nyquist plot of $G(j\omega)\ H(j\omega)$ point for a closed loop system passes through (–2, j0) point in GH plane, what would be the value of gain margin of system in dB<br>(1) 0dB (2) 2.0201 dBs<br>(3) 4.021 dB (4) 6.0205 dB |
| 71. | The amplifier circuit shown in the figure is implemented using a compensated operational amplifier (op-amp), and has an open-loop voltage gain $A = 10^5$, and an open-loop cut-off $f_c$ frequency. The voltage gain of the amplifier at 15kHz, in V/V is _____.<br>  <br><br>(1) 44.3 (2) 45.2<br>(3) 54.6 (4) 34.7 |

| Question No. | Questions |
|---|---|
| 78. | An amplifier operating from +3V provide a 2.2V peak sine wave across a 100 ohm load when provided with a 0.2V peak sine wave as an input from which 1.0 mA current is drawn. The average current in each supply is measured to be 20mA. What is the amplifier efficiency<br>(1) 25.2% (2) 30.2%<br>(3) 20.2% (4) 35.2% |
| 79. | Which of the following is not true<br>(1) both transformer and amplifier can provide voltage gain.<br>(2) both transformer and amplifier can provide current gain.<br>(3) both transformer and amplifier can provide power gain.<br>(4) None of the above |
| 80. | FSK reception uses<br>(1) Correlation receiver and PLL (2) PLL only<br>(3) Correlation receiver only (4) None of the above |
| 81. | Norton's theorem states that a complex network connected to a load can be replaced with an equivalent impedance<br>(1) in series with a current source<br>(2) in parallel with a voltage source<br>(3) in series with a voltage source<br>(4) in parallel with a current source |
| 82. | In the figure shown below, the ideal switch has been open for a long time. If it is closed at t = 0, then the magnitude of the current (in mA) through the 4kΩ resistor at t = 0+ is _____ .<br>  <br><br>(1) 1 Amp (2) 1.2 Amp (3) 1.5 Amp (4) 2 Amp |

| Question No. | Questions |
|---|---|
| 83. | The Boolean expression converted into the canonical product of sum (POS) form is<br>$F(X, Y, Z) = \overline{X}\,Y\overline{Z} + X\overline{Y}\,\overline{Z} + XY\overline{Z} + XYZ$<br>(1) $(X+Y+Z)\,(X+Y+\overline{Z})\,(X+\overline{Y}+\overline{Z})\,(\overline{X}+Y+\overline{Z})$<br>(2) $(X+\overline{Y}+Z)\,(\overline{X}+Y+\overline{Z})\,(\overline{X}+\overline{Y}+Z)(\overline{X}+\overline{Y}+\overline{Z})$<br>(3) $(X+Y+Z)\,(\overline{X}+Y+\overline{Z})\,(X+\overline{Y}+Z)(\overline{X}+\overline{Y}+\overline{Z})$<br>(4) $(X+\overline{Y}+\overline{Z})\,(\overline{X}+Y+Z)\,(\overline{X}+\overline{Y}+Z)(X+Y+Z)$ |
| 84. | In the given circuit, the maximum power (in Watts) that can be transferred to the load $R_L$ is _____ .<br>  <br>(1) 1.649 (2) 3.283 (3) 2.832 (4) 3.123 |
| 85. | In the given circuit, the values of $V_1$ and $V_2$ respectively are<br>  <br>(1) 15V, 35V (2) 10V, 30V<br>(3) 5V, 25V (4) 0V, 20V |

| Question No. | Questions |
|---|---|
| 86. | An FIR system is described by the system function<br>$H(z) = 1 + 1 + \frac{7}{2}z^{-1} + \frac{3}{2}z^{-2}$<br>The system is<br>(1) maximum phase (2) minimum phase<br>(3) mixed phase (4) zero phase |
| 87. | The input-output relationship of a causal stable LTI system is given as<br>$Y[n] = \alpha y[n-1] + \beta x[n]$<br>If the impulse response h[n] of this system satisfies the condition<br>$\sum_{n=0}^{\infty} h(n) = 2$<br>the relationship between $\alpha$ and $\beta$ is<br>(1) $\alpha = 1 - \beta/2$<br>(2) $\alpha = 1 + \beta/2$<br>(3) $\alpha = 2\beta$<br>(4) $\alpha = -2\beta$ |
| 88. | For the discrete-time system shown in the figure, the poles of the system transfer function are located at<br>  <br><br>(1) 2, 3 (2) ½, 3<br>(3) ½, 1/3 (4) 2, 1/3 |

| Question No. | Questions |
|---|---|
| 89. | In the given circuit, each resistor has a value equal to 1 |

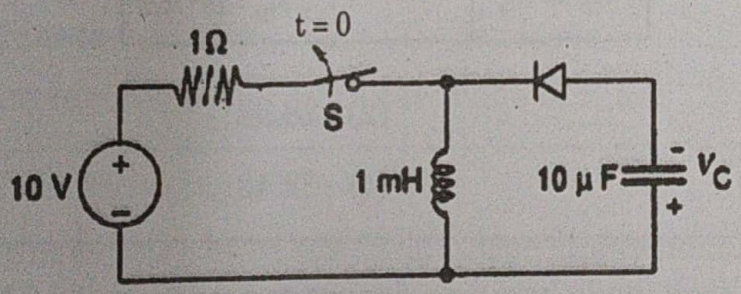



What is the equivalent resistance across the terminals a and b

(1) 1/6 Ω (2) 1/3 Ω

(3) 9/20 Ω (4) 8/15 Ω

**90.** The switch S in the circuit shown has been closed for a long time. It is opened at time t = 0 and remains open after that. Assume that the diode has zero reverse current and zero forward voltage drop-



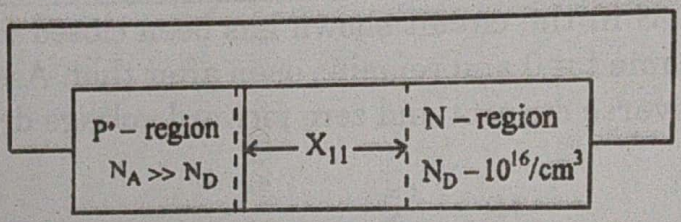

The steady state magnitude of the capacitor voltage V, (in volts) is _____

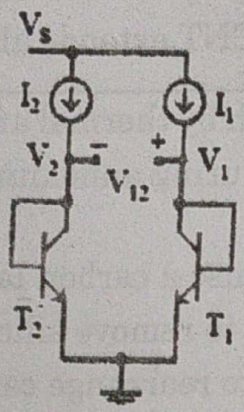
(1) 100

(2) 105

(3) 92

(4) 85

| Question No. | Questions |
|---|---|
| 91. | A silicon bar is doped with donor impurities $N_D = 2.25 \times 10^{15}$ atoms/cm$^3$. Given the intrinsic carrier concentration of silicon at T = 300 K is $n_i = 1.5 \times 10^{10}$ cm$^{-3}$. Assuming complete impurity ionization, the equilibrium electron and hole concentrations are<br>(1) $n_0 = 1.5 \times 10^{16}$ cm$^{-3}$, $p_0 = 1.5 \times 10^{5}$ cm$^{-3}$<br>(2) $n_0 = 1.5 \times 10^{10}$ cm$^{-3}$, $p_0 = 1.5 \times 10^{15}$ cm$^{-3}$<br>(3) $n_0 = 2.25 \times 10^{15}$ cm$^{-3}$, $p_0 = 1.5 \times 10^{10}$ cm$^{-3}$<br>(4) $n_0 = 2.25 \times 10^{15}$ cm$^{-3}$, $p_0 = 1 \times 10^{5}$ cm$^{-3}$ |
| 92. | Consider an abrupt PN junction (at T = 300 K) shown in the figure below. The depletion region width $X_n$ on the N-side of the junction is 0.2 μm and the permittivity of silicon ($\varepsilon_{si}$) is $1.044 \times 10^{-12}$ F/m. At the junction, the approximate value of the peak electric field (in kV/cm) is<br>  <br><br>(1) 25.40 (2) 28.32<br>(3) 30.66 (4) 32.42 |
| 93. | When a silicon diode having a doping concentration of $N_A = 9 \times 10^{16}$ cm$^{-3}$ on p-side and $N_D = 1 \times 10^{16}$ cm$^{-3}$ on n-side is reverse biased, the total depletion width is found to be 3 μm. Given that the permittivity of silicon is $1.044 \times 10^{-12}$ F/m, the depletion width on the p-side and the maximum electric field in the depletion region, respectively, are<br>(1) 2.7 μm and $2.3 \times 10^5$ V/cm (2) 0.3 μm and $4.15 \times 10^5$ V/cm<br>(3) 0.3 μm and $0.42 \times 10^5$ V/cm (4) 2.1 μm and $0.42 \times 10^5$ V/cm |

| Question No. | Questions |
|---|---|
| 94. | For the circuit shown below, $I_1 = 80$ mA and $I_2 = 4$mA. Transistors $T_1$ and $T_2$ are identical. Assume that the thermal voltage $V_T$ is 26 mV at 27°C. At 50°C, the value of the voltage $V_{12} = V_1 - V_2$ (in mV) is _____.<br>  <br><br>(1) 87.14 (2) 83.15<br>(3) 84.12 (4) 81.13 |
| 95. | The internal quantum efficiency of LEDs decrease exponentially when the temperature<br>(1) decreases (2) increases<br>(3) remains constant (4) none of these |
| 96. | Which of the following is/are true<br>(i) Graphene is an extremely thin three dimensional form of carbon.<br>(ii) In aqueous solution, graphene can bind negatively charged ion.<br>(1) Only 1 (2) Only 2<br>(3) Both 1 and 2 (4) Neither 1 nor 2 |
| 97. | Carbon nano tubes can store<br>(1) Nitrogen (2) Carbondioxide<br>(3) Hydrogen (4) Peroxides |

| Question No. | Questions |
|---|---|
| 98. | What does the 'Chirality'(n, m) denote for carbon nanotubes<br>(1) the chirality is single walled or multi-walled.<br>(2) the CNT is insulating or metallic.<br>(3) A direction that the graphene sheet is rolled up to form a tube.<br>(4) A direction that the CNT extends along |
| 99. | Graphene epitaxial growth by thermal annealing of SiC is completed by<br>(1) Silicon sublimation during annealing, while carbon atoms remain on the surface.<br>(2) Segregation to condense a carbon layer on top of surface.<br>(3) An oxidation process to remove silicon atoms.<br>(4) A reduction process to rearrange carbon atoms on the surface. |
| 100. | Which one of the following is most famously known as solar grade silicon<br>(1) Crystalline Silicon (2) Crushed Silicon<br>(3) Powdered Silicon (4) Silicon |

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

**(MPH/PHD/URS–EE–2019)**

# Electronics & Communication Engg.

Code **C**

Sr. No. 10019

**SET–"X"**

**Time : 1¼ Hours** **Total Questions : 100** **Max. Marks : 100**

Roll No. _____ (in figure)_____ (in words)

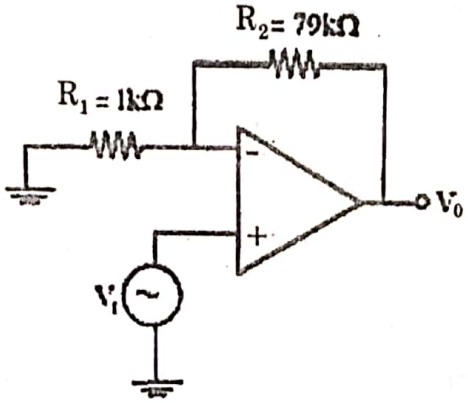
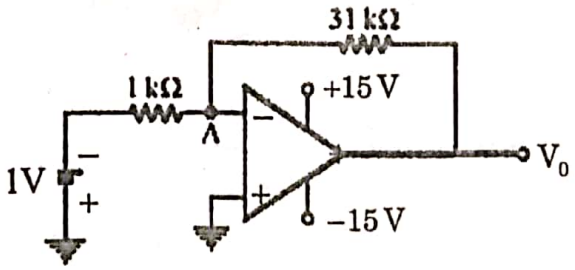
Name : _____ Father's Name : _____

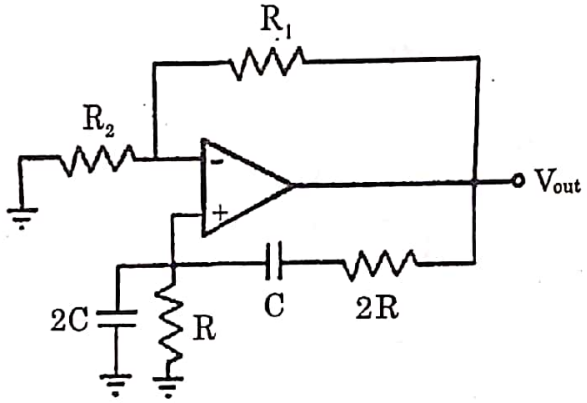
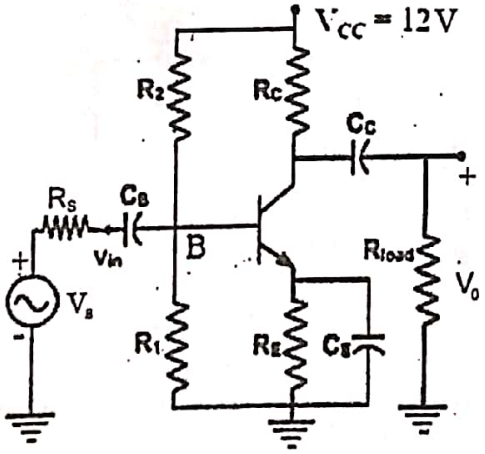
Mother's Name : _____ Date of Examination : _____

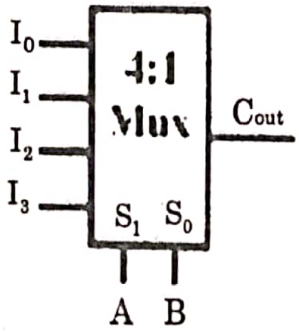
(Signature of the candidate) (Signature of the Invigilator)

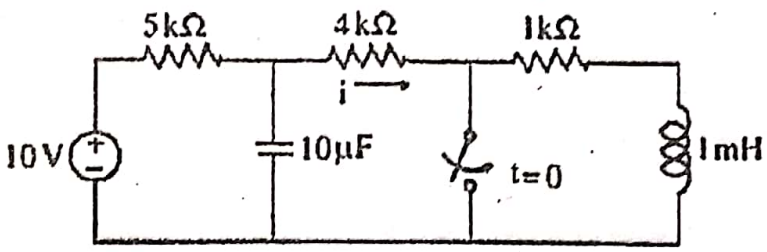
**CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.**

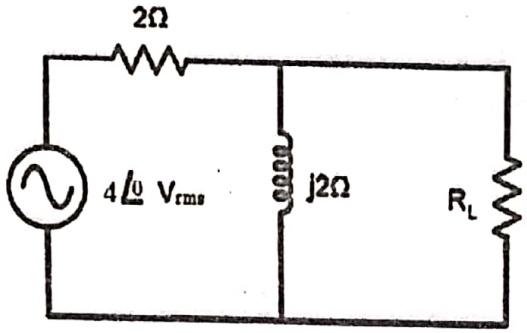
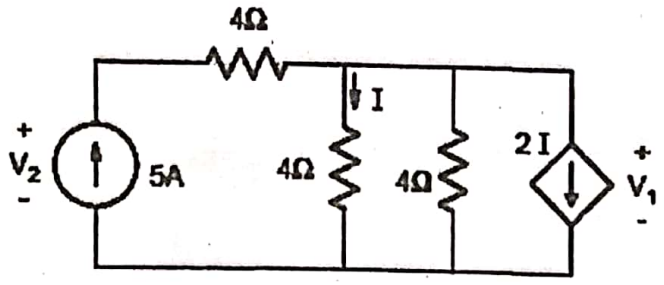
1. All questions are compulsory.
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / misbehaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A,B,C and D code will be got uploaded on the university website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E. Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers **MUST NOT** be ticked in the Question book-let.
6. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. Use only Black or Blue **BALL POINT PEN** of good quality in the OMR Answer-Sheet.
8. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

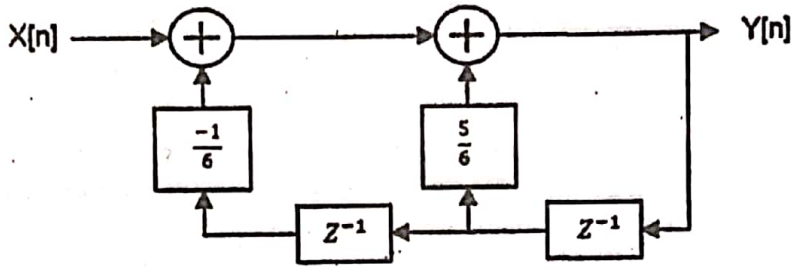
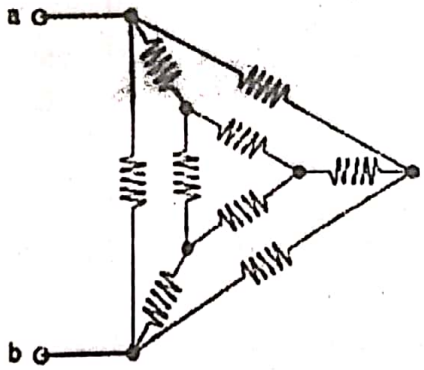
| Question No. | Questions |
|---|---|
| 1. | The amplifier circuit shown in the figure is implemented using a compensated operational amplifier (op-amp), and has an open-loop voltage gain A = $10^5$, and an open-loop cut-off $f_c$ frequency. The voltage gain of the amplifier at 15kHz, in V/V is _____.<br>  <br><br>(1) 44.3 (2) 45.2<br>(3) 54.6 (4) 34.7 |
| 2. | For the op-amp based circuit as shown below by assume the op-amp to be ideal the voltage (in volts, correct to one decimal place) at node A, connected to the negative input of the op-amp as indicated in the figure is<br>  <br><br>(1) 1.4 V (2) 2.0 V<br>(3) 0.5 V (4) 0.9 V |
| 3. | Bistable circuit is also known as<br>(1) Latch (2) Gate<br>(3) Flip-Flop (4) Bidirectional Circuit |

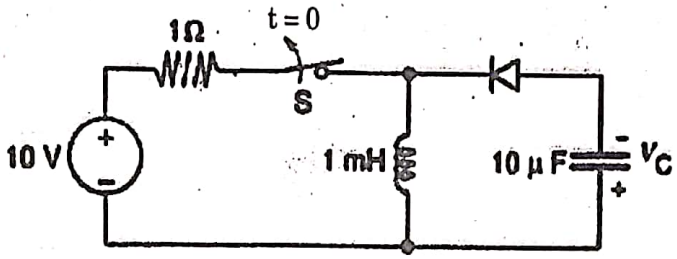
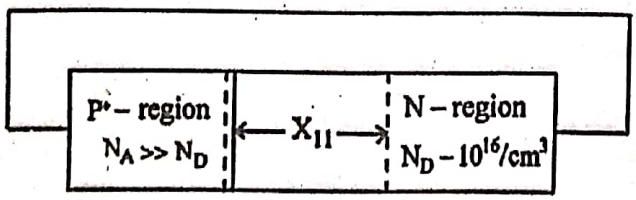
| Question No. | Questions |
|---|---|
| 4. | A monostable multivibrator can also be termed as<br>(1) Full Astable multivibrator (2) Half Astable multivibrator<br>(3) Half Bistable multivibrator (4) Full Bistable multivibrator |
| 5. | The circuit shown in the figure has an ideal opamp. The oscillation frequency and the condition to sustain the oscillations, respectively, are<br>  <br><br>(1) 1/CR and $R_1 = R_2$ (2) 1/CR and $R_1 = 4R_2$<br>(3) 1/2 CR and $R_1 = R_2$ (4) 1/2 CR and $R_1 = 4R_2$ |
| 6. | The voltage gain for the CE transistor amplifier shown below with $R_1$ = 10 kΩ, $R_2$= 20 kΩ, $R_c$= 4kΩ, $R_E$= 3.3 kΩ, β= 100, $R_L$= 10kΩ and $R_S$= 50Ω is<br>  <br><br>(1) 120 (2) –110<br>(3) 112 (4) –104 |

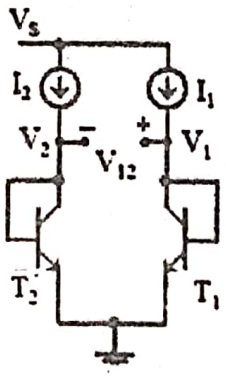
| Question No. | Questions |
|---|---|
| 7. | A 4:1 multiplexer is to be used for generating the output carry of a full adder. A and B are the bits to be added while $C_{in}$ is the input carry and $C_{out}$ is the output carry. A and B are to be used as the select bits with A being the more significant select bit.<br>  <br><br>Which one of the following statements correctly describes the choice of signals to be connected to the inputs $I_0$, $I_1$, $I_2$ and $I_3$ so that the output is $C_{out}$<br>(1) $I_0 = 0$, $I_1 = C_{in}$, $I_2 = C_{in}$ and $I_3 = 1$<br>(2) $I_0 = 1$, $I_1 = C_{in}$, $I_2 = C_{in}$ and $I_3 = 1$<br>(3) $I_0 = 0$, $I_1 = 0$, $I_2 = 1$ and $I_3 = C_{in}$<br>(4) $I_0 = 0$, $I_1 = C_{in}$, $I_2 = 1$ and $I_3 = C_{in}$ |
| 8. | An amplifier operating from +3V provide a 2.2V peak sine wave across a 100 ohm load when provided with a 0.2V peak sine wave as an input from which 1.0 mA current is drawn. The average current in each supply is measured to be 20mA. What is the amplifier efficiency<br>(1) 25.2% (2) 30.2%<br>(3) 20.2% (4) 35.2% |
| 9. | Which of the following is not true<br>(1) both transformer and amplifier can provide voltage gain.<br>(2) both transformer and amplifier can provide current gain.<br>(3) both transformer and amplifier can provide power gain.<br>(4) None of the above |
| 10. | FSK reception uses<br>(1) Correlation receiver and PLL (2) PLL only<br>(3) Correlation receiver only (4) None of the above |

| Question No. | Questions |
|---|---|
| 11. | Norton's theorem states that a complex network connected to a load can be replaced with an equivalent impedance<br>(1) in series with a current source<br>(2) in parallel with a voltage source<br>(3) in series with a voltage source<br>(4) in parallel with a current source |
| 12. | In the figure shown below, the ideal switch has been open for a long time. If it is closed at t = 0, then the magnitude of the current (in mA) through the 4kΩ resistor at t = 0+ is _____ .<br>  <br>(1) 1 Amp<br>(2) 1.2 Amp<br>(3) 1.5 Amp<br>(4) 2 Amp |
| 13. | The Boolean expression converted into the canonical product of sum (POS) form is<br>$F(X, Y, Z) = \overline{X}\,Y\overline{Z} + X\overline{Y}\,\overline{Z} + XY\overline{Z} + XYZ$<br>(1) $(X+Y+Z)\,(X+Y+\overline{Z})\,(X+\overline{Y}+\overline{Z})\,(\overline{X}+Y+\overline{Z})$<br>(2) $(X+\overline{Y}+Z)\,(\overline{X}+Y+\overline{Z})\,(\overline{X}+\overline{Y}+Z)(\overline{X}+\overline{Y}+\overline{Z})$<br>(3) $(X+Y+Z)\,(\overline{X}+Y+\overline{Z})\,(X+\overline{Y}+Z)(\overline{X}+\overline{Y}+\overline{Z})$<br>(4) $(X+\overline{Y}+\overline{Z})\,(\overline{X}+Y+Z)\,(\overline{X}+\overline{Y}+Z)(X+Y+Z)$ |

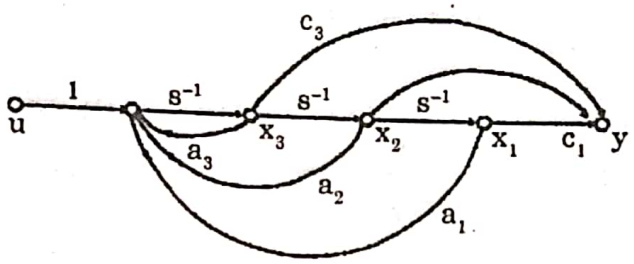
| Question No. | Questions |
|---|---|
| 14. | In the given circuit, the maximum power (in Watts) that can be transferred to the load $R_L$ is _____ .<br>  <br><br>(1) 1.649 (2) 3.283<br>(3) 2.832 (4) 3.123 |
| 15. | In the given circuit, the values of $V_1$ and $V_2$ respectively are<br>  <br><br>(1) 15V, 35V (2) 10V, 30V<br>(3) 5V, 25V (4) 0V, 20V |
| 16. | An FIR system is described by the system function<br>$$H(z) = 1 + 1 + \frac{7}{2}z^{-1} + \frac{3}{2}z^{-2}$$<br>The system is<br>(1) maximum phase (2) minimum phase<br>(3) mixed phase (4) zero phase |

| Question No. | Questions |
|---|---|
| 17. | The input-output relationship of a causal stable LTI system is given as<br>$Y[n] = \alpha y[n-1] + \beta x[n]$<br>If the impulse response h[n] of this system satisfies the condition<br>$\sum_{n=0}^{\infty} h(n) = 2$<br>the relationship between $\alpha$ and $\beta$ is<br>(1) $\alpha = 1 - \beta/2$ (2) $\alpha = 1 + \beta/2$<br>(3) $\alpha = 2\beta$ (4) $\alpha = -2\beta$ |
| 18. | For the discrete-time system shown in the figure, the poles of the system transfer function are located at<br>  <br><br>(1) 2, 3 (2) ½, 3<br>(3) ½, 1/3 (4) 2, 1/3 |
| 19. | In the given circuit, each resistor has a value equal to 1<br>  <br><br>What is the equivalent resistance across the terminals a and b<br>(1) 1/6 Ω (2) 1/3 Ω<br>(3) 9/20 Ω (4) 8/15 Ω |

| Question No. | Questions |
|---|---|
| 20. | The switch S in the circuit shown has been closed for a long time. It is opened at time t = 0 and remains open after that. Assume that the diode has zero reverse current and zero forward voltage drop-<br>  <br><br>The steady state magnitude of the capacitor voltage V, (in volts) is _____<br>(1) 100 (2) 105 (3) 92 (4) 85 |
| 21. | A silicon bar is doped with donor impurities $N_D = 2.25 \times 10^{15}$ atoms/cm$^3$. Given the intrinsic carrier concentration of silicon at T = 300 K is $n_i = 1.5 \times 10^{10}$ cm$^{-3}$. Assuming complete impurity ionization, the equilibrium electron and hole concentrations are<br>(1) $n_0 = 1.5 \times 10^{16}$ cm$^{-3}$, $p_0 = 1.5 \times 10^{5}$ cm$^{-3}$<br>(2) $n_0 = 1.5 \times 10^{10}$ cm$^{-3}$, $p_0 = 1.5 \times 10^{15}$ cm$^{-3}$<br>(3) $n_0 = 2.25 \times 10^{15}$ cm$^{-3}$, $p_0 = 1.5 \times 10^{10}$ cm$^{-3}$<br>(4) $n_0 = 2.25 \times 10^{15}$ cm$^{-3}$, $p_0 = 1 \times 10^{5}$ cm$^{-3}$ |
| 22. | Consider an abrupt PN junction (at T = 300 K) shown in the figure below. The depletion region width $X_n$ on the N-side of the junction is 0.2 μm and the permittivity of silicon ($\varepsilon_{si}$) is $1.044 \times 10^{-12}$ F/m. At the junction, the approximate value of the peak electric field (in kV/cm) is<br>  <br><br>(1) 25.40 (2) 28.32 (3) 30.66 (4) 32.42 |

| Question No. | Questions |
|---|---|
| 23. | When a silicon diode having a doping concentration of $N_A = 9\times10^{16}$ cm$^{-3}$ on p-side and $N_D = 1\times10^{16}$ cm$^{-3}$ on n-side is reverse biased, the total depletion width is found to be 3 μm. Given that the permittivity of silicon is $1.044\times10^{-12}$ F/m, the depletion width on the p-side and the maximum electric field in the depletion region, respectively, are<br>(1) 2.7 μm and $2.3\times10^5$ V/cm (2) 0.3 μm and $4.15\times10^5$ V/cm<br>(3) 0.3 μm and $0.42\times10^5$ V/cm (4) 2.1 μm and $0.42\times10^5$ V/cm |
| 24. | For the circuit shown below, $I_1 = 80$ mA and $I_2 = 4$mA. Transistors $T_1$ and $T_2$ are identical. Assume that the thermal voltage $V_T$ is 26 mV at 27°C. At 50°C, the value of the voltage $V_{12} = V_1 - V_2$ (in mV) is _____.<br>  <br><br>(1) 87.14 (2) 83.15<br>(3) 84.12 (4) 81.13 |
| 25. | The internal quantum efficiency of LEDs decrease exponentially when the temperature<br>(1) decreases<br>(2) increases<br>(3) remains constant<br>(4) none of these |

| Question No. | Questions |
|---|---|
| 26. | Which of the following is/are true<br>(i) Graphene is an extremely thin three dimensional form of carbon.<br>(ii) In aqueous solution, graphene can bind negatively charged ion.<br>(1) Only 1 (2) Only 2<br>(3) Both 1 and 2 (4) Neither 1 nor 2 |
| 27. | Carbon nano tubes can store<br>(1) Nitrogen (2) Carbondioxide<br>(3) Hydrogen (4) Peroxides |
| 28. | What does the 'Chirality'(n, m) denote for carbon nanotubes<br>(1) the chirality is single walled or multi-walled.<br>(2) the CNT is insulating or metallic.<br>(3) A direction that the graphene sheet is rolled up to form a tube.<br>(4) A direction that the CNT extends along |
| 29. | Graphene epitaxial growth by thermal annealing of SiC is completed by<br>(1) Silicon sublimation during annealing, while carbon atoms remain on the surface.<br>(2) Segregation to condense a carbon layer on top of surface.<br>(3) An oxidation process to remove silicon atoms.<br>(4) A reduction process to rearrange carbon atoms on the surface. |
| 30. | Which one of the following is most famously known as solar grade silicon<br>(1) Crystalline Silicon<br>(2) Crushed Silicon<br>(3) Powdered Silicon<br>(4) Silicon |

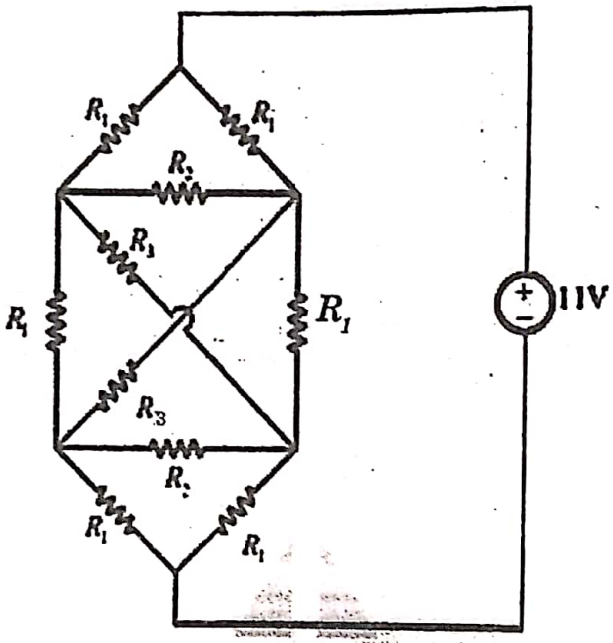
| Question No. | Questions |
|---|---|
| 31. | Consider the state space system expressed by the signal flow diagram shown in the figure.<br>  <br><br>The corresponding system is<br>(1) always controllable (2) always observable<br>(3) always stable (4) always unstable |
| 32. | A TRIAC is equivalent to two SCRs in _____.<br>(1) parallel (2) series<br>(3) inverse parallel (4) none of the above |
| 33. | The V-I Characteristics for a TRIAC in the first and third quadrants are essentially identical to those of _____ in the first quadrant.<br>(1) Transistor (2) SCR<br>(3) UJT (4) None of the above |
| 34. | A device that does not have gate terminal is _____.<br>(1) TRIAC (2) FET<br>(3) SCR (4) DIAC |
| 35. | In an unregulated power supply, if input ac voltage increases, the output voltage _____.<br>(1) Increases (2) Decreases<br>(3) Unchanged (4) Becomes zero |

| Question No. | Questions |
|---|---|
| 36. | SMPS is based on the principle of _____.<br>(1) Phase control (2) Integral control<br>(3) Chopper (4) MOSFET |
| 37. | Piezoelectric crystals<br>(1) float on water<br>(2) dissolve in water<br>(3) are not soluble in water<br>(4) absorb water |
| 38. | Operation of a thermocouple is governed by<br>(1) Peltier effect (2) Seebeck effect<br>(3) Thomson Effect (4) All of the mentioned |
| 39. | A spectrum analyser is used to measure<br>(1) frequency<br>(2) loss angle of dielectric<br>(3) harmonics<br>(4) insulating resistance |
| 40. | Oscilloscope is a _____.<br>(1) Ohmmeter (2) Ammeter<br>(3) Voltmeter (4) Multimeter |
| 41. | When 8051 wakes up then 0×00 is loaded to which register<br>(1) DPTR (2) SP<br>(3) PC (4) PSW |

| Question No. | Questions |
|---|---|
| 42. | On power up, the 8051 uses which RAM locations for register R0-R7<br>(1) 00-2F (2) 00-7F<br>(3) 00-07 (4) 00-0F |
| 43. | In 8086 microprocessor during comparison operation, the result of comparing or subtraction is stored in<br>(1) memory (2) registers<br>(3) stack (4) none of the above |
| 44. | Which segment of the 8086 contains the actual assembly language instructions to be executed by the microprocessor<br>(1) Data Segment (2) Code Segment<br>(3) Stack Segment (4) Extra Segment |
| 45. | A random variable '$X$' takes values –0.5 and 0.5 with probabilities ¼ and ¾, respectively. The noisy observation of $X$ is $Y = X + Z$, where $Z$ has uniform probability density over the interval (–1, 1). $X$ and $Z$ are independent. If the MAP rule based detector outputs ^ X as<br>$\hat{X} = \begin{cases} -0.5, & Y < \alpha \\ 0.5, & Y \geq \alpha \end{cases}$<br>then the value of $\alpha$ (accurate to two decimal places) is _____.<br>(1) 0.5 (2) 0.25<br>(3) 0.4 (4) 0.7 |
| 46. | The phenomenon leading to avalanche breakdown in reverse biased diodes is known as _____.<br>(1) Auger recombination (2) Mode hopping<br>(3) Impact ionization (4) Extract ionization |

| Question No. | Questions |
|---|---|
| 47. | Why VHF, UHF and microwave signals used in satellite communication<br>(1) More bandwidth<br>(2) More spectrum space<br>(3) Are not diffracted by ionosphere<br>(4) Economically viable |
| 48. | The free space model of propagation refers to<br>1. Unobstructed line of sight between transmitter and receiver.<br>2. Satellite communication systems and microwave line of sight radio links.<br>3. Propagation along the ground surface.<br>(1) 1 and 2 are correct<br>(2) 1 and 3 are correct<br>(3) 2 and 3 are correct<br>(4) All are correct |
| 49. | The material used to construct a variable reluctance stepper motor with salient poles is<br>(1) Paramagnetic<br>(2) Ferromagnetic<br>(3) Diamagnetic<br>(4) Non-magnetic |

| Question No. | Questions |
|---|---|
| 50. | Consider the network shown below with $R_1 = 1\Omega$, $R_2 = 2\Omega$ and $R_3 = 3\Omega$. The network is connected to a constant voltage source of 11V. |



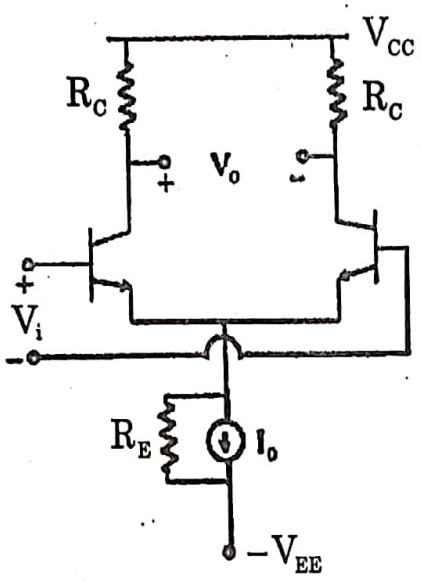
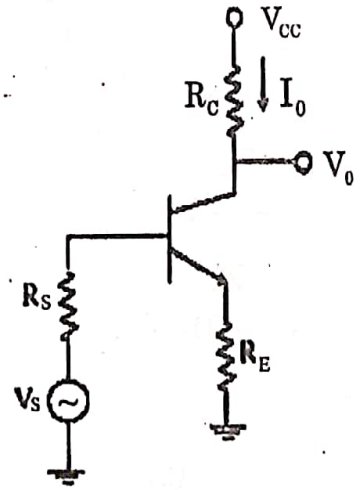

The magnitude of the current (in amperes, accurate to two decimal places) through the source is _____.

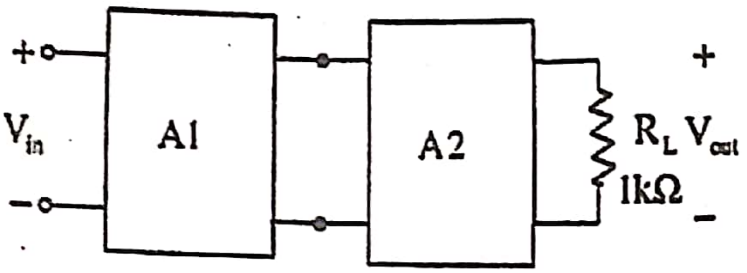
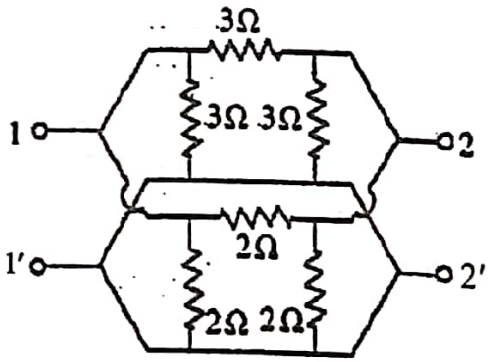
(1) 8 A

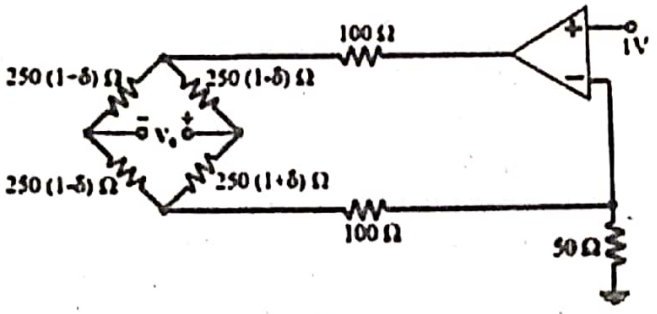
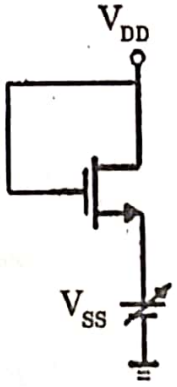
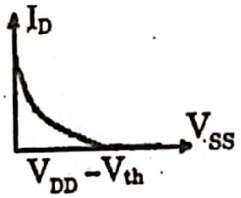
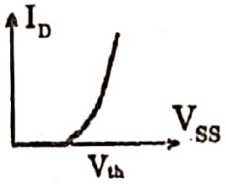
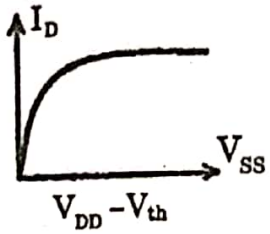
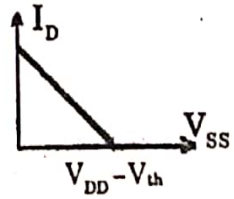
(2) 6 A

(3) 7 A

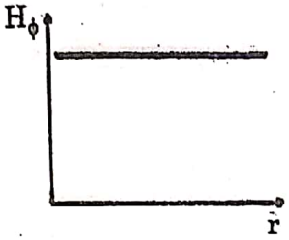
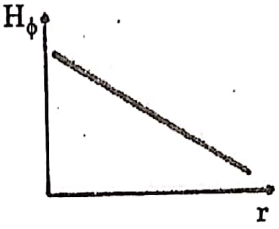
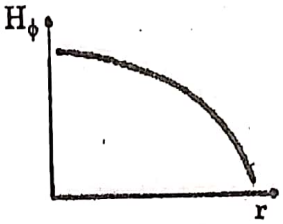
(4) 10 A

| Question No. | Questions |
|---|---|
| 51. | In the differential amplifier shown in the figure, the magnitudes of the common-mode and differential-mode gains are $A_{cm}$ and $A_d$, respectively. If the resistance RE is increased, then<br>  <br><br>(1) $A_{cm}$ increases (2) common-mode rejection ratio increases<br>(3) $A_d$ increases (4) common-mode rejection ratio decreases |
| 52. | The feedback topology in the amplifier circuit (the base bias circuit is not shown for simplicity) in the figure is<br>  <br><br>(1) Voltage shunt feedback (2) Current series feedback<br>(3) Current shunt feedback (4) Voltage series feedback |

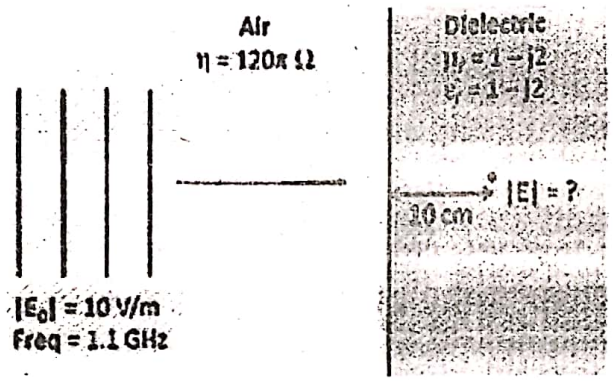
| Question No. | Questions |
|---|---|
| 53. | A cascade connection of two voltage amplifiers A1 and A2 is shown in the figure. The open-loop gain $A_{v0}$, input resistance $R_{in}$, and output resistance $R_0$ for A1 and A2 are as follows :<br>  <br><br>A1 : $A_{v0} = 10$, $R_{in} = 10k\Omega$, $R_0 = 1\ k\Omega$<br>A2 : $A_{v0} = 5$, $R_{in} = 5k\Omega$, $R_0 = 200$<br>The approximate overall voltage gain $V_{out} / V_{in}$ is _____.<br>(1) 28.548 (2) 32.231<br>(3) 33.682 (4) 34.722 |
| 54. | In the h-parameter model of the 2-port network given in the figure shown, the value of h22 (in S) is _____.<br>  <br><br>(1) 1.24 (2) 1.28<br>(3) 1.32 (4) 1.36 |

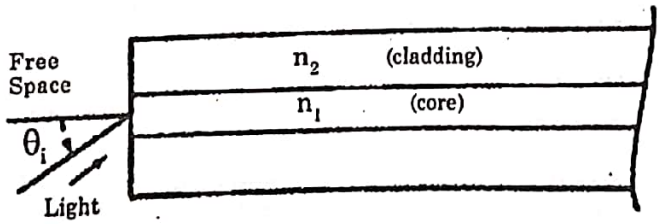
| Question No. | Questions |
|---|---|
| 55. | In the circuit shown, assume that the opamp is ideal. The bridge output voltage $V_0$ (in mV) for $\delta = 0.05$ is<br>  <br><br>(1) 350 (2) 250 (3) 450 (4) 125 |
| 56. | For the NMOSFET in the circuit shown, the threshold voltage is $V_{th}$, where $V_{th} > 0$. The source voltage $V_{SS}$ is varied from 0 to $V_{DD}$. Neglecting the channel length modulation, the drain current ID as a function of $V_{SS}$ is represented by which of the four options<br>  <br><br>(1)  <br><br>(2)  <br><br>(3)  <br><br>(4)  <br> |

| Question No. | Questions |
|---|---|
| 57. | To a Schmitt trigger in a non-inverting configuration an input triangular wave of $1V_p$ is applied. What will be the output waveform, if the upper and lower threshold voltages are 0.25 V<br>(1) Square Waveform (2) Pulse Waveform<br>(3) Sawtooth Waveform (4) Triangular Waveform |
| 58. | If $C_1$ and $C_2$ are the capacitance used in Colpitts oscillator the effective capacitance in the equation of frequency calculation is equal to _____.<br>(1) $\frac{\pi C_1 C_2}{C_1 + C_2}$ (2) $\frac{3C_1 C_2}{C_1 + C_2}$<br>(3) $\frac{C_1 C_2}{2\pi(C_1 + C_2)}$ (4) $\frac{C_1 C_2}{C_1 + C_2}$ |
| 59. | Recommended frequency range of Hartley oscillator is _____.<br>(1) 30 kHz to 30 MHz (2) 30 MHz to 300 MHz<br>(3) 20 kHz to 20 MHz (4) 0.5 kHz to 40 MHz |
| 60. | How the op-amp comparator should be chosen to get higher speed of operation<br>(1) Large Gain (2) High slew rate<br>(3) Wider bandwidth (4) None of the above |
| 61. | A rectangular waveguide of internal dimensions a × b(a > b), the cut-off frequency for the $TE_{11}$ mode is the arithmetic mean of the cut-off frequencies for $TE_{10}$ mode and $TE_{20}$ mode. If a = $\sqrt{5}$ cm the value of b(in cm) is _____.<br>(1) 1 cm (2) 2 cm<br>(3) 4 cm (4) 8 cm |

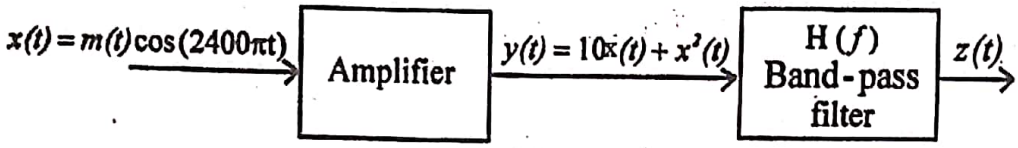
| Question No. | Questions |
|---|---|
| 62. | Consider a straight, infinitely long, current carrying conductor lying on the z-axis. Which one of the following plots (111 linear scale) qualitatively represents the dependence of $H_\phi$ oil r, where $H_\phi$ is the magnitude of the azimuthal component of magnetic field outside the conductor and r is the radial distance from the conductor<br>(1)  <br>(2)  <br>(3)  <br>(4)  |
| 63. | A helix is used in a travelling wave tube to<br>(1) Increase the speed of electron beam<br>(2) Decrease the speed of electron beam<br>(3) Increase the speed of electromagnetic wave along the axis of the tube<br>(4) Decrease the speed of electromagnetic wave along the axis of the tube |
| 64. | Which one of the following diodes provides high range of variable resistance<br>(1) PN Junction Silicon Diode (2) Schottky Diode<br>(3) Varactor Diode (4) PIN Diode |
| 65. | Which one of the following diodes will be most suitable for making high power transmitter<br>(1) PN Junction Diode (2) GUNN Diode<br>(3) Tunnel Diode (4) Schottky Diode |

| Question No. | Questions |
|---|---|
| 66. | Two identical transmitting and receiving antennas with gain of 15 dBi at 2.45 GHz are separated by a distance of 3 km. If the transmitted power is 20W, the power received will be<br>(1) –112.8 dBm (2) –78.4 dBm<br>(3) –52.8 dBm (4) –36.8 dBm |
| 67. | The phase velocity of electromagnetic waves in a hollow metal waveguide is<br>(1) Equal to group velocity<br>(2) Greater than velocity of light in free space<br>(3) Lesser than velocity of light in free space<br>(4) Equal to velocity of light in free space |
| 68. | A lossless $\lambda/2$ line having characteristic impedance = 70.7 Ω is terminated with 100 Ω. The input impedance of this line is<br>(1) 50Ω (2) 70.7Ω<br>(3) 100Ω (4) 200Ω |
| 69. | The electric field component of a plane wave travelling in a lossless dielectric medium is given by<br>$E(z, t) = 2\cos(10^8 t - \frac{z}{\sqrt{2}})$ V/m. The wavelength (in m) for the wave is _____.<br>(1) 8.89 (2) 7.28<br>(3) 4.87 (4) 6.23 |

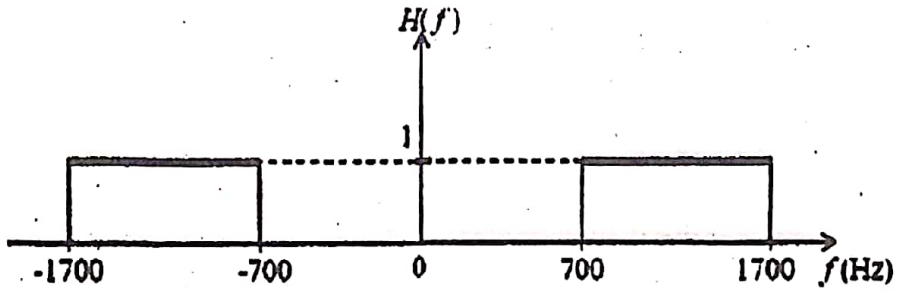
| Question No. | Questions |
|---|---|
| 70. | Consider a uniform plane wave with amplitude ($E_0$) of 10 V/m and 1.1 GHz frequency travelling in air, and incident normally on a dielectric medium with complex relative permittivity ($\varepsilon_r$) and permeability ($\mu_r$) as shown in the figure.<br>  <br>The magnitude of the transmitted electric field component (in V/m) after it has travelled a distance of 10 cm inside the electric region is _____.<br>(1) 0.2 (2) 0.3<br>(3) 0.1 (4) 0.4 |
| 71. | Consider sinusoidal modulation in an AM system. Assuming no over-modulation, the modulation index(μ) when the maximum and minimum values of the envelope, respectively, are 3V and 1 V, is _____.<br>(1) 1.0 (2) 0.5<br>(3) 1.5 (4) 2.0 |
| 72. | Coherent orthogonal binary FSK modulation is used to transmit two equi-probable symbol waveforms $S_1(t) = \alpha cos\ 2\pi f_1 t$ and $S_2(t) = \alpha cos 2\pi f_2 t$, where $\alpha = 4mV$. Assume an AWGN channel with two-sided noise power spectral density $N_0/2 = 0.5 \times 10^{-12}$ W/Hz. Using an optimal receiver and the relation<br>$$Q(v) = \frac{1}{\sqrt{2\pi}} \int^{db} e^{-v^2/2}\, du$$<br>the bit error probability for a data rate of 500 kbps is<br>(1) Q(2) (2) $Q(2\sqrt{2})$<br>(3) Q(4) (4) $Q(4\sqrt{2})$ |

| Question No. | Questions |
|---|---|
| 73. | A sinusoidal signal of 2 kHz frequency is applied to a delta modulator. The sampling rate and step-size $\Delta$ of the delta modulator are 20,000 sample per second and 0.1 V, respectively. To prevent slope overload, the maximum amplitude of the sinusoidal signal (in Volts) is<br>(1) $1/2\pi$ (2) $1/\pi$<br>(3) $2/\pi$ (4) $\pi$ |
| 74. | The transmitted signal in a GSM system is of 200 kHz bandwidth and 8 users share a common bandwidth using TDMA. If at a given time 12 users are talking in a cell, the total bandwidth of the signal received by the base station of the cell will be at least (in kHz) _____.<br>(1) 300 kHz (2) 400 kHz<br>(3) 450 kHz (4) 500 kHz |
| 75. | Light from free space is incident at an angle 0°, to the normal of the facet of a step-index large core optical fibre. The core and cladding refractive indices are $n_1 = 1.5$ and $n_2 = 1.4$, respectively. The maximum value of $\theta_i$ (in degrees) for which the incident light will be guided in the core of the fibre is _____.<br>  <br><br>(1) 35 (2) 32.58<br>(3) 34 (4) 37 |
| 76. | Consider the signal<br>$s(t) = m(t)\cos(2\pi f_c t) + m_1(t)\sin(2\pi f_c t)$<br>Where $m_1(t)$ denotes the Hilbert transform of m(t) and the bandwidth of m(t) is very small compared to $f_c$. The signal s(t) is a<br>(1) high-pass signal<br>(2) low-pass signal<br>(3) band-pass signal<br>(4) double sideband suppressed carrier signal |

| Question No. | Questions |
|---|---|
| 77. | In the system shown in Figure (a), m(t) is a low-pass signal with bandwidth W Hz. The frequency response of the band-pass filter H(f) is shown in Figure (b). If it is desired that the output signal z(t) = 10x(t). The maximum value of W (in Hz) should be strictly less than |




(a)

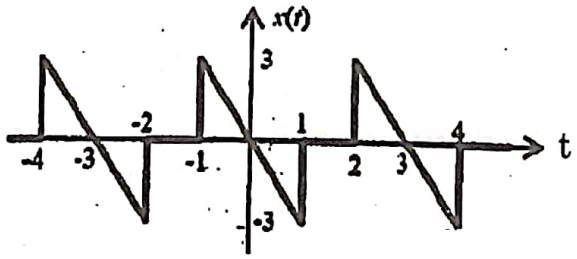



(b)

(1) 450 (2) 400

(3) 350 (4) 500

78. The waveform of a periodic signal x(t) is shown in the figure.

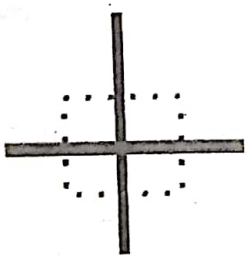
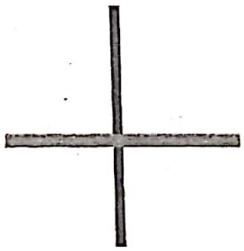
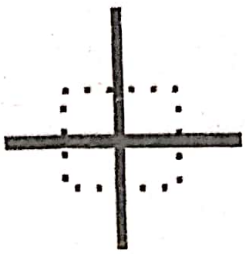
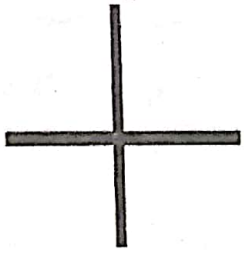


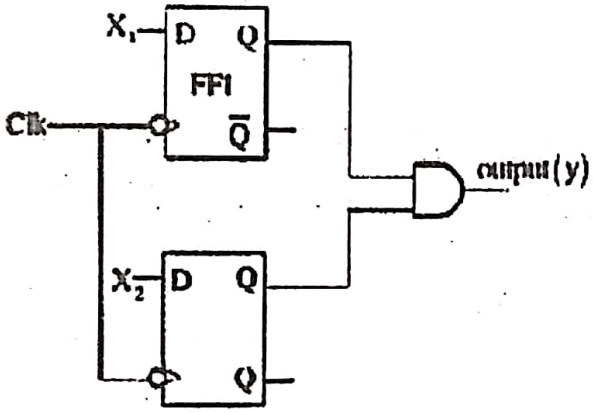
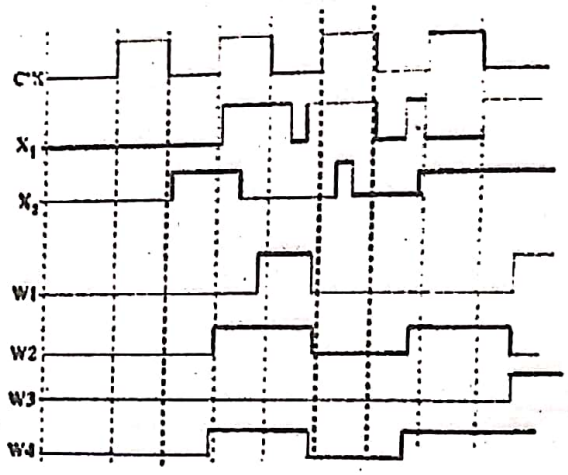
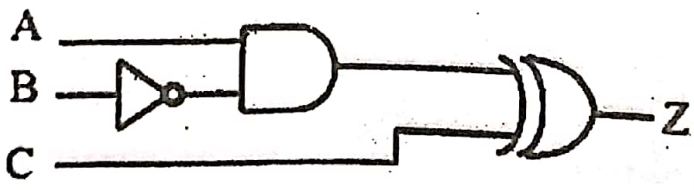

A signal g(t) is defined by $g(t) = x\left(\frac{t-1}{2}\right)$. The average power of g(t) is _____.

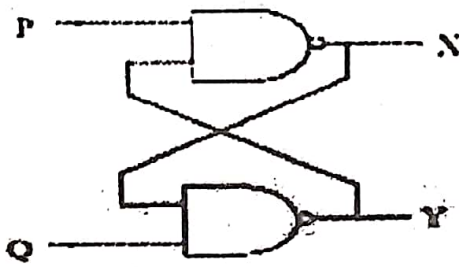
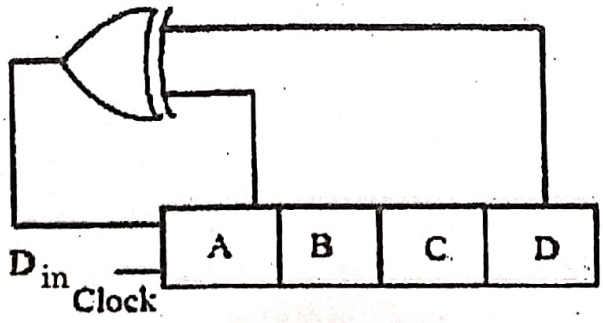
(1) 2 (2) 7

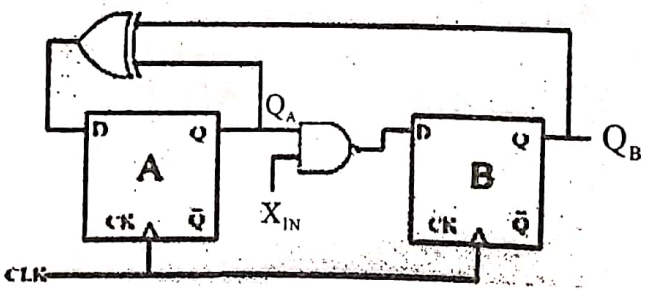
(3) 6 (4) 8

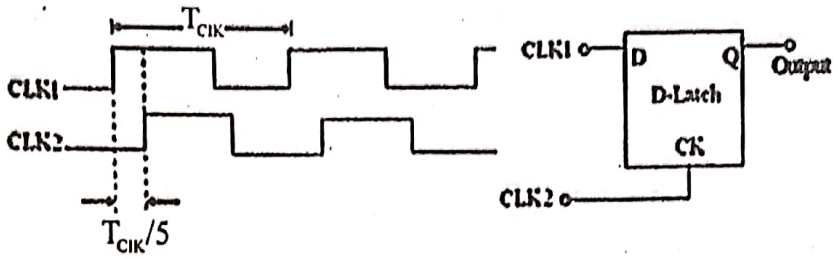
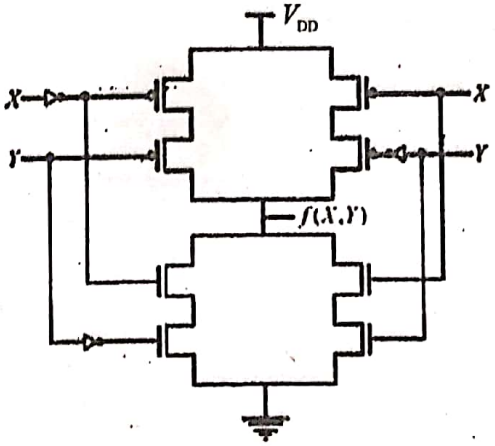
| Question No. | Questions |
|---|---|
| 79. | In a proportional temperature controller, if the quantity under the heater increases the offset will<br>(1) increases<br>(2) decreases<br>(3) remains unaffected<br>(4) increases first and then decreases after a threshold |
| 80. | If a Nyquist plot of $G(j\omega)\ H(j\omega)$ point for a closed loop system passes through (–2, j0) point in GH plane, what would be the value of gain margin of system in dB<br>(1) 0dB (2) 2.0201 dBs<br>(3) 4.021 dB (4) 6.0205 dB |
| 81. | nMOS devices are formed in<br>(1) p-type substrate of high doping level<br>(2) n-type substrate of low doping level<br>(3) p-type substrate of moderate doping level<br>(4) n-type substrate of high doping level |
| 82. | Speed power product is measured as the product of<br>(1) gate switching delay and gate power dissipation<br>(2) gate switching delay and gate power absorption<br>(3) gate switching delay and net gate power<br>(4) gate power dissipation and absorption |
| 83. | In nMOS fabrication, etching is done using<br>(1) plasma<br>(2) hydrochloric acid<br>(3) sulphuric acid<br>(4) sodium chloride |

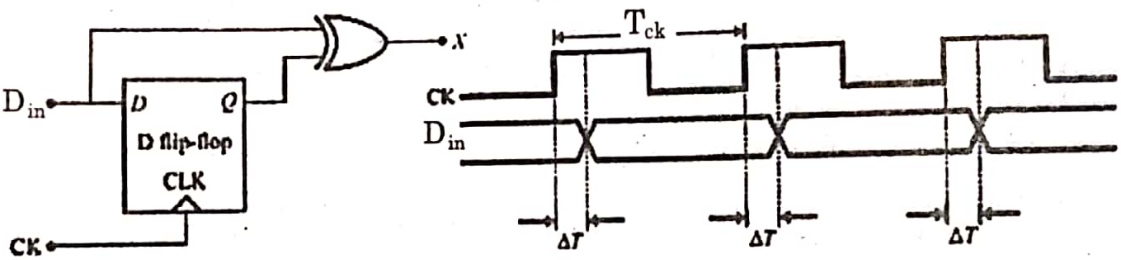
| Question No. | Questions |
|---|---|
| 84. | Heavily doped polysilicon is deposited using<br>(1) chemical vapour decomposition<br>(2) chemical vapour deposition<br>(3) chemical deposition<br>(4) dry deposition |
| 85. | In CMOS fabrication, the photoresist layer is exposed to<br>(1) visible light (2) ultraviolet light<br>(3) infrared light (4) fluorescent |
| 86. | P-well doping concentration and depth will affect the<br>(1) threshold voltage (2) $V_{ss}$<br>(3) $V_{dd}$ (4) $V_{gs}$ |
| 87. | Few parts of photoresist layer is removed by using<br>(1) acidic solution (2) neutral solution<br>(3) pure water (4) diluted water |
| 88. | Which color is used for implant<br>(1) red (2) blue<br>(3) green (4) yellow |
| 89. | How is nMOS depletion mode transistor represented<br>(1)  (2)  <br>(3)  (4)  |

| Question No. | Questions |
|---|---|
| 90. | In CMOS inverter, transistor is a switch having<br>(1) infinite on resistance (2) finite off resistance<br>(3) buffer (4) infinite off resistance |
| 91. | In the circuit shown, choose the correct timing diagram of the output(y) from the given waveforms W1, W2, W3 and W4<br>  <br><br>  <br><br>(1) W1 (2) W2<br>(3) W3 (4) W4 |
| 92. | All the logic gates shown in the figure have a propagation delay of 20 ns. Let A = C = 0 and B = 1 until time t = 0. At t = 0, all the inputs flip (i.e., A = C = 1 and B = 0) and remain in that state. For t > 0, output Z = 1 for a duration (in ns) of _____.<br>  <br><br>(1) 20 (2) 40 (3) 35 (4) 25 |

| Question No. | Questions |
|---|---|
| 93. | In the latch circuit shown below, the NAND gates have non-zero, but unequal propagation delays. The present input condition is: P = Q = '0'. If the input condition is changed simultaneously to P = Q = '1', the outputs X and Y are<br>  <br><br>(1) X = '1', Y = '1'<br>(2) either X = '1', Y = '0' or X = '0', Y = '1'<br>(3) either X = '1', Y = '1' or X = '0', Y = '0'<br>(4) X = '0', Y = '0' |
| 94. | A 4-bit shift register circuit configured for right-shift operation, D→A, A→B, B→C, C→D is shown below. If the present state of the shift register is ABCD = 1101, the number of clock cycles required to reach the state ABCD = 1111 is _____.<br>  <br><br>(1) 10 (2) 11 (3) 12 (4) 8 |

| Question No. | Questions |
|---|---|
| 95. | Which one of the following gives the simplified sum of products expression for the Boolean function $F= m_0 + m_1 + m_2 + m_3 + m_5$ where '$m_x$' are min terms corresponding to the inputs A, B and C with A as the MSB and C as the LSB<br><br>(1) $\overline{A}B+\overline{A}\,\overline{B}\,\overline{C}+A\overline{B}\,C$<br><br>(2) $\overline{A}\,\overline{C}+\overline{A}B+A\overline{B}\,C$<br><br>(3) $\overline{A}\,\overline{C}+A\overline{B}+A\overline{B}\,C$<br><br>(4) $\overline{A}BC+\overline{A}\,\overline{C}+A\overline{B}\,C$ |
| 96. | A Finite State Machine (FSM) is implemented using the D flip-flops A and B, and logic gates, as shown in the figure below. The four possible states of the FSM are $Q_AQ_B = 00$, 01, 10 and 11.<br><br>  <br><br><br>Assume that X1N is held at a constant logic level throughout the operation of the FSM. When the FSM is initialized to the state $Q_AQ_B= 00$ and clocked, after a few clock cycles, it starts cycling through<br>(1) all of the four possible states if $X_{IN} = 1$<br>(2) three of the four possible states if $X_{IN} = 0$<br>(3) only two of the four possible states if $X_{IN} = 1$<br>(4) only two of the four possible states if $X_{IN} = 0$ |

| Question No. | Questions |
|---|---|
| 97. | Consider the D-Latch shown in the figure, which is transparent when its clock input CK is high and has zero propagation delay. In the figure, the clock signal CLK1 has a 50% duty cycle and CLK2 is a one-fifth period delayed version of CLK1. The duty cycle at the output latch in percentage is _____.<br>  <br><br>(1) 30%<br>(2) 28%<br>(3) 34%<br>(4) 32% |
| 98. | The logic function $f(X, Y)$ realized by the given circuit is<br>  <br><br>(1) NOR<br>(2) AND<br>(3) XOR<br>(4) NAND |

| Question No. | Questions |
|---|---|
| 99. | In the circuit shown below, a positive edge-triggered D flip-flop is used for sampling input data $D_{in}$ using clock CK. The XOR gate outputs 3.3 volts for logic HIGH and 0 volts for logic LOW levels. The data bit and clock periods are equal and the value of $\Delta T/T_{CK} = 0.15$, where the parameters $\Delta T$ and $T_{CK}$ are shown in the figure. Assume that the flip-flop and the XOR gate are ideal. If the probability of input data bit ($D_{in}$) transition in each clock period is 0.3, the average value (in volts) of the voltage at node $X$, is _____.   (1) 1.5148 (2) 0.5148 (3) 0.8415 (4) 1.8415 |
| 100. | For programmable logic functions, which type of PLD should be used (1) PLA (2) PAL (3) CPLD (4) SLD |

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

**(MPH/PHD/URS–EE–2019)**

# Electronics & Communication Engg.

Code **D**

Sr. No. 10020

**SET–"X"**

**Time : 1¼ Hours** **Total Questions : 100** **Max. Marks : 100**

Roll No. _____ (in figure) _____ (in words)

Name : _____ Father's Name : _____

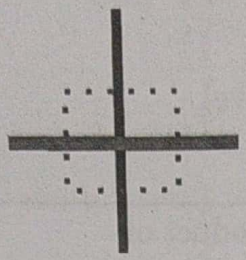
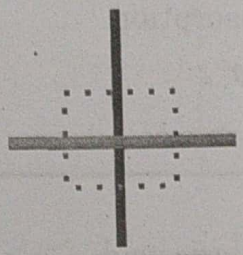
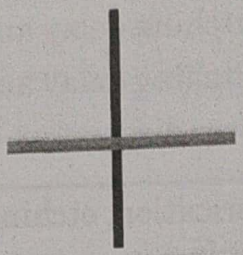
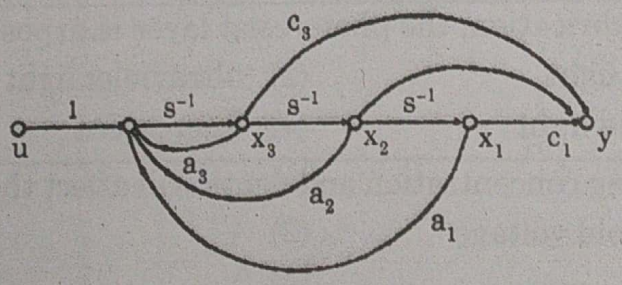
Mother's Name : _____ Date of Examination : _____

(Signature of the candidate) (Signature of the Invigilator)

**CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.**

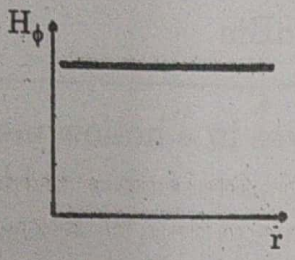
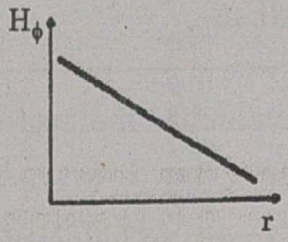
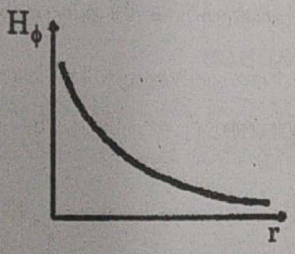
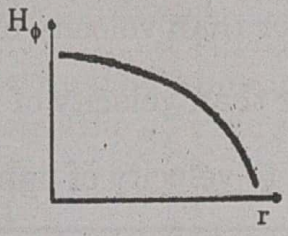
1. All questions are compulsory.
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / misbehaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A,B,C and D code will be got uploaded on the university website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E. Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers **MUST NOT** be ticked in the Question book-let.
6. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. Use only Black or Blue **BALL POINT PEN** of good quality in the OMR Answer-Sheet.
8. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

| Question No. | Questions |
|---|---|
| 1. | nMOS devices are formed in<br>(1) p-type substrate of high doping level<br>(2) n-type substrate of low doping level<br>(3) p-type substrate of moderate doping level<br>(4) n-type substrate of high doping level |
| 2. | Speed power product is measured as the product of<br>(1) gate switching delay and gate power dissipation<br>(2) gate switching delay and gate power absorption<br>(3) gate switching delay and net gate power<br>(4) gate power dissipation and absorption |
| 3. | In nMOS fabrication, etching is done using<br>(1) plasma (2) hydrochloric acid<br>(3) sulphuric acid (4) sodium chloride |
| 4. | Heavily doped polysilicon is deposited using<br>(1) chemical vapour decomposition<br>(2) chemical vapour deposition<br>(3) chemical deposition<br>(4) dry deposition |
| 5. | In CMOS fabrication, the photoresist layer is exposed to<br>(1) visible light (2) ultraviolet light<br>(3) infrared light (4) fluorescent |
| 6. | P-well doping concentration and depth will affect the<br>(1) threshold voltage (2) $V_{ss}$<br>(3) $V_{dd}$ (4) $V_{gs}$ |
| 7. | Few parts of photoresist layer is removed by using<br>(1) acidic solution (2) neutral solution<br>(3) pure water (4) diluted water |
| 8. | Which color is used for implant<br>(1) red (2) blue (3) green (4) yellow |

| Question No. | Questions |
|---|---|
| 9. | How is nMOS depletion mode transistor represented<br>(1)  <br>(2)  <br>(3)  <br>(4)  |
| 10. | In CMOS inverter, transistor is a switch having<br>(1) infinite on resistance (2) finite off resistance<br>(3) buffer (4) infinite off resistance |
| 11. | Consider the state space system expressed by the signal flow diagram shown in the figure.<br>  <br><br>The corresponding system is<br>(1) always controllable (2) always observable<br>(3) always stable (4) always unstable |

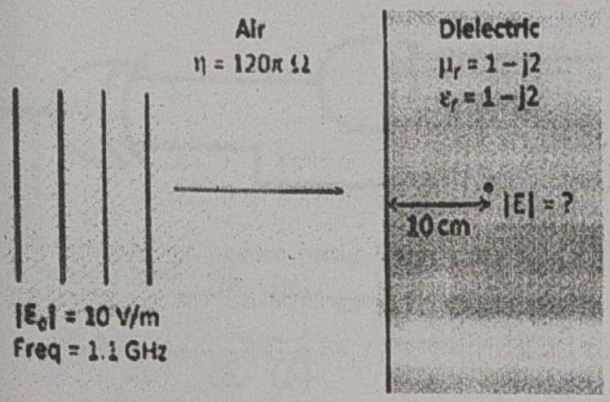
| Question No. | Questions |
|---|---|
| 12. | A TRIAC is equivalent to two SCRs in _____.<br>(1) parallel (2) series<br>(3) inverse parallel (4) none of the above |
| 13. | The V-I Characteristics for a TRIAC in the first and third quadrants are essentially identical to those of _____ in the first quadrant.<br>(1) Transistor (2) SCR<br>(3) UJT (4) None of the above |
| 14. | A device that does not have gate terminal is _____.<br>(1) TRIAC (2) FET<br>(3) SCR (4) DIAC |
| 15. | In an unregulated power supply, if input ac voltage increases, the output voltage _____.<br>(1) Increases (2) Decreases<br>(3) Unchanged (4) Becomes zero |
| 16. | SMPS is based on the principle of _____.<br>(1) Phase control (2) Integral control<br>(3) Chopper (4) MOSFET |
| 17. | Piezoelectric crystals<br>(1) float on water<br>(2) dissolve in water<br>(3) are not soluble in water<br>(4) absorb water |

| Question No. | Questions |
|---|---|
| 18. | Operation of a thermocouple is governed by<br>(1) Peltier effect<br>(2) Seebeck effect<br>(3) Thomson Effect<br>(4) All of the mentioned |
| 19. | A spectrum analyser is used to measure<br>(1) frequency<br>(2) loss angle of dielectric<br>(3) harmonics<br>(4) insulating resistance |
| 20. | Oscilloscope is a _____.<br>(1) Ohmmeter (2) Ammeter<br>(3) Voltmeter (4) Multimeter |
| 21. | A rectangular waveguide of internal dimensions a × b(a > b), the cut-off frequency for the $TE_{11}$ mode is the arithmetic mean of the cut-off frequencies for $TE_{10}$ mode and $TE_{20}$ mode. If a = $\sqrt{5}$ cm the value of b(in cm) is _____.<br>(1) 1 cm<br>(2) 2 cm<br>(3) 4 cm<br>(4) 8 cm |

| Question No. | Questions |
|---|---|
| 22. | Consider a straight, infinitely long, current carrying conductor lying on the z-axis. Which one of the following plots (111 linear scale) qualitatively represents the dependence of $H_\phi$ oil r, where $H_\phi$ is the magnitude of the azimuthal component of magnetic field outside the conductor and r is the radial distance from the conductor<br>(1)  <br>(2)  <br>(3)  <br>(4)  |
| 23. | A helix is used in a travelling wave tube to<br>(1) Increase the speed of electron beam<br>(2) Decrease the speed of electron beam<br>(3) Increase the speed of electromagnetic wave along the axis of the tube<br>(4) Decrease the speed of electromagnetic wave along the axis of the tube |
| 24. | Which one of the following diodes provides high range of variable resistance<br>(1) PN Junction Silicon Diode (2) Schottky Diode<br>(3) Varactor Diode (4) PIN Diode |
| 25. | Which one of the following diodes will be most suitable for making high power transmitter<br>(1) PN Junction Diode (2) GUNN Diode<br>(3) Tunnel Diode (4) Schottky Diode |

| Question No. | Questions |
|---|---|
| 26. | Two identical transmitting and receiving antennas with gain of 15 dBi at 2.45 GHz are separated by a distance of 3 km. If the transmitted power is 20W, the power received will be<br>(1) –112.8 dBm (2) –78.4 dBm<br>(3) –52.8 dBm (4) –36.8 dBm |
| 27. | The phase velocity of electromagnetic waves in a hollow metal waveguide is<br>(1) Equal to group velocity<br>(2) Greater than velocity of light in free space<br>(3) Lesser than velocity of light in free space<br>(4) Equal to velocity of light in free space |
| 28. | A lossless $\lambda/2$ line having characteristic impedance = 70.7 Ω is terminated with 100 Ω. The input impedance of this line is<br>(1) 50Ω (2) 70.7Ω<br>(3) 100Ω (4) 200Ω |
| 29. | The electric field component of a plane wave travelling in a lossless dielectric medium is given by<br>$E(z, t) = 2\cos(10^8 t - \frac{z}{\sqrt{2}})$ V/m. The wavelength (in m) for the wave is _____.<br>(1) 8.89 (2) 7.28<br>(3) 4.87 (4) 6.23 |

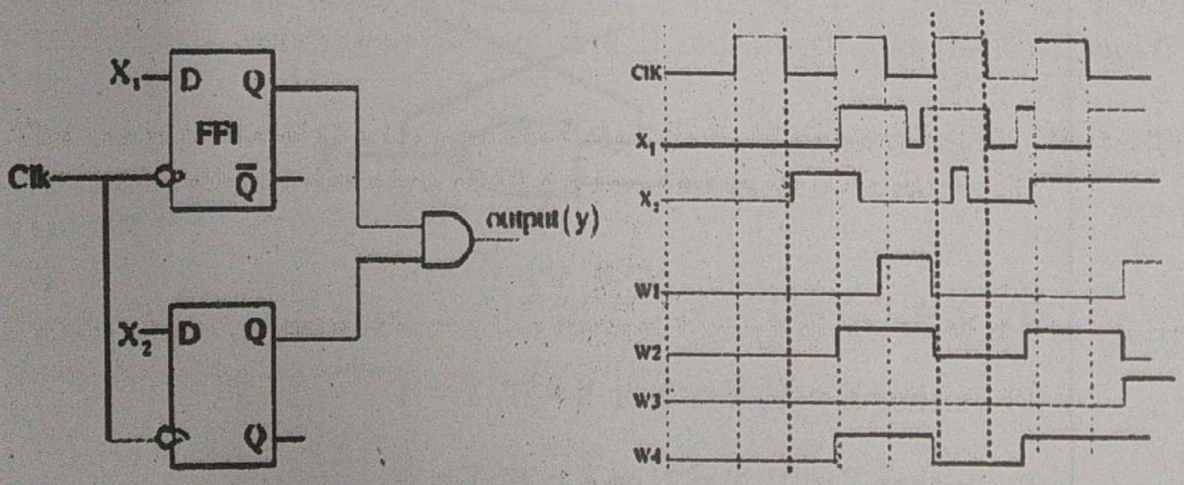
| Question No. | Questions |
|---|---|
| 30. | Consider a uniform plane wave with amplitude ($E_0$) of 10 V/m and 1.1 GHz frequency travelling in air, and incident normally on a dielectric medium with complex relative permittivity ($\varepsilon_r$) and permeability ($\mu_r$) as shown in the figure. |



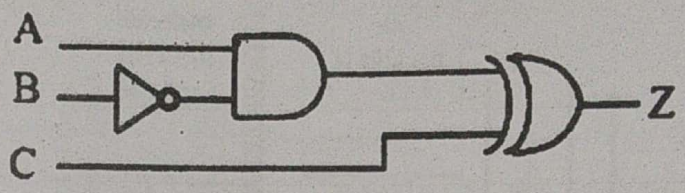
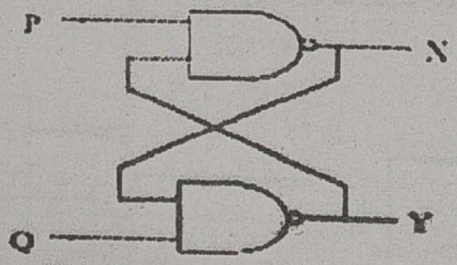

The magnitude of the transmitted electric field component (in V/m) after it has travelled a distance of 10 cm inside the electric region is _____.

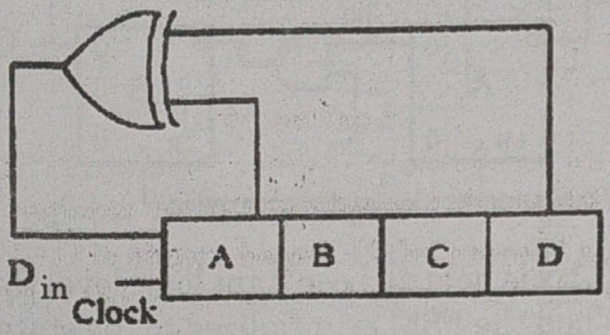
(1) 0.2 (2) 0.3
(3) 0.1 (4) 0.4

| | |
|---|---|
| 31. | In the circuit shown, choose the correct timing diagram of the output(y) from the given waveforms W1, W2, W3 and W4 |

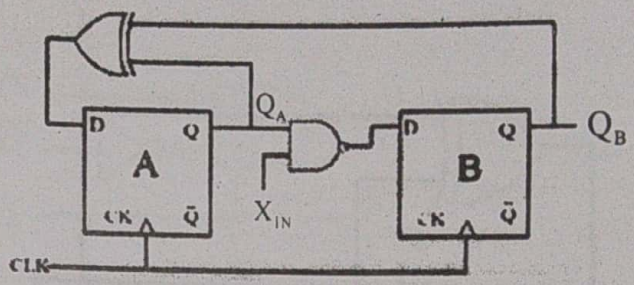



(1) W1 (2) W2
(3) W3 (4) W4

| Question No. | Questions |
|---|---|
| 32. | All the logic gates shown in the figure have a propagation delay of 20 ns. Let A = C = 0 and B = 1 until time t = 0. At t = 0, all the inputs flip (i.e., A = C = 1 and B = 0) and remain in that state. For t > 0, output Z = 1 for a duration (in ns) of _____.<br>  <br><br>(1) 20 (2) 40<br>(3) 35 (4) 25 |
| 33. | In the latch circuit shown below, the NAND gates have non-zero, but unequal propagation delays. The present input condition is: P = Q = '0'. If the input condition is changed simultaneously to P = Q = '1', the outputs X and Y are<br>  <br><br>(1) X = '1', Y = '1'<br>(2) either X = '1', Y = '0' or X = '0', Y = '1'<br>(3) either X = '1', Y = '1' or X = '0', Y = '0'<br>(4) X = '0', Y = '0' |

| Question No. | Questions |
|---|---|
| 34. | A 4-bit shift register circuit configured for right-shift operation, D→A, A→B, B→C, C→D is shown below. If the present state of the shift register is ABCD = 1101, the number of clock cycles required to reach the state ABCD = 1111 is _____.<br>  <br><br>(1) 10 (2) 11<br>(3) 12 (4) 8 |
| 35. | Which one of the following gives the simplified sum of products expression for the Boolean function $F= m_0 + m_1 + m_2 + m_3 + m_5$ where '$m_x$' are min terms corresponding to the inputs A, B and C with A as the MSB and C as the LSB<br>(1) $\overline{A}B+\overline{A}\,\overline{B}\,\overline{C}+A\overline{B}C$<br>(2) $\overline{A}\,\overline{C}+\overline{A}B+A\overline{B}C$<br>(3) $\overline{A}\,\overline{C}+A\overline{B}+A\overline{B}C$<br>(4) $\overline{A}BC+\overline{A}\,\overline{C}+A\overline{B}C$ |

| Question No. | Questions |
|---|---|
| 36. | A Finite State Machine (FSM) is implemented using the D flip-flops A and B, and logic gates, as shown in the figure below. The four possible states of the FSM are $Q_A Q_B = 00, 01, 10$ and 11. |




Assume that X1N is held at a constant logic level throughout the operation of the FSM. When the FSM is initialized to the state $Q_A Q_B = 00$ and clocked, after a few clock cycles, it starts cycling through

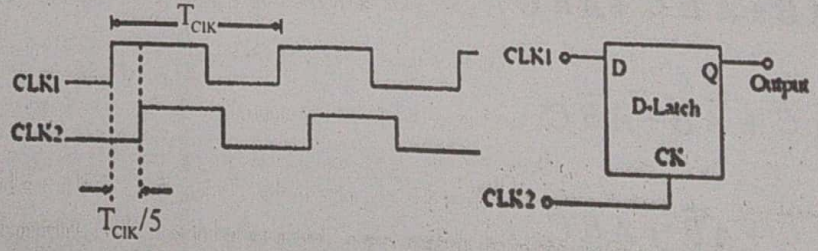
(1) all of the four possible states if $X_{IN} = 1$

(2) three of the four possible states if $X_{IN} = 0$

(3) only two of the four possible states if $X_{IN} = 1$

(4) only two of the four possible states if $X_{IN} = 0$

**37.** Consider the D-Latch shown in the figure, which is transparent when its clock input CK is high and has zero propagation delay. In the figure, the clock signal CLK1 has a 50% duty cycle and CLK2 is a one-fifth period delayed version of CLK1. The duty cycle at the output latch in percentage is _____.

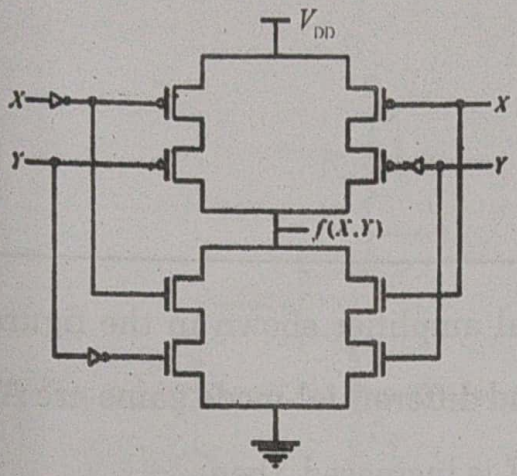
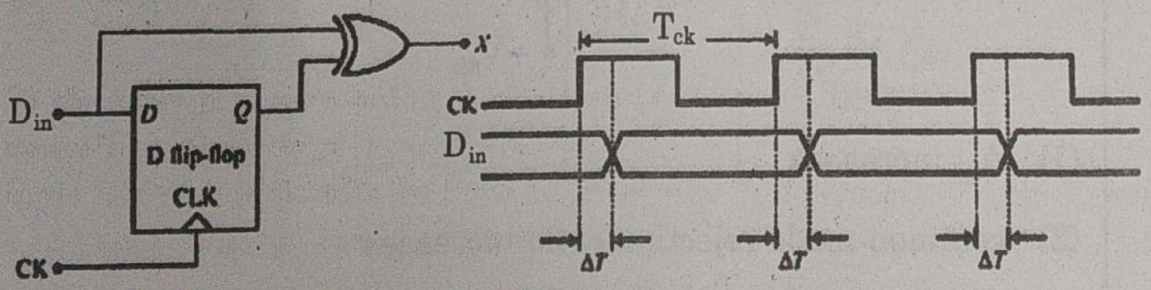


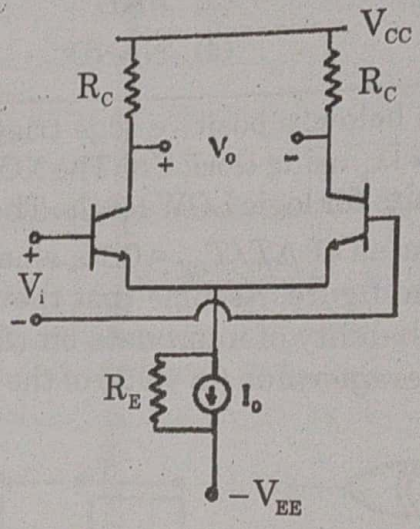

(1) 30%

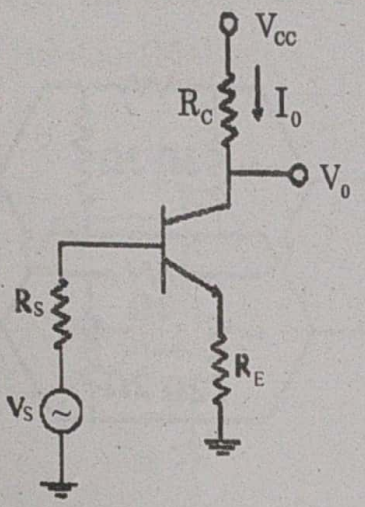
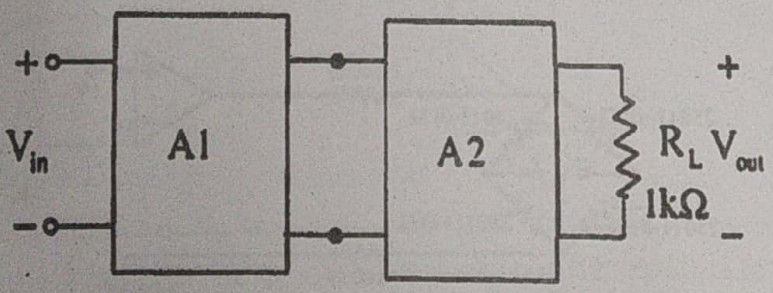
(2) 28%

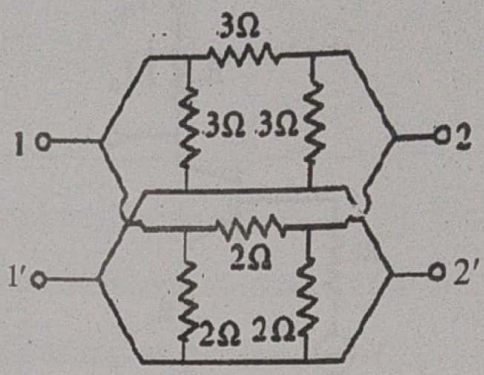
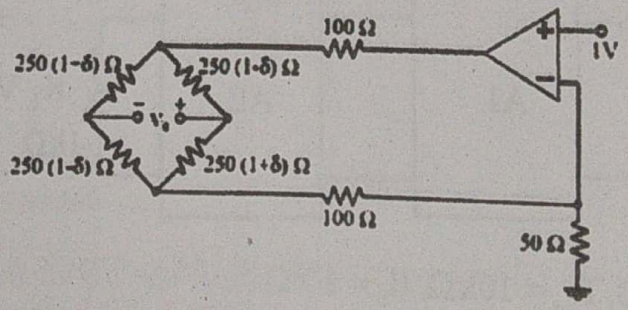
(3) 34%

(4) 32%

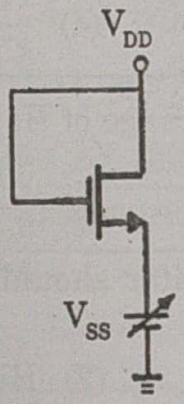
| Question No. | Questions |
|---|---|
| 38. | The logic function $f(X, Y)$ realized by the given circuit is   (1) NOR (2) AND (3) XOR (4) NAND |
| 39. | In the circuit shown below, a positive edge-triggered D flip-flop is used for sampling input data $D_{in}$ using clock CK. The XOR gate outputs 3.3 volts for logic HIGH and 0 volts for logic LOW levels. The data bit and clock periods are equal and the value of $\Delta T/T_{CK} = 0.15$, where the parameters $\Delta T$ and $T_{CK}$ are shown in the figure. Assume that the flip-flop and the XOR gate are ideal. If the probability of input data bit ($D_{in}$) transition in each clock period is 0.3, the average value (in volts) of the voltage at node $X$, is _____.   (1) 1.5148 (2) 0.5148 (3) 0.8415 (4) 1.8415 |

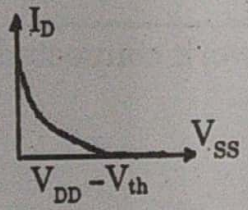
| Question No. | Questions |
|---|---|
| 40. | For programmable logic functions, which type of PLD should be used<br>(1) PLA<br>(2) PAL<br>(3) CPLD<br>(4) SLD |
| 41. | In the differential amplifier shown in the figure, the magnitudes of the common-mode and differential-mode gains are $A_{cm}$ and $A_d$, respectively. If the resistance RE is increased, then<br>  <br><br>(1) $A_{cm}$ increases<br>(2) common-mode rejection ratio increases<br>(3) $A_d$ increases<br>(4) common-mode rejection ratio decreases |

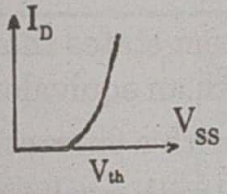
| Question No. | Questions |
|---|---|
| 42. | The feedback topology in the amplifier circuit (the base bias circuit is not shown for simplicity) in the figure is   (1) Voltage shunt feedback (2) Current series feedback (3) Current shunt feedback (4) Voltage series feedback |
| 43. | A cascade connection of two voltage amplifiers A1 and A2 is shown in the figure. The open-loop gain $A_{v0}$, input resistance $R_{in}$, and output resistance $R_0$ for A1 and A2 are as follows :   A1 : $A_{v0} = 10$, $R_{in} = 10k\Omega$, $R_0 = 1\,k\Omega$ A2 : $A_{v0} = 5$, $R_{in} = 5k\Omega$, $R_0 = 200$ The approximate overall voltage gain $V_{out} / V_{in}$ is _____. (1) 28.548 (2) 32.231 (3) 33.682 (4) 34.722 |

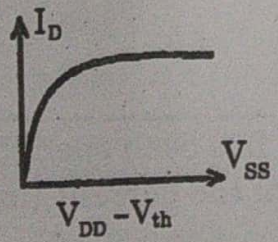
| Question No. | Questions |
|---|---|
| 44. | In the h-parameter model of the 2-port network given in the figure shown, the value of h22 (in S) is _____.<br>  <br><br>(1) 1.24 (2) 1.28<br>(3) 1.32 (4) 1.36 |
| 45. | In the circuit shown, assume that the opamp is ideal. The bridge output voltage $V_0$ (in mV) for $\delta = 0.05$ is<br>  <br><br>(1) 350 (2) 250<br>(3) 450 (4) 125 |

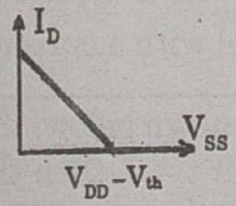
| Question No. | Questions |
|---|---|
| 46. | For the NMOSFET in the circuit shown, the threshold voltage is $V_{th}$, where $V_{th} > 0$. The source voltage $V_{SS}$ is varied from 0 to $V_{DD}$. Neglecting the channel length modulation, the drain current ID as a function of $V_{SS}$ is represented by which of the four options |




(1) 


(2) 

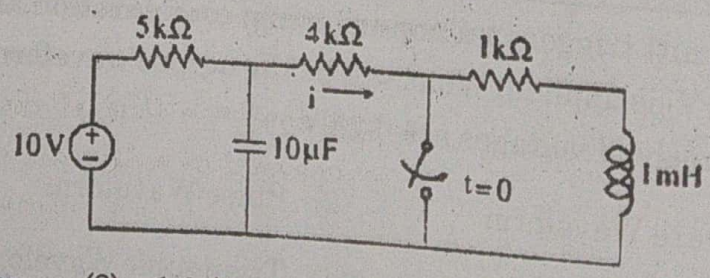

(3) 

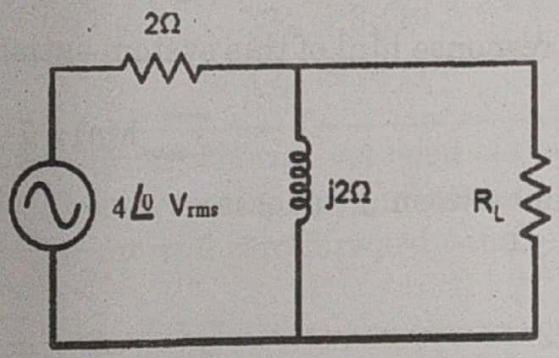
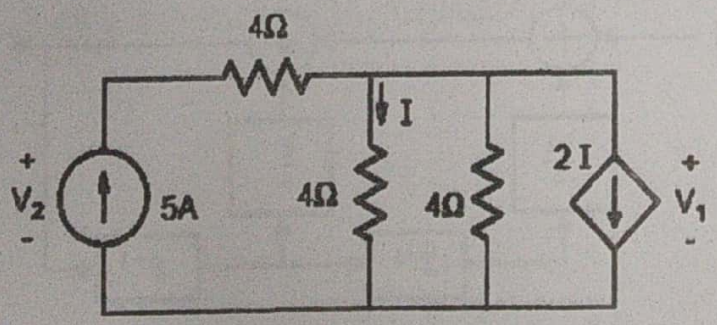

(4) 

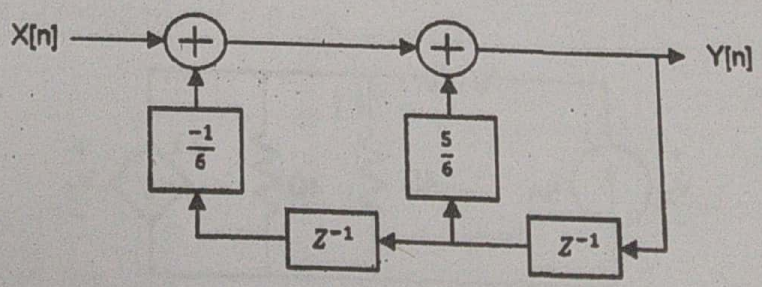

| | |
|---|---|
| 47. | To a Schmitt trigger in a non-inverting configuration an input triangular wave of $1V_p$ is applied. What will be the output waveform, if the upper and lower threshold voltages are 0.25 V |

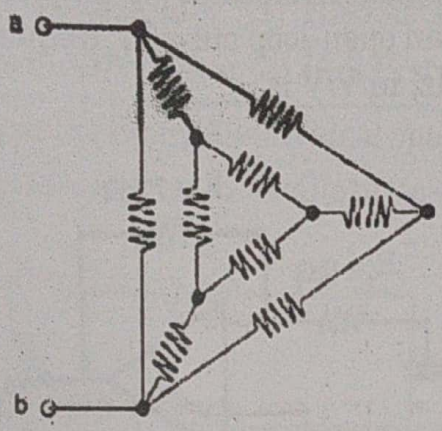
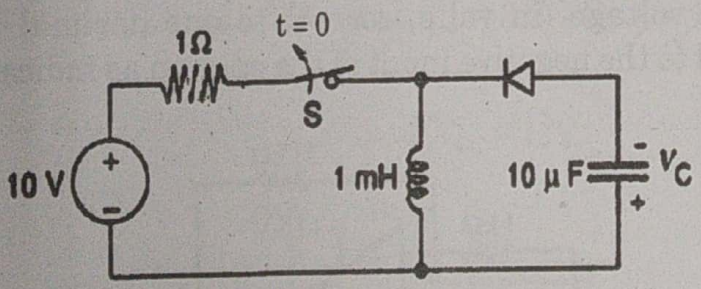
(1) Square Waveform (2) Pulse Waveform

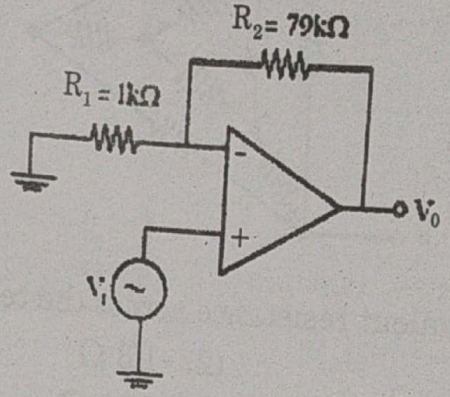
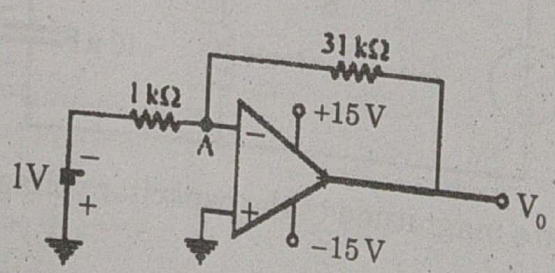
(3) Sawtooth Waveform (4) Triangular Waveform

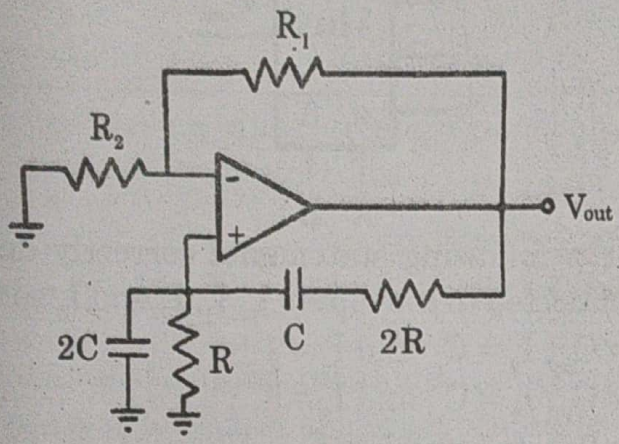
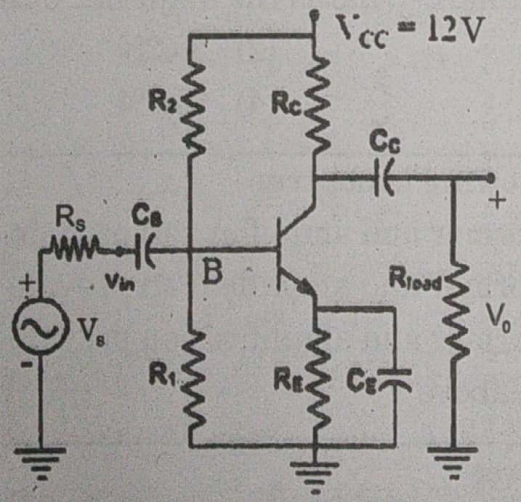
| Question No. | Questions |
|---|---|
| 48. | If $C_1$ and $C_2$ are the capacitance used in Colpitts oscillator the effective capacitance in the equation of frequency calculation is equal to _____.<br>(1) $\frac{\pi C_1 C_2}{C_1 + C_2}$ (2) $\frac{3C_1 C_2}{C_1 + C_2}$<br>(3) $\frac{C_1 C_2}{2\pi(C_1 + C_2)}$ (4) $\frac{C_1 C_2}{C_1 + C_2}$ |
| 49. | Recommended frequency range of Hartley oscillator is _____.<br>(1) 30 kHz to 30 MHz (2) 30 MHz to 300 MHz<br>(3) 20 kHz to 20 MHz (4) 0.5 kHz to 40 MHz |
| 50. | How the op-amp comparator should be chosen to get higher speed of operation<br>(1) Large Gain (2) High slew rate<br>(3) Wider bandwidth (4) None of the above |
| 51. | Norton's theorem states that a complex network connected to a load can be replaced with an equivalent impedance<br>(1) in series with a current source<br>(2) in parallel with a voltage source<br>(3) in series with a voltage source<br>(4) in parallel with a current source |
| 52. | In the figure shown below, the ideal switch has been open for a long time. If it is closed at t = 0, then the magnitude of the current (in mA) through the 4kΩ resistor at t = 0+ is _____.<br>  <br>(1) 1 Amp (2) 1.2 Amp (3) 1.5 Amp (4) 2 Amp |

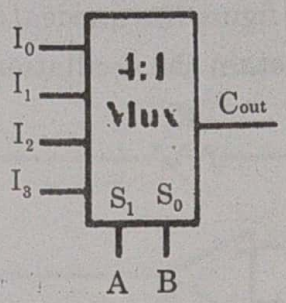
| Question No. | Questions |
|---|---|
| 53. | The Boolean expression converted into the canonical product of sum (POS) form is<br>$F(X, Y, Z) = \overline{X}\,Y\overline{Z} + X\overline{Y}\,\overline{Z} + XY\overline{Z} + XYZ$<br>(1) $(X+Y+Z)\,(X+Y+\overline{Z})\,(X+\overline{Y}+\overline{Z})\,(\overline{X}+Y+\overline{Z})$<br>(2) $(X+\overline{Y}+Z)\,(\overline{X}+Y+\overline{Z})\,(\overline{X}+\overline{Y}+Z)(\overline{X}+\overline{Y}+\overline{Z})$<br>(3) $(X+Y+Z)\,(\overline{X}+Y+\overline{Z})\,(X+\overline{Y}+Z)(\overline{X}+\overline{Y}+\overline{Z})$<br>(4) $(X+\overline{Y}+\overline{Z})\,(\overline{X}+Y+Z)\,(\overline{X}+\overline{Y}+Z)(X+Y+Z)$ |
| 54. | In the given circuit, the maximum power (in Watts) that can be transferred to the load $R_L$ is _____ .<br>  <br>(1) 1.649 (2) 3.283<br>(3) 2.832 (4) 3.123 |
| 55. | In the given circuit, the values of $V_1$ and $V_2$ respectively are<br>  <br>(1) 15V, 35V (2) 10V, 30V (3) 5V, 25V (4) 0V, 20V |

| Question No. | Questions |
|---|---|
| 56. | An FIR system is described by the system function<br>$H(z) = 1 + 1 + \frac{7}{2}z^{-1} + \frac{3}{2}z^{-2}$<br>The system is<br>(1) maximum phase<br>(2) minimum phase<br>(3) mixed phase<br>(4) zero phase |
| 57. | The input-output relationship of a causal stable LTI system is given as<br>$Y[n] = \alpha y[n-1] + \beta x[n]$<br>If the impulse response h[n] of this system satisfies the condition<br>$\sum_{n=0}^{\infty} h(n) = 2$<br>the relationship between $\alpha$ and $\beta$ is<br>(1) $\alpha = 1 - \beta/2$<br>(2) $\alpha = 1 + \beta/2$<br>(3) $\alpha = 2\beta$<br>(4) $\alpha = -2\beta$ |
| 58. | For the discrete-time system shown in the figure, the poles of the system transfer function are located at<br>  <br><br>(1) 2, 3 (2) ½, 3<br>(3) ½, 1/3 (4) 2, 1/3 |

| Question No. | Questions |
|---|---|
| 59. | In the given circuit, each resistor has a value equal to 1<br>  <br><br>What is the equivalent resistance across the terminals a and b<br>(1) 1/6 Ω (2) 1/3 Ω<br>(3) 9/20 Ω (4) 8/15 Ω |
| 60. | The switch S in the circuit shown has been closed for a long time. It is opened at time t = 0 and remains open after that. Assume that the diode has zero reverse current and zero forward voltage drop-<br>  <br><br>The steady state magnitude of the capacitor voltage V, (in volts) is _____<br>(1) 100<br>(2) 105<br>(3) 92<br>(4) 85 |

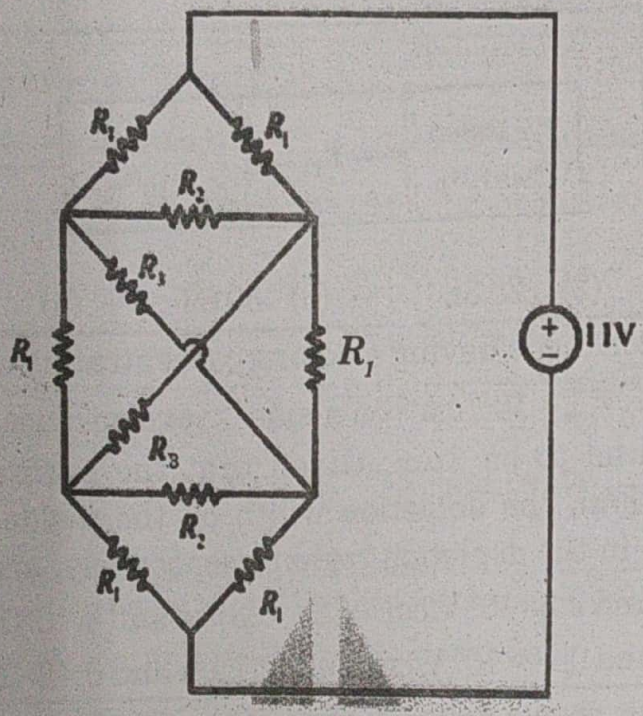
| Question No. | Questions |
|---|---|
| 61. | The amplifier circuit shown in the figure is implemented using compensated operational amplifier (op-amp), and has an open-loop voltage gain $A = 10^5$, and an open-loop cut-off $f_c$ frequency. The voltage gain of the amplifier at 15kHz, in V/V is _____.   (1) 44.3 (2) 45.2 (3) 54.6 (4) 34.7 |
| 62. | For the op-amp based circuit as shown below by assume the op-amp to be ideal the voltage (in volts, correct to one decimal place) at node A, connected to the negative input of the op-amp as indicated in the figure is   (1) 1.4 V (2) 2.0 V (3) 0.5 V (4) 0.9 V |
| 63. | Bistable circuit is also known as (1) Latch (2) Gate (3) Flip-Flop (4) Bidirectional Circuit |

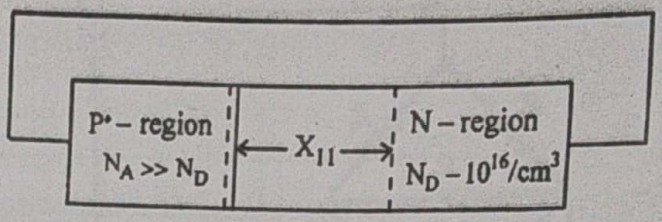
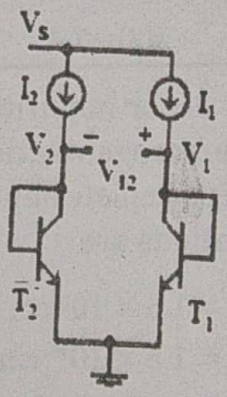
| Question No. | Questions |
|---|---|
| 64. | A monostable multivibrator can also be termed as<br>(1) Full Astable multivibrator (2) Half Astable multivibrator<br>(3) Half Bistable multivibrator (4) Full Bistable multivibrator |
| 65. | The circuit shown in the figure has an ideal opamp. The oscillation frequency and the condition to sustain the oscillations, respectively, are<br>  <br><br>(1) 1/CR and $R_1 = R_2$ (2) 1/CR and $R_1 = 4R_2$<br>(3) 1/2 CR and $R_1 = R_2$ (4) 1/2 CR and $R_1 = 4R_2$ |
| 66. | The voltage gain for the CE transistor amplifier shown below with $R_1 = 10\ k\Omega$, $R_2 = 20\ k\Omega$, $R_c = 4k\Omega$, $R_E = 3.3\ k\Omega$, $\beta = 100$, $R_L = 10k\Omega$ and $R_S = 50\Omega$ is<br>  <br><br>(1) 120 (2) –110<br>(3) 112 (4) –104 |

| Question No. | Questions |
|---|---|
| 67. | A 4:1 multiplexer is to be used for generating the output carry of a full adder. A and B are the bits to be added while $C_{in}$ is the input carry and $C_{out}$ is the output carry. A and B are to be used as the select bits with A being the more significant select bit.<br>  <br><br>Which one of the following statements correctly describes the choice of signals to be connected to the inputs $I_0$, $I_1$, $I_2$ and $I_3$ so that the output is $C_{out}$<br>(1) $I_0 = 0$, $I_1 = C_{in}$, $I_2 = C_{in}$ and $I_3 = 1$<br>(2) $I_0 = 1$, $I_1 = C_{in}$, $I_2 = C_{in}$ and $I_3 = 1$<br>(3) $I_0 = 0$, $I_1 = 0$, $I_2 = 1$ and $I_3 = C_{in}$<br>(4) $I_0 = 0$, $I_1 = C_{in}$, $I_2 = 1$ and $I_3 = C_{in}$ |
| 68. | An amplifier operating from +3V provide a 2.2V peak sine wave across a 100 ohm load when provided with a 0.2V peak sine wave as an input from which 1.0 mA current is drawn. The average current in each supply is measured to be 20mA. What is the amplifier efficiency<br>(1) 25.2% (2) 30.2%<br>(3) 20.2% (4) 35.2% |
| 69. | Which of the following is not true<br>(1) both transformer and amplifier can provide voltage gain.<br>(2) both transformer and amplifier can provide current gain.<br>(3) both transformer and amplifier can provide power gain.<br>(4) None of the above |
| 70. | FSK reception uses<br>(1) Correlation receiver and PLL (2) PLL only<br>(3) Correlation receiver only (4) None of the above |

| Question No. | Questions |
|---|---|
| 71. | When 8051 wakes up then 0×00 is loaded to which register<br>(1) DPTR (2) SP<br>(3) PC (4) PSW |
| 72. | On power up, the 8051 uses which RAM locations for register R0-R7<br>(1) 00-2F (2) 00-7F<br>(3) 00-07 (4) 00-0F |
| 73. | In 8086 microprocessor during comparison operation, the result of comparing or subtraction is stored in<br>(1) memory (2) registers<br>(3) stack (4) none of the above |
| 74. | Which segment of the 8086 contains the actual assembly language instructions to be executed by the microprocessor<br>(1) Data Segment (2) Code Segment<br>(3) Stack Segment (4) Extra Segment |
| 75. | A random variable '$X$' takes values –0.5 and 0.5 with probabilities ¼ and ¾, respectively. The noisy observation of $X$ is $Y = X + Z$, where $Z$ has uniform probability density over the interval (–1, 1). $X$ and $Z$ are independent. If the MAP rule based detector outputs ^ X as<br>$\hat{X} = \begin{cases} -0.5, & Y < \alpha \\ 0.5, & Y \geq \alpha \end{cases}$<br>then the value of $\alpha$ (accurate to two decimal places) is _____.<br>(1) 0.5 (2) 0.25 (3) 0.4 (4) 0.7 |
| 76. | The phenomenon leading to avalanche breakdown in reverse biased diodes is known as _____.<br>(1) Auger recombination (2) Mode hopping<br>(3) Impact ionization (4) Extract ionization |

| Question No. | Questions |
|---|---|
| 77. | Why VHF, UHF and microwave signals used in satellite communication<br>(1) More bandwidth<br>(2) More spectrum space<br>(3) Are not diffracted by ionosphere<br>(4) Economically viable |
| 78. | The free space model of propagation refers to<br>1. Unobstructed line of sight between transmitter and receiver.<br>2. Satellite communication systems and microwave line of sight radio links.<br>3. Propagation along the ground surface.<br>(1) 1 and 2 are correct<br>(2) 1 and 3 are correct<br>(3) 2 and 3 are correct<br>(4) All are correct |
| 79. | The material used to construct a variable reluctance stepper motor with salient poles is<br>(1) Paramagnetic<br>(2) Ferromagnetic<br>(3) Diamagnetic<br>(4) Non-magnetic |

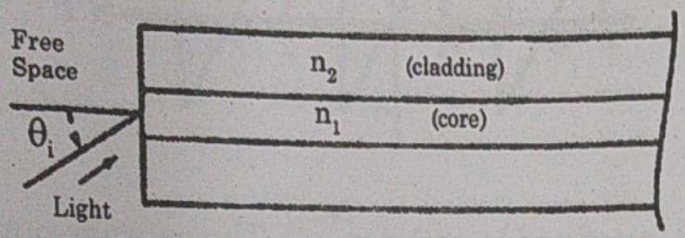
| Question No. | Questions |
|---|---|
| 80. | Consider the network shown below with $R_1 = 1\Omega$, $R_2 = 2\Omega$ and $R_3 = 3\Omega$. The network is connected to a constant voltage source of 11V.<br>  <br><br>The magnitude of the current (in amperes, accurate to two decimal places) through the source is _____.<br>(1) 8 A (2) 6 A (3) 7 A (4) 10 A |
| 81. | A silicon bar is doped with donor impurities $N_D = 2.25 \times 10^{15}$ atoms/cm$^3$. Given the intrinsic carrier concentration of silicon at T = 300 K is $n_i = 1.5 \times 10^{10}$ cm$^{-3}$. Assuming complete impurity ionization, the equilibrium electron and hole concentrations are<br>(1) $n_0 = 1.5 \times 10^{16}$ cm$^{-3}$, $p_0 = 1.5 \times 10^5$ cm$^{-3}$<br>(2) $n_0 = 1.5 \times 10^{10}$ cm$^{-3}$, $p_0 = 1.5 \times 10^{15}$ cm$^{-3}$<br>(3) $n_0 = 2.25 \times 10^{15}$ cm$^{-3}$, $p_0 = 1.5 \times 10^{10}$ cm$^{-3}$<br>(4) $n_0 = 2.25 \times 10^{15}$ cm$^{-3}$, $p_0 = 1 \times 10^5$ cm$^{-3}$ |

| Question No. | Questions |
|---|---|
| 82. | Consider an abrupt PN junction (at T = 300 K) shown in the figure below. The depletion region width $X_n$ on the N-side of the junction is 0.2 μm and the permittivity of silicon ($\varepsilon_{si}$) is $1.044\times10^{-12}$ F/m. At the junction, the approximate value of the peak electric field (in kV/cm) is<br>  <br><br>(1) 25.40 (2) 28.32 (3) 30.66 (4) 32.42 |
| 83. | When a silicon diode having a doping concentration of $N_A = 9\times10^{16}$ cm$^{-3}$ on p-side and $N_D = 1\times10^{16}$ cm$^{-3}$ on n-side is reverse biased, the total depletion width is found to be 3 μm. Given that the permittivity of silicon is $1.044\times10^{-12}$ F/m, the depletion width on the p-side and the maximum electric field in the depletion region, respectively, are<br>(1) 2.7 μm and $2.3\times10^5$ V/cm (2) 0.3 μm and $4.15\times10^5$ V/cm<br>(3) 0.3 μm and $0.42\times10^5$ V/cm (4) 2.1 μm and $0.42\times10^5$ V/cm |
| 84. | For the circuit shown below, $I_1$ = 80 mA and $I_2$ = 4mA. Transistors $T_1$ and $T_2$ are identical. Assume that the thermal voltage $V_T$ is 26 mV at 27°C. At 50°C, the value of the voltage $V_{12} = V_1 - V_2$ (in mV) is _____.<br>  <br><br>(1) 87.14 (2) 83.15 (3) 84.12 (4) 81.13 |

| Question No. | Questions |
|---|---|
| 85. | The internal quantum efficiency of LEDs decrease exponentially when the temperature<br>(1) decreases (2) increases<br>(3) remains constant (4) none of these |
| 86. | Which of the following is/are true<br>(i) Graphene is an extremely thin three dimensional form of carbon.<br>(ii) In aqueous solution, graphene can bind negatively charged ion.<br>(1) Only 1 (2) Only 2<br>(3) Both 1 and 2 (4) Neither 1 nor 2 |
| 87. | Carbon nano tubes can store<br>(1) Nitrogen (2) Carbondioxide<br>(3) Hydrogen (4) Peroxides |
| 88. | What does the 'Chirality'(n, m) denote for carbon nanotubes<br>(1) the chirality is single walled or multi-walled.<br>(2) the CNT is insulating or metallic.<br>(3) A direction that the graphene sheet is rolled up to form a tube.<br>(4) A direction that the CNT extends along |
| 89. | Graphene epitaxial growth by thermal annealing of SiC is completed by<br>(1) Silicon sublimation during annealing, while carbon atoms remain on the surface.<br>(2) Segregation to condense a carbon layer on top of surface.<br>(3) An oxidation process to remove silicon atoms.<br>(4) A reduction process to rearrange carbon atoms on the surface. |
| 90. | Which one of the following is most famously known as solar grade silicon<br>(1) Crystalline Silicon (2) Crushed Silicon<br>(3) Powdered Silicon (4) Silicon |

| Question No. | Questions |
|---|---|
| 91. | Consider sinusoidal modulation in an AM system. Assuming no over-modulation, the modulation index($\mu$) when the maximum and minimum values of the envelope, respectively, are 3V and 1 V, is _____.<br>(1) 1.0 (2) 0.5<br>(3) 1.5 (4) 2.0 |
| 92. | Coherent orthogonal binary FSK modulation is used to transmit two equi-probable symbol waveforms $S_1(t) = \alpha cos\ 2\pi f_1 t$ and $S_2(t) = \alpha cos 2\pi f_2 t$, where $\alpha = 4mV$. Assume an AWGN channel with two-sided noise power spectral density $N_0/2 = 0.5 \times 10^{-12}$ W/Hz. Using an optimal receiver and the relation<br>$$Q(v) = \frac{1}{\sqrt{2\pi}} \int^{db} e^{-v^2/2} du$$<br>the bit error probability for a data rate of 500 kbps is<br>(1) Q(2) (2) $Q(2\sqrt{2})$<br>(3) Q(4) (4) $Q(4\sqrt{2})$ |
| 93. | A sinusoidal signal of 2 kHz frequency is applied to a delta modulator. The sampling rate and step-size $\Delta$ of the delta modulator are 20,000 sample per second and 0.1 V, respectively. To prevent slope overload, the maximum amplitude of the sinusoidal signal (in Volts) is<br>(1) $1/2\pi$ (2) $1/\pi$<br>(3) $2/\pi$ (4) $\pi$ |
| 94. | The transmitted signal in a GSM system is of 200 kHz bandwidth and 8 users share a common bandwidth using TDMA. If at a given time 12 users are talking in a cell, the total bandwidth of the signal received by the base station of the cell will be at least (in kHz) _____.<br>(1) 300 kHz<br>(2) 400 kHz<br>(3) 450 kHz<br>(4) 500 kHz |

| Question No. | Questions |
|---|---|
| 95. | Light from free space is incident at an angle 0°, to the normal of the facet of a step-index large core optical fibre. The core and cladding refractive indices are $n_1 = 1.5$ and $n_2 = 1.4$, respectively. The maximum value of $\theta_i$ (in degrees) for which the incident light will be guided in the core of the fibre is _____. |




(1) 35 (2) 32.58 (3) 34 (4) 37

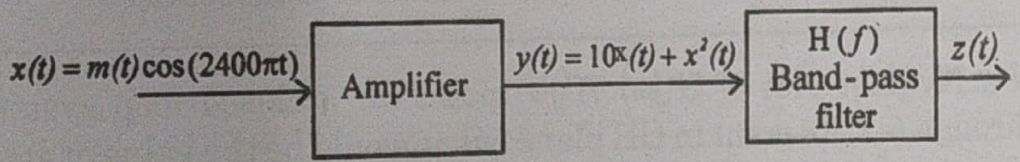
**96.** Consider the signal

$$s(t) = m(t)\cos(2\pi f_c t) + m_1(t)\sin(2\pi f_c t)$$

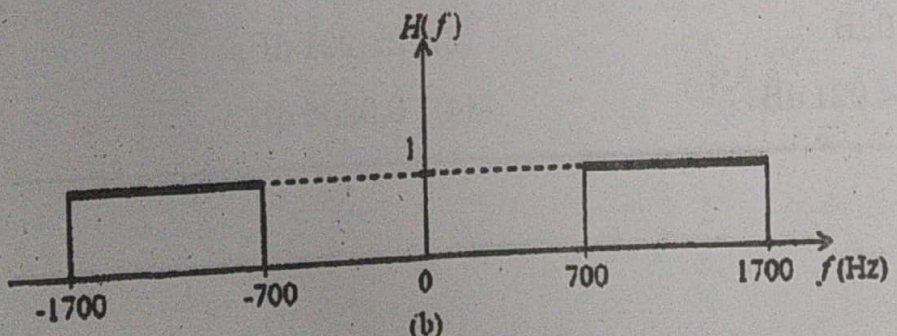
Where $m_1(t)$ denotes the Hilbert transform of m(t) and the bandwidth of m(t) is very small compared to $f_c$. The signal s(t) is a

(1) high-pass signal (2) low-pass signal
(3) band-pass signal (4) double sideband suppressed carrier signal

**97.** In the system shown in Figure (a), m(t) is a low-pass signal with bandwidth W Hz. The frequency response of the band-pass filter H(f) is shown in Figure (b). If it is desired that the output signal $z(t) = 10x(t)$. The maximum value of W (in Hz) should be strictly less than

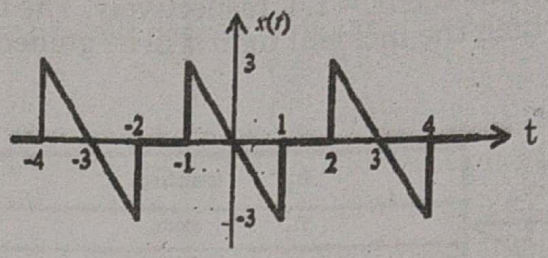



(a)




(b)

(1) 450 (2) 400 (3) 350 (4) 500

| Question No. | Questions |
|---|---|
| 98. | The waveform of a periodic signal x(t) is shown in the figure.<br>  <br><br>A signal g(t) is defined by $g(t) = x\left(\frac{t-1}{2}\right)$. The average power of g(t) is _____.<br>(1) 2 (2) 7<br>(3) 6 (4) 8 |
| 99. | In a proportional temperature controller, if the quantity under the heater increases the offset will<br>(1) increases<br>(2) decreases<br>(3) remains unaffected<br>(4) increases first and then decreases after a threshold |
| 100. | If a Nyquist plot of $G(j\omega)\,H(j\omega)$ point for a closed loop system passes through (–2, j0) point in GH plane, what would be the value of gain margin of system in dB<br>(1) 0dB (2) 2.0201 dBs<br>(3) 4.021 dB (4) 6.0205 dB |
| | |

| Answer Key of M.Phil/Ph.D 2019 (ECE) | | | | |
|---|---|---|---|---|
| Sr. No. | Set A | Set B | Set C | Set D |
| 1 | 4 | 1 | 4 | 2 |
| 2 | 3 | 3 | 2 | 3 |
| 3 | 2 | 2 | 1 | 1 |
| 4 | 2 | 4 | 1 | 2 |
| 5 | 2 | 1 | 3 | 2 |
| 6 | 4 | 3 | 3 | 3 |
| 7 | 3 | 2 | 1 | 3 |
| 8 | 3 | 4 | 3 | 1 |
| 9 | 1 | 3 | 4 | 1 |
| 10 | 1 | 3 | 1 | 4 |
| 11 | 3 | 2 | 2 | 4 |
| 12 | 1 | 2 | 3 | 3 |
| 13 | 1 | 4 | 1 | 2 |
| 14 | 2 | 1 | 2 | 2 |
| 15 | 2 | 2 | 2 | 2 |
| 16 | 1 | 1 | 3 | 4 |
| 17 | 1 | 1 | 3 | 3 |
| 18 | 4 | 4 | 1 | 3 |
| 19 | 3 | 1 | 1 | 1 |
| 20 | 2 | 3 | 4 | 1 |
| 21 | 4 | 2 | 3 | 3 |
| 22 | 2 | 3 | 1 | 2 |
| 23 | 1 | 1 | 1 | 2 |
| 24 | 1 | 2 | 2 | 1 |
| 25 | 3 | 2 | 2 | 2 |
| 26 | 3 | 3 | 1 | 4 |
| 27 | 1 | 3 | 1 | 1 |
| 28 | 3 | 1 | 4 | 3 |
| 29 | 4 | 1 | 3 | 3 |
| 30 | 1 | 4 | 2 | 2 |
| 31 | 2 | 4 | 3 | 1 |
| 32 | 2 | 2 | 2 | 3 |
| 33 | 4 | 1 | 2 | 3 |
| 34 | 1 | 1 | 1 | 2 |
| 35 | 2 | 3 | 2 | 4 |
| 36 | 1 | 3 | 4 | 2 |
| 37 | 1 | 1 | 1 | 1 |
| 38 | 4 | 3 | 3 | 3 |
| 39 | 1 | 4 | 3 | 3 |
| 40 | 3 | 1 | 2 | 1 |
| 41 | 1 | 2 | 4 | 3 |
| 42 | 3 | 3 | 3 | 3 |
| 43 | 3 | 4 | 2 | 4 |
| 44 | 2 | 4 | 2 | 2 |
| 45 | 4 | 2 | 2 | 1 |
| 46 | 2 | 4 | 4 | 3 |
| 47 | 1 | 2 | 3 | 3 |
| 48 | 3 | 3 | 3 | 1 |
| 49 | 3 | 1 | 1 | 2 |
| 50 | 1 | 3 | 1 | 1 |

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| | | | | |
|---|---|---|---|---|
| 51 | 3 | 3 | 1 | 2 |
| 52 | 2 | 1 | 3 | 2 |
| 53 | 2 | 1 | 2 | 4 |
| 54 | 1 | 2 | 4 | 1 |
| 55 | 2 | 2 | 1 | 2 |
| 56 | 4 | 1 | 3 | 1 |
| 57 | 1 | 1 | 2 | 1 |
| 58 | 3 | 4 | 4 | 4 |
| 59 | 3 | 3 | 3 | 1 |
| 60 | 2 | 2 | 3 | 3 |
| 61 | 3 | 3 | 1 | 2 |
| 62 | 3 | 2 | 3 | 3 |
| 63 | 4 | 2 | 3 | 4 |
| 64 | 2 | 1 | 2 | 4 |
| 65 | 1 | 2 | 4 | 2 |
| 66 | 3 | 4 | 2 | 4 |
| 67 | 3 | 1 | 1 | 2 |
| 68 | 1 | 3 | 3 | 3 |
| 69 | 2 | 3 | 3 | 1 |
| 70 | 1 | 2 | 1 | 3 |
| 71 | 2 | 4 | 3 | 4 |
| 72 | 3 | 3 | 3 | 2 |
| 73 | 4 | 2 | 4 | 1 |
| 74 | 4 | 2 | 2 | 1 |
| 75 | 2 | 2 | 1 | 3 |
| 76 | 4 | 4 | 3 | 3 |
| 77 | 2 | 3 | 3 | 1 |
| 78 | 3 | 3 | 1 | 3 |
| 79 | 1 | 1 | 2 | 4 |
| 80 | 3 | 1 | 1 | 1 |
| 81 | 2 | 3 | 2 | 1 |
| 82 | 3 | 3 | 3 | 3 |
| 83 | 1 | 4 | 4 | 2 |
| 84 | 2 | 2 | 4 | 4 |
| 85 | 2 | 1 | 2 | 1 |
| 86 | 3 | 3 | 4 | 3 |
| 87 | 3 | 3 | 2 | 2 |
| 88 | 1 | 1 | 3 | 4 |
| 89 | 1 | 2 | 1 | 3 |
| 90 | 4 | 1 | 3 | 3 |
| 91 | 1 | 1 | 2 | 3 |
| 92 | 3 | 3 | 2 | 1 |
| 93 | 2 | 3 | 4 | 1 |
| 94 | 4 | 2 | 1 | 2 |
| 95 | 1 | 4 | 2 | 2 |
| 96 | 3 | 2 | 1 | 1 |
| 97 | 2 | 1 | 1 | 1 |
| 98 | 4 | 3 | 4 | 4 |
| 99 | 3 | 3 | 1 | 3 |
| 100 | 3 | 1 | 3 | 2 |

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