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## PAPER – III

## ELECTRONIC SCIENCE

Signature of the Invigilator | Question Booklet No. ....140112.....

1. | OMR Sheet No.. .....

**Subject Code** 14 | **ROLL No.** | | | | | | | | |

**Time Allowed : 150 Minutes** | **Max. Marks : 150**

No. of pages in this Booklet : **16** | No. of Questions : **75**

### INSTRUCTIONS FOR CANDIDATES

1. Write your Roll No. and the OMR Sheet No. in the spaces provided on top of this page.
2. Fill in the necessary information in the spaces provided on the OMR response sheet.
3. This booklet consists of seventy five (75) compulsory questions each carrying 2 marks.
4. Examine the question booklet carefully and tally the number of pages/questions in the booklet with the information printed above. **Do not accept a damaged or open booklet**. Damaged or faulty booklet may be got replaced within the first **5** minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time given.
5. Each Question has four alternative responses marked (A), (B), (C) and (D) in the OMR sheet. You have to completely darken the circle indicating the most appropriate response against each item as in the illustration.




6. All entries in the OMR response sheet are to be recorded in the original copy only.
7. Use only Blue/Black Ball point pen.
8. Rough Work is to be done on the blank pages provided at the end of this booklet.
9. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Sheet, except in the spaces allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, you will render yourself liable to disqualification.
10. You have to return the Original OMR Sheet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. **You are, however, allowed to carry the test booklet and the duplicate copy of OMR Sheet** on conclusion of examination.
11. Use of any calculator, mobile phone or log table etc. is strictly prohibited.
12. **There is no negative marking.**

**14-16**

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## PAPER-III
## ELECTRONIC SCIENCE

1. The density of carriers in a pure semiconductor is proportional to :

(A) $\exp\left(\frac{-E_g}{2kT}\right)$

(B) $\exp\left(\frac{-2E_g}{kT^2}\right)$

(C) $\exp\left(\frac{-E_g}{kT^2}\right)$

(D) $\exp\left(\frac{-E_g}{kT}\right)$

2. The phenomenon known as early effect in a bipolar transistor refers to a reduction in base width caused by :

(A) Electron hole recombination at base

(B) The forward bias of emitter base junction

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

(D) The reverse biasing of base collector junction

3. In series R-L-C circuit, R = 2kΩ, L = 1H and $C = \frac{1}{400}\mu F$. The resonant frequency is :

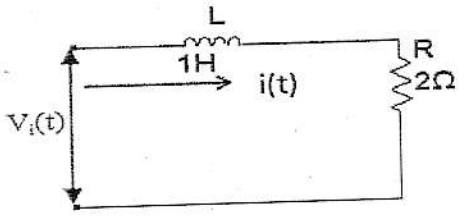
(A) $2 \times 10^4$ Hz

(B) $\frac{10^4}{\pi}$ Hz

(C) $10^4$ Hz

(D) $2\pi \times 10^4$ Hz

4. For R-L circuit shown in figure, the input voltage $V_1(t) = u(t)$, the current i (t) is :



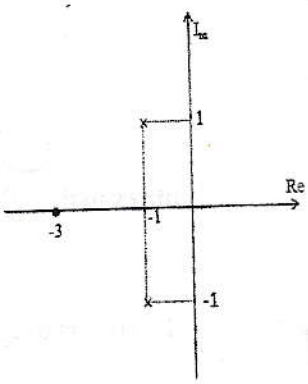

(A) $i(t) = \frac{1}{2}(1 - e^{-2t})u(t)$

(B) $i(t) = 2(1 - e^{-2t})u(t)$

(C) $i(t) = \frac{1}{2}(1 - e^{t})u(t)$

(D) $i(t) = 2(1 - e^{t/2})u(t)$

5. The driving point impedance Z (s) of a network ha the pole-zero locations as shown in the figure If Z (0) = 3 then Z (s) is :




(A) $\frac{2(s+3)}{s^2+2s+2}$

(B) $\frac{3(s+3)}{s^2+2s+3}$

(C) $\frac{3(s-3)}{s^2-2s-2}$

(D) $\frac{2(s-3)}{s^2-2s-2}$



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6. An inductance of 80 mH is in series with two inductances in parallel, one of 3 mH and other of 6 mH. The $L_{eq}$ is equal to :

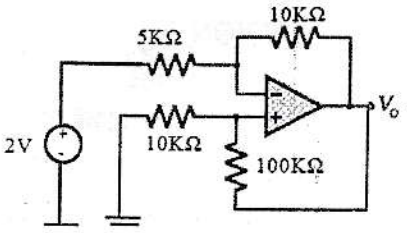
(A) 8.0 mH (B) 10.0 mH
(C) 20.0 mH (D) 170.0 mH

7. The magnitude of the integrator transfer function using an op-amp is :

(A) $-\omega R_I C_F$ (B) $-\frac{1}{\omega R_1 C_F}$

(C) $\frac{1}{\omega R_1 C_F}$ (D) $\omega R_I C_F$

8. The output $V_0$ of the following circuit is :




(A) 6 V (B) – 4 V
(C) – 5.5 V (D) 5 V

9. The following instructions have been executed by an 8085 microprocessor :

| Address (Hex) | Instruction |
|---|---|
| 6010 | LXIH, 8A79H |
| 6013 | MOVA, L |
| 6015 | ADD H |
| 6016 | DAA |
| 6017 | MOV H, A |
| 6018 | PCHL |

From which address will the next instruction be fetched ?

(A) 6019 (B) 6979
(C) 6379 (D) None of the above

10. The execution of the following assembly level program in a 8085 microprocessor will result in :

```
        MVI B, 87H
        MO A, B
START : JMP NEXT
        MVI B, 00H
        XRA B
        OUT PORT1
        HLT
NEXT :  XRA B
        JB START
        OUT PORT2
        HLT
```

(A) Infinite looping of the program execution with accumulator data alternating between 00H and 87H
(B) An output of 87H at PORT1
(C) Infinite looping of the program execution with accumulator data remaining at 00H
(D) An output of 87H at PORT2

11. What is printed when the given sample code is executed ?

```
int y[4] = {6, 7, 8, 9];
int * ptr = y + 2;
printf ("%d/n", ptr[1])
```

(A) 7
(B) 8
(C) 9
(D) The code will not compile

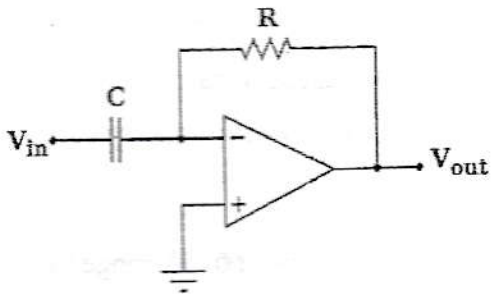
12. Which of the following DO statements is invalid in FORTRAN ?

(A) DO 10 I = 1, 15
(B) DO 10 J = 1, 5, 1
(C) DO 10 J = -5, 5, 2
(D) none of the above



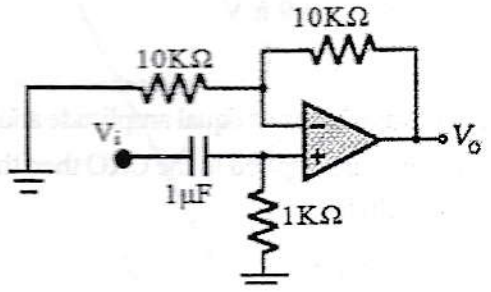
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20. Assume that the op-amp in the given figure is ideal. If $V_{in}$ is a triangular wave, then $V_0$ will be a :




(A) Square wave (B) Sine wave
(C) Ramp wave (D) Triangular wave

21. The op-amp shown in the figure is a filter. The types of filter and its cut off frequency are respectively :




(A) High pass, 1000 rad/sec
(B) Low pass, 1000 rad/sec
(C) High pass, 10000 rad/sec
(D) Low pass, 10000 rad/sec

22. The bandwidth of an n-stage tuned amplifier with each stage of bandwidth of B, is given by :

(A) $\frac{B}{\sqrt{n}}$

(B) $B\sqrt{2^{1/n}-1}$

(C) $\frac{B}{n}$

(D) $\frac{B}{\sqrt{2^{1/n}-1}}$

23. A circulator /isolator used in microwave waveguides works on the following effect :

(A) Kerr effect (B) Pockel effect
(C) Kelvin effect (D) Faraday rotation

24. A plane wave in air with an electric field $\vec{E} = E_0(\omega t - 3x - \sqrt{3}z)\hat{y}$ $V/m$ is incident on a non-magnetic dielectric slab of relative permittivity 3 in region z>0. The angle of transmission in the slab is :

(A) 45 deg. (B) 60 deg.
(C) 30 deg. (D) 90 deg.

25. Ionospheric propagation is not possible for microwave because :

(A) Microwaves will be fully absorbed by the ionospheric layers
(B) Microwaves will penetrate through the ionospheric layers
(C) Microwaves will be scattered in all directions
(D) There will be large dispersion of microwave energy

26. Voice frequency range in a telephone system is restricted to :

(A) 100 - 3600 Hz (B) 0 - 4000 Hz
(C) 300 - 3400 Hz (D) 0 - 3400 Hz

27. For a given data rate , the bandwidth , $B_o$, of OOK or ASK signal and bandwidth, $B_p$, of QPSK signal are related as :

(A) $B_p = B_o$ (B) $B_p = 0.5\ B_o$
(C) $B_p = 2B_o$ (D) $B_p = 4B_o$



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28. A pre-emphasis circuit provides extra noise immunity by :

(A) Boosting the low audio frequencies
(B) Pre-amplifying the whole audio band
(C) Converting the phase modulation FM
(D) Amplifying the higher audio frequencies

29. The reason for using non-uniform quantization in PCM system is that it :

(A) Simplifies the quantization process
(B) Leads to reduced transmission bandwidth
(C) Decreases quantization noise for low signal levels
(D) Increases the maximum signal to noise ratio

30. A single phase full-wave half controlled bridge converter feeds an inductive load. The two SCRs in the converter connected to a common DC bus. The converter has to have a free-wheeling diode :

(A) Because the converter does not provide free-wheeling for high value of triggering angles
(B) Because the converter inherently does not provide free wheeling
(C) Or else the free-wheeling action of the converter will cause shorting of AC supply
(D) Or else if a gate pulse to one of the SCR's is missed, it will subsequently cause a high load current in the other SCR

31. The voltage $V_{BB}$ is applied across the terminal of an UJT with forward diode voltage $V_D$. The emitter voltage at peak point is :

(A) $\eta V_{BB} + V_D$ (B) $\eta V_{BB}$
(C) $(\eta + 1)V_{BB}$ (D) $V_D$

32. To save energy during braking of a motor :

(A) Plugging is used
(B) Regenerative braking is used
(C) Mechanical braking is used
(D) Dynamic braking is used

33. A digital voltmeter of 0 - 1V range has a $3\frac{1}{2}$ digital display. The voltmeter can show values :

(A) -1999 to 1999 mV
(B) -999-999 mV
(C) 0 - 1000 mV
(D) 0 - 9999 mV

34. If two waveforms of equal amplitude and 90 degree difference are applied to the CRO then the Lissjous pattern will be :

(A) Ellipse
(B) Circle
(C) Vertical line
(D) Straight line at 45 degree to x-axis

35. The sweep generator of CRO is used to produce :

(A) Saw tooth voltages for the vertical deflection of the beam
(B) Saw tooth voltages for the horizontal deflection of the beam
(C) Sinusoidal voltages for the vertical deflection of the beam
(D) Sinusoidal voltages for the horizontal deflection of the beam



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36. Temperature measurement with thermocouple is based on :

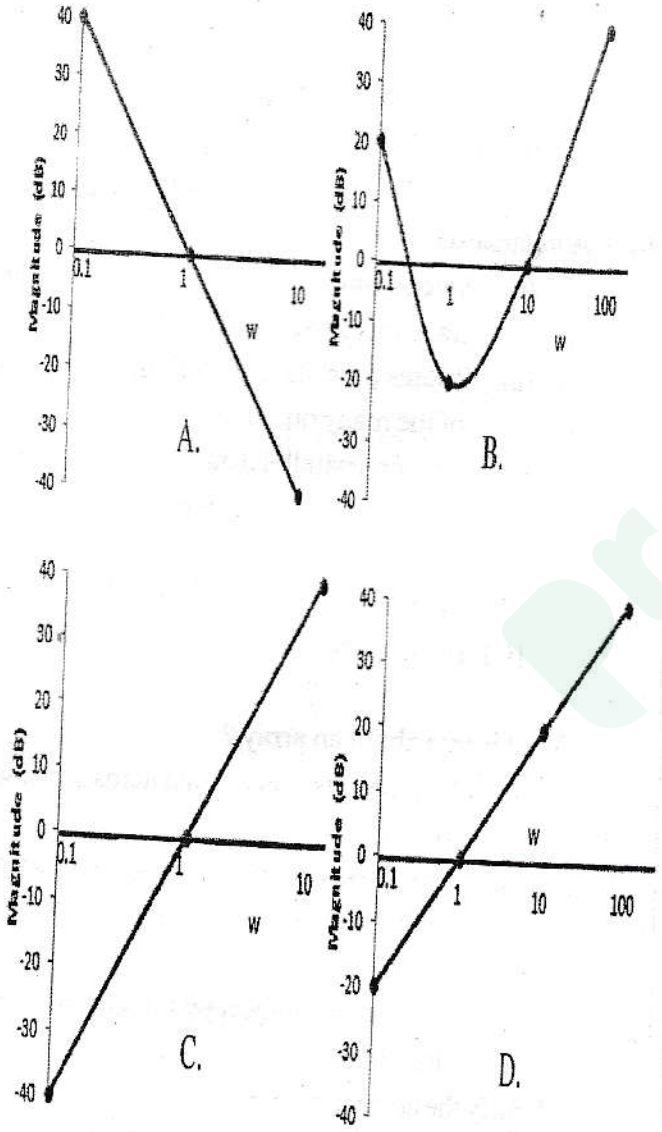
(A) Peltier effect

(B) Seebeck effect

(C) Piezo-electric effect

(D) Thomson effect

37. The Bode plot (magnitude) for $\frac{1}{(j\omega)^2}$ is :



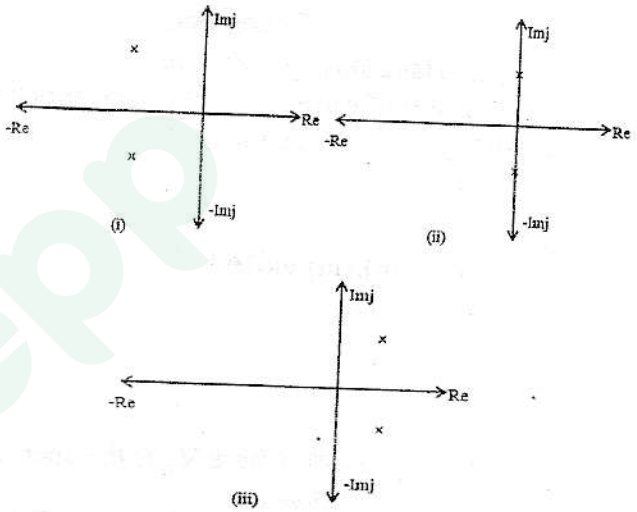

38. Two consecutive rows of Ruth array are $\begin{vmatrix} * & * & * \\ 1 & 3 & 6 \\ 1 & 3 & 6 \end{vmatrix}$.

The number of roots of the corresponding characteristics equation on the $j\omega$ axis are :

(A) 0 (B) 3

(C) 1 (D) 2

39. From the location of the roots in the s-plane, determine whether the system is stable or not :




(A) (i) stable, (ii) sustained oscillation, (iii) unstable

(B) (i) stable, (ii) unstable, (iii) sustained oscillation

(C) (i) unstable, (ii) stable, (iii) sustained oscillation

(D) (i) sustained oscillation, (ii) unstable, (iii) stable



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40. Frequency response of a system means :

(A) Transient response of the system to sinusoidal input signal

(B) Steady state response of the system to impulse input signal

(C) Steady state response of the system to unit step input signal

(D) Steady state response to sinusoidal input signal

41. Liquid Phase Epitaxy (LPE) :

(i) Is the growth of epitaxial layers on crystalline substrates by direct precipitation from liquid phase

(ii) Is particularly useful for growing GaAs and related III-IV compounds

(iii) Has a slow growth rate

(iv) Is useful to grow multilayered structures

Identify the correct statements :

(A) (i) and (iv)

(B) (ii) and (iii)

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

(D) (i) only

42. Thevenin's resistance can be computed as follows :

(i) $R_{th} = \frac{V_{th}}{I_n}$ where $V_{th}$ is the open circuit voltage and $I_n$ is short circuit current through the terminals

(ii) $R_{th} = \frac{V_{th}}{I_n}$ where $V_{th}$ is the short circuit voltage and $I_n$ is open circuit current through the terminals

(iii) If the active network does contain any dependent sources, $R_{th}$ is simply the equivalent resistance of the passive network at the terminals

(iv) $R_{th}$ cannot be obtained for an active network

Identify the correct statements :

(A) (i) and (ii) (B) (ii) and (iii)

(C) (i), (iii), and (iv) (D) (i) and (iii)

43. Which of the following is true about a transistor based amplifier ?

(i) Common collector amplifier provides current gain but no voltage gain

(ii) Common base amplifier provides voltage gain but no current gain

(iii) Common emitter amplifier provides both current gain and voltage gain

(iv) Cascade amplifier is a wide band amplifier

Identify the correct statements :

(A) (i) and (iv)

(B) (ii) and (iii)

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

(D) (i), (iii), and (iv)

44. A multiplexer :

(i) Select one of the several inputs and transmits it to a single input

(ii) Routes the data from a single input to one of the many outputs

(iii) Converts parallel data into serial input

(iv) It is a combinational circuit

Identify the correct statements :

(A) (ii) and (iv) (B) (i) and (iii)

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

45. What is true about an array ?

(i) It represents a list of data items of the same data type

(ii) One dimensional array is known as table

(iii) Array element is represented by index values

(iv) Array elements occupy subsequent memory locations

Identify the correct statements :

(A) (iii) and (iv) (B) (i) and (iv)

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



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46. Consider the following statements with regard to the Hilbert's transform :

(i) It is used for generation of SSB signal

(ii) It is used for the representation of bandpass signals

(iii) A signal x(t) and its Hilbert transform $X_n(t)$ are mutually orthogonal

(iv) The phase difference between x(t) and its Hilbert transform $X_n(t)$ is 180°

Identify the correct statements :

(A) (i) and (ii) (B) (ii) and (iii)

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

47. Consider the following statements about Thyristor :

(i) It is a four layer pnpn device

(ii) When forward voltage is applied, a small forward leakage current flows

(iii) It can be turned off by negative gate signal

(iv) A high dv/dt can turn off the Thyristor

Identify the correct statements :

(A) (ii) and (iii) (B) (ii) only

(C) (i), (ii) and (iv) (D) (i) and (ii)

48. Depending on whether the display is numeric or alphanumeric, the segmental display is :

(i) 7 segmental

(ii) 14 segmental

(iii) 21 segmental

(iv) 28 segmental

Identify the correct statements :

(A) Either (ii) or (iii) (B) Either (ii) or (iv)

(C) Only (iii) (D) Either (i) or (ii)

49. Consider the following statements for a PI compensator of a control system :

(i) It is equivalent to adding a zero at the origin

(ii) It is reduces overshoot

(iii) It improves order of the system by 1

(iv) It improves steady state response of the system

Identify the correct statements :

(A) (i) and (iii) (B) (ii) only

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

50. Consider the following statements for communication by geosynchronous satellites :

(i) The propagation loss over each direction (uplink and downlink ) is about 200 dB at 5 GHz

(ii) Radius of geosynchronous orbit is 35,860 Km

(iii) An arc of about 17° must be covered by the satellite antenna in the equatorial plane

(iv) The Polar Regions are well covered by satellite antenna

Identify the correct statements :

(A) (i) only (B) (iii) only

(C) (i) and (iv) (D) (i) and (ii) and (iv)

Directions : **Q. No. 51 to 60** : The following items consist of two statements, one labelled the "Assertion (A)" and the other labelled the "Reason (R)". You are to examine these two statements carefully and decide if the Assertion (A) and Reason (R) are individually true and if so, whether the Reason is a correct explanation of the Assertion . Select your answers to these items using the codes given below and mark your answer accordingly .



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**Assertion (A) :**

**Reason (R) :**

**Codes :**

(A) Both (A) and (R) are correct and (R) is correct explanation of (A)

(B) Both (A) and (R) are correct, but (R) is not correct explanation of (A)

(C) (A) is true, but (R) is false

(D) (A) is false, but (R) is true

51. Assertion (A) : For Zener effect to occur, a very abrupt junction is required.

Reason (R) : For quantum tunneling, a very narrow energy barrier is required.

52. Assertion (A) : A low-pass RC filter passes the higher frequencies and blocks the lower frequencies.

Reason (R) : Capacitive reactance decreases with increasing frequency.

53. Assertion (A) : An op-amp cannot amplify a dc signal.

Reason (R) : An op-amp is a direct coupled amplifier.

54. Assertion (A) : Synchronous counter has higher speed of operation as compared to ripple counter.

Reason (R) : Synchronous counter has high speed flip flops.

55. Assertion (A) : In an Intel 8085 the lower byte of address and data lines are multiplexed.

Reason (R) : This helps to limit the number of external pin terminals.

56. Assertion (A) : GaAs Gunn oscillators make use Transferred Electron Effect.

Reason (R) : The lower and higher conduction bands in GaAs have low and high electron mobility.

57. Assertion (A) : Microwave isolators and circulators are made up of Ferrites.

Reason (R) : The electric field of a linearly polarized wave rotates when it travels through a magnetized ferrite medium

58. Assertion (A) : A Thyristor is a gate controlled device.

Reason (R) : It can be turned on and off using a gate.

59. Assertion (A) : In a prototype second order system the rise time $t_r$ and bandwidth are inversely proportional .

Reason (R) : Increasing $w_n$ increases bandwidth while $t_r$ is reduced.

60. Assertion (A) : 1550 nm is the preferred wavelength in fiber optic communication.

Reason (R) : 1550 nm corresponds to the zero dispersion wavelength in the silica glass.



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61. Match the items in List I with the items in List II and then select the correct answer using the codes given below the lists :

| List-I | List-II |
|---|---|
| (a) LED | (1) Heavy doping |
| (b) Avalanche Photodiode | (2) Coherent radiation |
| (c) Tunnel Diode | (3) Spontaneous emission |
| (d) LASER | (4) Current gain |

| Codes : | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| (A) | (1) | (3) | (2) | (4) |
| (B) | (1) | (2) | (3) | (4) |
| (C) | (3) | (4) | (1) | (2) |
| (D) | (4) | (2) | (3) | (1) |

62. Match the items in List I with their duals in List II and then select the correct answer using the codes given below the lists :

| List- I | List -II |
|---|---|
| (a) Inductance | (1) KVL |
| (b) Node | (2) Capacitance |
| (c) Voltage | (3) Current |
| (d) KCL | (4) Mesh |

| Codes : | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| (A) | (4) | (3) | (2) | (1) |
| (B) | (1) | (3) | (2) | (4) |
| (C) | (3) | (4) | (1) | (2) |
| (D) | (2) | (4) | (3) | (1) |

63. Match the following Boolean logic functions in List I and Inverse of functions in List II and then select the correct answer using the codes given below the lists :

| List-I | List-II |
|---|---|
| (a) $ab + bc + ca + abc$ | (1) $\bar{a}(\bar{b} + \bar{c})$ |
| (b) $ab + \bar{a}\bar{b} + \bar{c}$ | (2) $\bar{a}\bar{b} + \bar{b}\bar{c} + \bar{c}\bar{a}$ |
| (c) $a + bc$ | (3) $(a \oplus b)c$ |
| (d) $(\bar{a}+\bar{b}+\bar{c})(a+\bar{b}+\bar{c})(\bar{a}+\bar{b}+c)$ | (4) $abc + \bar{a}bc + ab\bar{c}$ |

| Codes : | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| (A) | (1) | (2) | (3) | (4) |
| (B) | (2) | (3) | (4) | (1) |
| (C) | (3) | (4) | (2) | (1) |
| (D) | (2) | (3) | (1) | (4) |

64. Match the Data type given in List I with their range given in List II and then select the correct answer using the codes given below the lists :

| List-I (Data type) | List-II (Range) |
|---|---|
| (a) Char | (1) 0 to 65535 |
| (b) Unsigned char | (2) -128 to 127 |
| (c) Int | (3) 0 to 255 |
| (d) Unsigned int | (4) -32768 to 32767 |

| Codes : | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| (A) | (4) | (3) | (2) | (1) |
| (B) | (3) | (2) | (1) | (4) |
| (C) | (2) | (3) | (4) | (1) |
| (D) | (1) | (4) | (3) | (2) |



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65. Match the Type of Instruction given in List I with the Instruction given in List II and then select the correct answer using the codes given below the lists :

| List-I (Type of Instruction) | | List-II (Instruction) |
|---|---|---|
| (a) One byte instruction | (1) | MOV A, DATA |
| (b) Two byte instruction | (2) | MOV A, B |
| (c) Three byte instruction | (3) | MOV A, M |
| (d) Register indirect addressing | (4) | JMP ADDRESS |

| Codes : | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| (A) | (2) | (1) | (4) | (3) |
| (B) | (2) | (3) | (1) | (4) |
| (C) | (2) | (4) | (1) | (3) |
| (D) | (3) | (1) | (4) | (2) |

66. Transmission lines of length $l$ are specified in List I and the characteristics in List II. Match the lists and select the correct answer using the codes given below the lists :

| List-I | | List-II |
|---|---|---|
| (a) Lossless line | (1) | $Z_{in} = -jZ_0 \tan \beta l$ |
| (b) Distortion- less line | (2) | $Z_{in} = jZ_0 \tan \beta l$ |
| (c) Shorted line | (3) | $R = G = 0$ |
| (d) Open circuited line | (4) | $\frac{R}{L} = \frac{G}{C}$ |

| Codes : | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| (A) | (1) | (2) | (3) | (4) |
| (B) | (2) | (3) | (4) | (1) |
| (C) | (4) | (3) | (2) | (1) |
| (D) | (3) | (4) | (2) | (1) |

67. Match the Theorem /Law of given in List I with the item in List II and then select the correct answer using codes given below the lists :

| List -I | | List -II |
|---|---|---|
| (a) Shannon Source theorem | (1) | Channel capacity theorem |
| (b) Dimensionality theorem | (2) | Storage space of a signal |
| (c) Wiener - Khintchine theorem | (3) | Power spectral density of random process |
| (d) Shannon Hartley Law | (4) | Optimum-code length |

| Codes : | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| (A) | (4) | (2) | (3) | (1) |
| (B) | (1) | (3) | (2) | (4) |
| (C) | (3) | (4) | (1) | (2) |
| (D) | (2) | (4) | (3) | (1) |

68. Match the items given in List I with the items given in List II and then select the correct answer using codes given below the lists :

| List -I | | List -II |
|---|---|---|
| (a) Phase controlled Rectifier | (1) | Constant ac to variable ac converter |
| (b) Invertors | (2) | Fixed dc to variable dc |
| (c) Choppers | (3) | Constant ac to variable dc |
| (d) Cycloconverters | (4) | Dc to ac converter |

| Codes : | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| (A) | (4) | (2) | (3) | (1) |
| (B) | (3) | (4) | (2) | (1) |
| (C) | (3) | (1) | (4) | (2) |
| (D) | (2) | (4) | (3) | (1) |



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69. Match the electric field given in List I with the corresponding polarization in List II and then select the correct answer using codes given below the lists :

| List- I | List-II |
|---|---|
| (a) $\vec{E} = (E_1\hat{x} + E_2\hat{y})e^{-jk_0z}$ (1) | Left handed circularly polarized |
| (b) $\vec{E} = E_0(\hat{x} + j\hat{y})e^{-jk_0z}$ (2) | Right handed circularly polarized |
| (c) $\vec{E} = (E_1\hat{x} + E_2j\hat{y})e^{-jk_0z}$ (3) | Linearly polarized |
| (d) $\vec{E} = E_0(\hat{x} - j\hat{y})e^{-jk_0z}$ (4) | Ellipticaly polarized |

| Codes : | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| (A) | (1) | (2) | (3) | (4) |
| (B) | (1) | (3) | (2) | (4) |
| (C) | (3) | (1) | (4) | (2) |
| (D) | (2) | (4) | (3) | (1) |

70. Match the items given in List I with the items in List II in context of 2nd order feedback control systems and then select the correct answer using codes given below the lists :

| List-I | List -II |
|---|---|
| (a) Under - damped | (1) $\xi = 1$ |
| (b) Over - damped | (2) $\xi > 1$ |
| (c) Critically damped | (3) $1/2\xi$ |
| (d) Quality factor | (4) $0 < \xi < 1$ |

| Codes : | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| (A) | (4) | (2) | (1) | (3) |
| (B) | (4) | (3) | (2) | (1) |
| (C) | (3) | (1) | (4) | (2) |
| (D) | (2) | (1) | (3) | (4) |

Read the following text and answer Q. **71-75** :

The MESFET consists of a conducting channel positioned between a source and drain contact region. The carrier flow from source to drain is controlled by a Schottky metal gate. The control of the channel is obtained by varying the depletion layer width underneath the metal contact which modulates the thickness of the conducting channel and thereby the current between source and drain .

The key advantages of the MESFET is the higher mobility of the carriers in the channel as compared to the MOSFET. Since the carriers located in the inversion layer of a MOSFET have a wave function, which extends into the oxide, their mobility is less than half of the mobility of bulk material. As the depletion region separates the carriers from the surface their mobility is close to that of bulk material.

The disadvantage of the MESFET structure is the presence of the Schottky metal gate. It limits the forward bias voltage on the gate to the turn-on voltage of the Schottky diode. This turn-on voltage is typically 0.7 V for GaAs Schottky diodes. The threshold voltage therefore must be lower than this turn-on voltage. As a result it is more difficult to fabricate circuits containing a large number of enhancement-mode MESFET.

The advantages of the MESFET provides a superior microwave amplifier or circuit, the limitation by the diode turn-on is easily tolerated. Typically depletion-mode devices are used since they provide a larger current and larger transconductance and the circuits contain only a few transistors, so that threshold control is not a limited factor. The buried channel also yields a better noise performance as trapping and release of



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carriers into and from surface states and defects is eliminated.

71. MESFET stands for :
    (A) Metal Semi-Insulating Field Effect Transistor
    (B) Metal Schottky Field Effect Transistor
    (C) Metal Semiconductor Field Effect Transistor
    (D) MOS Silicon Field Effect Transistor

72. What is the advantages of higher mobility of the carriers in the channel ?
    (A) Higher current
    (B) Higher transconductance
    (C) Higher transit frequency
    (D) All of these

73. What is a Schottky junction ?
    (A) A p-n junction
    (B) A metal-metal junction
    (C) A metal-semiconductor junction
    (D) A metal-semi-insulator junction

74. What is the advantages of using GaAs MESFETs over Silicon MESFETs ?
    (A) The electron mobility at room temperature in GaAs is more than 5 times larger
    (B) Threshold voltage is lesser in a GaAs MESFET
    (C) Fabrication is easier in GaAs
    (D) All of these

75. When $V_{GS} = 2V$ produces a transconductance of 1 mS, what is the value of drain current ?
    (A) 0.666 mA (B) 0.5 mA
    (C) 2 mA (D) 0.75 mA



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