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T.B.C. : B-HUF-P-VEB

Test Booklet Series

1071017

Serial

A

TEST BOOKLET

ELECTRONICS & TELECOMMUNICATION ENGINEERING
Paper II

*Time Allowed : Two Hours*   *Maximum Marks : 200*

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET *DOES NOT* HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.

2. Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series Code A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet. Any omission/discrepancy will render the Answer Sheet liable for rejection.

3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. *DO NOT* write *anything else* on the Test Booklet.

4. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case, you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **ONLY ONE** response for each item.

5. You have to mark all your responses **ONLY** on the separate Answer Sheet provided. See directions in the Answer Sheet.

6. All items carry equal marks.

7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.

8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator *only the Answer Sheet*. You are permitted to take away with you the Test Booklet.

9. Sheets for rough work are appended in the Test Booklet at the end.

10. **Penalty for wrong answers :**
    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE.
    (i)   There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0·33)** of the marks assigned to that question will be deducted as penalty.
    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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1. A single-stage amplifier has a voltage gain of 100. The load connected to the collector is 500 Ω and its input impedance is 1 kΩ. Two such stages are connected in cascade through an R-C coupling. The overall gain is
   (a) 10000
   (b) 6666·66
   (c) 5000
   (d) 1666·66

2. Assuming $V_{CE\,(Sat)} = 0·3$ V for a Silicon transistor at ambient temperature of 25°C and $h_{FE} = 50$, the minimum base current I_B required to drive the transistor into saturation for the circuit shown is
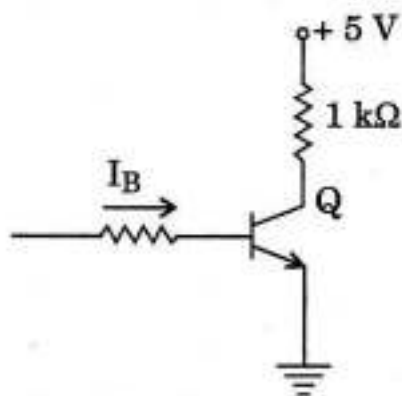
   (a) 64 µA
   (b) 78 µA
   (c) 94 µA
   (d) 140 µA

3. Which of the following regions of operation are mainly responsible for heating of the transistor under switching operation ?
   1. Saturation region
   2. Cut-off region
   3. Transition from saturation to cut-off
   4. Transition from cut-off to saturation
   Select the correct answer using the codes given below :
   (a) 1, 2, and 4 only
   (b) 1, 3, and 4 only
   (c) 2 and 3 only
   (d) 1 and 3 only

4. In a sinusoidal oscillator, sustained oscillations will be produced only if the loop gain (at the oscillation frequency) is
   (a) Less than unity but not zero
   (b) Zero
   (c) Unity
   (d) Greater than unity

5. The Class-B push-pull amplifier is an efficient two-transistor circuit, in which the two transistors operate in the following way :
   (a) Both transistors operate in the active region throughout the negative ac cycle
   (b) Both transistors operate in the active region for more than half-cycle but less than a whole cycle
   (c) One transistor conducts during the positive half-cycle and the other during the negative half-cycle
   (d) Full supply voltage appears across each of the transistors

6. Consider the following statements regarding Wien Bridge oscillator :
   1. It has a larger bandwidth than the phase shift oscillator.
   2. It has a smaller bandwidth than the phase shift oscillator.
   3. It has 2 capacitors while the phase shift oscillator has 3 capacitors.
   4. It has 3 capacitors while the phase shift oscillator has 2 capacitors.
   Which of the above statements are correct ?
   (a) 1 and 3 only
   (b) 2 and 4 only
   (c) 1 and 4 only
   (d) 2 and 3 only

7. For normal operation of a transistor
   (a) Forward bias the emitter diode and reverse bias the collector diode
   (b) Forward bias the emitter diode as well as the collector diode
   (c) Reverse bias the emitter diode as well as the collector diode
   (d) Reverse bias the emitter diode and forward bias the collector diode

8. Consider the following statements regarding linear power supply :
   1. It requires low frequency transformer.
   2. It requires high frequency transformer.
   3. The transistor works in active region.
   Which of the above statements is/are correct ?
   (a) 1 only
   (b) 2 and 3 only
   (c) 1 and 3 only
   (d) 3 only

9. The capacitance of a full wave rectifier, with 60 Hz input signal, peak output voltage $V_p = 10$ V, load resistance R = 10 kΩ and input ripple voltage $V_r = 0.2$ V, is

   (a)   22·7 μF

   (b)   33·3 μF

   (c)   41·7 μF

   (d)   83·4 μF

10. A full wave rectifier connected to the output terminals of the mains transformer produces an RMS voltage of 18 V across the secondary. The no-load voltage across the secondary of the transformer is

   (a)   1·62 V

   (b)   16·2 V

   (c)   61·2 V

   (d)   6·12 V

11. An Op-Amp can be connected to provide

   1.   Voltage controlled current source

   2.   Current controlled voltage source

   3.   Current controlled current source

Which of the above statements are correct ?

   (a)   1 and 2 only

   (b)   1 and 3 only

   (c)   2 and 3 only

   (d)   1, 2 and 3

12. In an Op-Amp, if the feedback voltage is reduced by connecting a voltage divider at the output, which of the following will happen ?

   1.   Input impedance increases

   2.   Output impedance reduces

   3.   Overall gain increases

Which of the above statements is/are correct ?

   (a)   1 only

   (b)   2 only

   (c)   3 only

   (d)   1, 2 and 3

13. The transient response rise time (unity gain) of an Op-Amp is 0·05 μs. The small signal bandwidth is

   (a)   7 kHz

   (b)   20 kHz

   (c)   7 MHz

   (d)   20 MHz

14. A negative feedback of $\beta = 2.5 \times 10^{-3}$ is applied to an amplifier of open-loop gain 1000. What is the change in overall gain of the feedback amplifier, if the gain of the internal amplifier is reduced by 20% ?

   (a)   295·7

   (b)   286·7

   (c)   275·7

   (d)   266·7

15. If the quality factor of a single-stage single-tuned amplifier is doubled, the bandwidth will

   (a)   Remain the same

   (b)   Become half

   (c)   Become double

   (d)   Become four times

16. Consider the following statements related to oscillator circuits :

   1.   The tank circuit of a Hartley oscillator is made up of a tapped capacitor and a common inductor.

   2.   The tank circuit of a Colpitts oscillator is made up of a tapped capacitor and a common oscillator.

   3.   The Wien Bridge oscillator is essentially a two-stage amplifier with an RC bridge in the first stage, and, the second stage serving as an inverter.

   4.   Crystal oscillators are fixed frequency oscillators with a high 2-factor.

Which of the above statements are correct ?

   (a)   1, 2 and 3 only

   (b)   2, 3 and 4 only

   (c)   1, 2 and 4 only

   (d)   1, 3 and 4 only

17. The most commonly used transistor configuration for use as a switching device is

(a) Common-base configuration

(b) Common-collector configuration

(c) Collector-emitter shorted configuration

(d) Common-emitter configuration

18. The value of h_{FE} (the hybrid parameters) of a Common-Emitter (CE) connection of a Bipolar Junction Transistor (BJT) is given as 250. What is the value of α_{dc} (ratio of collector current to emitter current), for this BJT ?

(a) 0·436

(b) 0·656

(c) 0·874

(d) 0·996

19. For realizing a binary half-subtractor having two inputs A and B, the correct set of logical expressions for the outputs D (A minus B) and X (borrow) are

1. The difference output $D = \bar{A}B + A\bar{B}$

2. The borrow output $B = A\bar{B}$

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

20. The simplified form of the Boolean expression $AB + A(B + C) + B(B + C)$ is given by

(a) $AB + AC$

(b) $B + AC$

(c) $BC + AC$

(d) $AB + C$

21. Product of Maxterms representation for the Boolean function $F = \bar{B}D + \bar{A}D + BD$ is

(a) $\prod M\,(1, 3, 5, 7)$

(b) $\prod M\,(0, 2, 4, 6)$

(c) $\prod M\,(0, 1, 2, 3)$

(d) $\prod M\,(4, 5, 6, 7)$

22. Simplified form of the Boolean expression $Y = \overline{(A.B + \bar{C})(\bar{A} + B + C)}$ is

(a) $\bar{A}\bar{C} + A\bar{C} + B\bar{C} + \bar{B}C$

(b) $(\bar{A} + \bar{B} + \bar{C})(A + B + C)$

(c) $(\bar{A} + \bar{B})(A + \bar{C})$

(d) $A(B + C)$

23. What is the maximum frequency for a sine wave output voltage of 10 V peak with an Op-Amp whose slew rate is 1 V/μs ?

(a) 15·92 kHz

(b) 19·73 kHz

(c) 23·54 kHz

(d) 27·36 kHz

24. Which one of the following statements is correct ?

(a) TTL logic cannot be used in digital circuits.

(b) Digital circuits are linear circuits.

(c) AND gate is a logic circuit whose output is equal to its highest input.

(d) In a four-input AND circuit, all inputs must be high for the output to be high.

25. The slew rate is the rate of change of output voltage of an operational amplifier when a particular input is applied. What is that input ?

(a) Sine wave input

(b) Ramp input

(c) Pulse input

(d) Step input

26. Except at high frequencies of switching, nearly all the power dissipated in the switch mode operation of a BJT occurs, when the transistor is in the

(a) Active region

(b) Blocking state

(c) Hard saturation region

(d) Soft saturation region

27. Consider the following statements with respect to combinational circuit :

1. The output at any time depends only on the present combination of inputs.

2. It does not employ storage elements.

3. It performs an operation that can be specified logically by a set of Boolean functions.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

28. Consider the following statements :

A multiplexer

1. selects one of the several inputs and transmits it to a single output.

2. routes the data from a single input to one of many outputs.

3. converts parallel data into serial data.

4. is a combinational circuit.

Which of the above statements are correct ?

(a) 1 and 3 only

(b) 2 and 4 only

(c) 1, 3 and 4 only

(d) 2, 3 and 4 only

29. What are the two types of basic adder circuits ?

(a) Half adder and full adder

(b) Half adder and parallel adder

(c) Asynchronous adder and synchronous adder

(d) One's complement adder and two's complement adder

30. Consider the following statements :

1. An 8-input MUX can be used to implement any 4 variable functions.

2. A 3-line to 8-line DEMUX can be used to implement any 4 variable functions.

3. A 64-input MUX can be built using nine 8-input MUXs.

4. A 6-line to 64-line DEMUX can be built using nine 3-line to 8-line DEMUXs.

Which of the above statements are correct ?

(a) 1, 2, 3 and 4

(b) 1, 2 and 4 only

(c) 3 and 4 only

(d) 1, 2 and 3 only

31. For an n-bit binary adder, what is the number of gates through which a carry has to propagate from input to output ?

(a) n

(b) 2n

(c) n^2

(d) n + 1

32. The main disadvantage of DTL logic circuits is

(a) Medium speed

(b) Very large power supply voltage

(c) High cost

(d) Very large gate propagation delay

33. Which one of the following statements best describes the operation of a negative-edge-triggered D flip-flop ?

(a) The logic level at the D input is transferred to Q on NGT of CLK.

(b) The Q output is always identical to the CLK input if the D input is high.

(c) The Q output is always identical to the D input when CLK = PGT.

(d) The Q output is always identical to the D input.

34. A 3-bit ripple counter is constructed using three T flip-flops to do the binary counting. The three flip-flops have T-inputs fixed at

(a) 0, 0 and 1

(b) 1, 0 and 1

(c) 0, 1 and 1

(d) 1, 1 and 1

35. What is the function $Y = A + \bar{B}C$ in Product-of-Sums (POS) form ?
(a) $M_6 M_5 M_4 M_3$
(b) $M_3 M_2 M_1 M_0$
(c) $M_0 M_2 M_3$
(d) $M_4 M_3 M_2 M_1$

36. The initial content of a four-bit shift register is 1000. What is the register content after it is shifted four times to the right, with the serial input being 111100 ?
(a) 1111
(b) 1100
(c) 1000
(d) 0011

37. When a large number of analog signals is to be converted to digital form, an analog multiplexer is used. The A-to-D converter most suitable in this case will be
(a) Forward counter type
(b) Up-down counter type
(c) Successive approximation type
(d) Dual slope type

38. For Emitter-Coupled Logic (ECL), the switching speed is very high because
(a) Negative logic is used
(b) The transistors are not saturated when they are conducting
(c) Multi-emitter transistors are used
(d) Of low fan-out

39. A flip-flop is a
(a) Combinational logic circuit and edge sensitive
(b) Sequential logic circuit and edge sensitive
(c) Combinational logic circuit and level sensitive
(d) Sequential logic circuit and level sensitive

40. The transfer function $\dfrac{1}{2s + 1}$ will have
(a) dc gain 1 and high frequency gain 1
(b) dc gain 0 and high frequency gain ∞
(c) dc gain 1 and high frequency gain 0
(d) dc gain 0 and high frequency gain 1

41. The closed-loop transfer function of a certain control system is given by $\dfrac{C}{R}(s) = \dfrac{100}{s^2 + 10s + 100}$. Then the settling time for a 2% tolerance band is given by
(a) 0·8 s
(b) 1·2 s
(c) 1·5 s
(d) 2·1 s

42. The unit step input response of a certain control system is given by
$c(t) = 1 + 0·2\, e^{-60t} - 1·2\, e^{-10t}$. The undamped natural frequency ω_n and damping ratio δ are, respectively
(a) 24·5 and 1·27
(b) 33·5 and 1·27
(c) 24·5 and 1·43
(d) 33·5 and 1·43

43. In Force-Voltage Analogy
(a) Force is analogous to current
(b) Mass is analogous to capacitance
(c) Velocity is analogous to current
(d) Displacement is analogous to magnetic flux linkage

44. For a unity feedback control system having an open-loop transfer function $G(s) = \dfrac{25}{s(s + 6)}$, what is the time t_p at which the peak of the step input response occurs ?
(a) 0·52 s
(b) 2·75 s
(c) 0·79 s
(d) 1·57 s

45. The transfer function $G(s) = \dfrac{10(s-1)}{(s+10)}$ represents

(a) Unstable system

(b) Minimum phase system

(c) Non-minimum phase system

(d) PID controller system

46. What is the maximum input frequency limit of a 3-bit Ripple counter configured around flip-flops, with inherent propagation delay time $t_{pd} = 50$ ns ?

(a) 6670 MHz

(b) 667 MHz

(c) 66·7 MHz

(d) 6·67 MHz

47. The characteristic equation of a certain feedback control system is given by

$s^4 + 4s^3 + 13s^2 + 36s + k = 0$. The range of values of k for which the feedback system is stable, is given by

(a) $0 < k < 4$

(b) $4 < k < 36$

(c) $0 < k < 36$

(d) $13 < k < 36$

48. The closed-loop transfer function of a unity feedback control system is,

$\dfrac{C(s)}{R(s)} = \dfrac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2}$.

The velocity error constant of the system is

(a) $\dfrac{\omega_n}{2\zeta}$

(b) $\dfrac{\omega_n}{\zeta}$

(c) $\dfrac{2\omega_n}{\zeta}$

(d) $\dfrac{3\omega_n}{2\zeta}$

49. The system described by the following state equations

$\dot{X} = \begin{bmatrix} 0 & 1 \\ 2 & -3 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u, \quad Y = [1, 1] X$ is

1. Completely controllable

2. Completely observable

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

50. Consider the system with $G(s) = \dfrac{K(s+2)}{s^2 + 2s + 3}$ and H(s) = 1. The breakaway point(s) of the root loci is/are at

(a) $-0\cdot265$ only

(b) $-3\cdot735$ only

(c) $-3\cdot735$ and $-0\cdot265$

(d) There is no breakaway point

51. How would a binary number 0010 be represented by a 4-bit binary word, if the range of voltage is 0 to 10 V ?

(a) 0·666 V

(b) 1·333 V

(c) 0·333 V

(d) 2·000 V

52. For a unity feedback system with open-loop transfer function $\dfrac{25}{s(s+6)}$, the resonant peak output M_m and the corresponding resonant frequency ω_m are, respectively

(a) 2·6 and 2·67 r/s

(b) 1·04 and 2·67 r/s

(c) 2·6 and 4·8 r/s

(d) 1·04 and 4·8 r/s

53. The transfer function of a control system is said to be 'All Pass System', if it has

(a) Unit magnitude at all frequencies with anti-symmetric pole-zero pattern

(b) Unit magnitude at all frequencies with symmetric pole-zero pattern

(c) Magnitude varying with frequency and with anti-symmetric pole-zero pattern

(d) Unit magnitude at some frequencies with symmetric pole-zero pattern

54. Consider the following :

1. Bode plot
2. Nyquist plot
3. Nichols chart

Which of the above frequency response plots are commonly employed in the analysis of control systems ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

55. An A-to-D converter in which one sub-circuit is a D-to-A converter is

(a) Parallel A/D converter

(b) Dual slope A/D converter

(c) Successive approximation A/D converter

(d) Extended parallel type A/D converter

56. Consider the transfer function :

$$G(s) = \frac{5(s^2 + 10s + 100)}{s^2(s^2 + 15s + 1)}$$

The corner frequencies in Bode's plot for this transfer function are as

(a) 10 r/s and 10 r/s

(b) 100 r/s and 10 r/s

(c) 10 r/s and 1 r/s

(d) 100 r/s and 1 r/s

57. Consider the transfer function $(0.1 + 0.01s)$ for a PD controller. What is the frequency at which the magnitude is 20 dB (by using asymptotic Bode's plot) ?

(a) 2000 r/s

(b) 1000 r/s

(c) 200 r/s

(d) 100 r/s

58. The main objectives of drawing the root-locus plot are

1. To obtain a clear picture of the open-loop poles and zeros of the system

2. To obtain a clear picture of the transient response of the system for varying gain, K

3. To find the range of K to make the system stable

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 1 and 3 only

(d) 2 and 3 only

59. A unity feedback system has open-loop poles at $s = -2 \pm j\, 2$, $s = -1$ and $s = 0$ and a zero at $s = -3$.

What are the angles made by the root-loci asymptotes with the real axis ?

(a) 60°, 180° and – 60°

(b) 30°, 90° and 60°

(c) 60°, 120° and – 30°

(d) 30°, 60° and 180°

60. The open-loop transfer function of a unity feedback system is $G(s) = \dfrac{K}{s(s+5)}$. The gain K that results in a phase margin of 45° is

(a) 35

(b) 30

(c) 25

(d) 20

61. Consider the following statements :

The Gain margin and Phase margin of an unstable system may respectively be

1. Positive, negative

2. Negative, positive

3. Negative, negative

Which of the above statements is/are correct ?

(a) 3 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

62. A phase lead compensator has its transfer function, $G_c(s) = \dfrac{1+0.5s}{1+0.05s}$. The maximum phase lead and the corresponding frequency, respectively are nearly

(a) $\sin^{-1}(0.9)$ and 6 r/s

(b) $\sin^{-1}(0.82)$ and 4 r/s

(c) $\sin^{-1}(0.9)$ and 4 r/s

(d) $\sin^{-1}(0.82)$ and 6 r/s

63. Consider the following statements :

1. Lead compensation decreases the bandwidth of the system.

2. Lag compensation increases the bandwidth of the system.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

64. A proportional controller with transfer function, K_p is used with a first-order system having its transfer function as $G(s) = \dfrac{K}{(1+s\tau)}$, in unity feedback structure. For step inputs, an increase in K_p will

(a) Increase the time constant and decrease the steady state error

(b) Decrease the time constant and decrease the steady state error

(c) Decrease the time constant and increase the steady state error

(d) Increase the time constant and increase the steady state error

65. For a second-order differential equation, if the damping ratio ζ is unity, then

(a) The poles are imaginary and complex conjugate

(b) The poles are in the right half of s-plane

(c) The poles are equal, negative and real

(d) Both the poles are unequal, negative and real

66. Consider the following statements associated with microstrip patch antenna :

1. The microstrip patch behaves more like a leaky cavity rather than like a radiator and this is not a highly efficient antenna.

2. They can be adapted for radiation of circularly polarized waves.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

67. A carrier waveform $10 \cos \omega_c t$ and modulating signal $3 \cos \omega_m t$ have $f_c = 100$ kHz and $f_m = 4$ kHz. Given that sensitivity of FM is 4 kHz/V and FM spectra beyond J_6 is negligible, what are the channel bandwidth requirements for AM and FM, respectively ?

(a) 12 kHz and 48 kHz

(b) 8 kHz and 48 kHz

(c) 12 kHz and 24 kHz

(d) 8 kHz and 24 kHz

68. When the modulating frequency is doubled, the modulation index is halved, and the modulating voltage remains constant. The modulation system is

1. Amplitude modulation

2. Phase modulation

3. Frequency modulation

Select the correct answer from the codes given below :

(a) 1 only

(b) 2 only

(c) 3 only

(d) 1, 2 and 3

69. What is the modulation index of an FM signal having a carrier swing of 100 kHz and modulating frequency of 8 kHz ?

(a) 4·75

(b) 5·50

(c) 6·25

(d) 7·50

70. In a Pulse Code Modulated system, the number of bits is increased from 7 to 8 bits. The improvement in signal to quantization noise ratio will be

(a) 2 dB

(b) 4 dB

(c) 6 dB

(d) 8 dB

71. In the process of modulation

(a) Some characteristics of a high frequency sine wave are varied in accordance with the instantaneous value of a low frequency signal

(b) Parameters of carrier wave are held constant

(c) For proper and efficient radiation, the receiving antennas should have heights comparable to half-wavelength of the signal received

(d) The signal is converted first within the range of 10 Hz to 20 Hz

72. If the sampling is carried out at a rate higher than twice the highest frequency of the original signal (f_{max}), then it is possible to receive the original signal from the sampled signal by passing it through

(a) A high-pass filter with the cut-off frequency equal to f_{max}

(b) A low-pass filter with the cut-off frequency equal to f_{max}

(c) A high-pass filter with the cut-off frequency greater than f_{max}

(d) A low-pass filter with the cut-off frequency greater than f_{max}

73. The open-loop transfer function of a unity feedback system is $G(s) = \dfrac{10(1+0\cdot2s)}{(1+0\cdot5s)}$. The phase shift at $\omega = 0$ and $\omega = \infty$, will be, respectively

(a) $-90°$ and $180°$

(b) $0°$ and $180°$

(c) $-90°$ and $90°$

(d) $0°$ and $0°$

74. The conversion time for a 10-bit successive approximation A/D converter, for a clock frequency of 1 MHz is
   (a)   1 µs
   (b)   5 µs
   (c)   10 µs
   (d)   15 µs

75. The minimum bandwidth of the link needed for a guard band of 10 kHz frequency to prevent interference between six channels, each with 100 kHz frequency, is
   (a)   425 kHz
   (b)   575 kHz
   (c)   650 kHz
   (d)   725 kHz

76. The different access methods which permit many satellite users to operate in parallel through a single transponder without interfering with each other are
   1.   Frequency Division Multiple Access (FDMA)
   2.   Time Division Multiple Access (TDMA)
   3.   Code Division Multiple Access (CDMA)
   Which of the above are correct ?
   (a)   1 and 2 only
   (b)   1 and 3 only
   (c)   2 and 3 only
   (d)   1, 2 and 3

77. In an optical fibre, the pulse dispersion effect is minimized by
   1.   Using a high frequency light source
   2.   Using plastic cladding
   3.   Minimizing the core diameter
   Which of the above statements is/are correct ?
   (a)   1 only
   (b)   2 only
   (c)   3 only
   (d)   1, 2 and 3

78. Consider the following statements :

   As compared to short-circuited stubs, open-circuited stubs are not preferred because the latter

   1.   Are of different characteristic impedance
   2.   Have a tendency to radiate
   Which of the above statements is/are correct ?
   (a)   1 only
   (b)   2 only
   (c)   Both 1 and 2
   (d)   Neither 1 nor 2

79. Consider the following statements for multiple access system in a satellite earth station :
   1.   Access to same repeater sub-systems and same RF channel is possible.
   2.   Frequency division multiple access is used.
   3.   Several carriers are not amplified by same TWT.
   Which of the above statements are correct ?
   (a)   2 and 3 only
   (b)   1 and 3 only
   (c)   1 and 2 only
   (d)   1, 2 and 3

80. The Bode plot of the open-loop transfer function of a system is described as follows :
   • Slope − 40 dB/decade $\omega < 0\cdot1$ rad/s
   • Slope − 20 dB/decade $0\cdot1 < \omega < 10$ rad/s
   • Slope   0 $\omega > 10$ rad/s
   The system described will have
   (a)   1 pole and 2 zeros
   (b)   2 poles and 2 zeros
   (c)   2 poles and 1 zero
   (d)   1 pole and 1 zero

81. From the Nichols chart, one can determine the following quantities pertaining to a closed-loop system :

 (a) Magnitude, bandwidth and phase

 (b) Bandwidth and phase only

 (c) Magnitude and phase only

 (d) Bandwidth only

82. In position control systems, the Tacho-generator feedback is used to

 (a) Increase the effective damping in the system

 (b) Decrease the effective damping in the system

 (c) Decrease the steady state error

 (d) Increase the steady state error

83. Consider the following statements :

 1. The pin diode consists of two narrow, but highly doped, semiconductor regions separated by a thicker, lightly doped material called the intrinsic region.

 2. Silicon is used most often for its power-handling capability and because it provides a highly resistive intrinsic region.

 3. The pin diode acts as an ordinary diode at frequencies above 100 MHz.

 Which of the above statements are correct ?

 (a) 1 and 2 only

 (b) 1 and 3 only

 (c) 2 and 3 only

 (d) 1, 2 and 3

84. Consider the following statements :

 1. Additional cavities serve to velocity-modulate the electron beam and produce an increase in the energy available at the output.

 2. The addition of intermediate cavities between the input and output cavities of the basic klystron greatly improves the amplification, power output, and efficiency of the klystron.

 Which of the above statements is/are correct ?

 (a) 1 only

 (b) 2 only

 (c) Both 1 and 2

 (d) Neither 1 nor 2

85. In a waveguide with perfectly conducting flat wall, the angle of reflection is equal to the angle of

 (a) Diffraction

 (b) Incidence

 (c) Refraction

 (d) Penetration

86. In microwave system, waveguides have the advantages of

 (a) High power-handling capability and low loss

 (b) Thin dielectric substrate

 (c) Low power-handling and adequate stability

 (d) Positive phase shift

87. A straight dipole radiator fed in the centre will produce maximum radiation at

 1. The plane parallel to its axis

 2. The plane normal to its axis

 3. Extreme ends

 Which of the above statements is/are correct ?

 (a) 1 only

 (b) 2 only

 (c) 1 and 3 only

 (d) 2 and 3 only

88. In communication systems, modulation is the process of
    (a) Improving frequency stability of transmitter
    (b) Combining signal and radio frequency waves
    (c) Generating constant frequency radio waves
    (d) Reducing distortion in RF waves

89. Which one of the following statements is correct ?
    (a) Sampling and quantization operate in amplitude domain.
    (b) Sampling and quantization operate in time domain.
    (c) Sampling operates in time domain and quantization operates in amplitude domain.
    (d) Sampling operates in amplitude domain and quantization operates in time domain.

90. What is the voltage attenuation provided by a 25 cm length of waveguide having a = 1 cm and b = 0·5 cm in which a 1 GHz signal is propagated in the dominant mode ?
    (a) 721 dB
    (b) 681 dB
    (c) 521 dB
    (d) 481 dB

91. When a plane wave travelling in free-space is incident normally on a medium having $\varepsilon_r = 9·0$ and $\mu_r = 1·0$, the fraction of power transmitted into the medium is
    (a) $\dfrac{4}{3}$
    (b) $\dfrac{3}{4}$
    (c) $\dfrac{1}{2}$
    (d) $\dfrac{1}{3}$

92. A microwave antenna with the absorbing cross-section area (A) and the power flux density (S) in the incident wave is employed as an absorber. The absorbed power (P) of the antenna is
    (a) $\dfrac{A}{S}$
    (b) $\dfrac{S}{A}$
    (c) SA
    (d) $\dfrac{S+1}{A-1}$

93. LASER beam of light essentially finds its application in transmission of a signal in the optical fibre communication systems due to
    (a) Incredible speed of signal communication
    (b) Low loss transmission of the signal
    (c) Inexpensive installation cost
    (d) Bulk availability of LASER sources

94. The controller which is highly sensitive to noise is
    (a) PI
    (b) PD
    (c) Both PI and PD
    (d) Neither PI nor PD

95. The 2's complement representation of -17 is
    (a) 100001
    (b) 101111
    (c) 110011
    (d) 101110

96. The subtraction of two hexadecimal numbers $84_{16} - 2A_{16}$ results in
    (a) $2B_{16}$
    (b) $3A_{16}$
    (c) $4B_{16}$
    (d) $5A_{16}$

97. The Vestigial Side Band (VSB) modulation is preferred in TV systems because

1. It reduces the bandwidth requirement to half

2. It avoids phase distortion at low frequencies

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

98. If, A = 60 and B = 3, then using C-programming A >> B results in

(a) 11100000

(b) 00000111

(c) 00111111

(d) 01111000

99. What is the base of the numbers for the following operation to be correct ?

$$\frac{(54)_b}{(4)_b} = (13)_b$$

(a) 2

(b) 4

(c) 8

(d) 16

100. It is awkward to employ signed-magnitude system in computer arithmetic, because

1. Sign and magnitude have to be handled separately

2. It has two representations for '0'

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

101. Consider the following statements :

Pointers in C-programming are useful to

1. Handle the data tables efficiently

2. Reduce the length of a program

3. Reduce the complexity of a program

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1, 2 and 3

(c) 2 and 3 only

(d) 1 and 3 only

102. Data transfer between the main memory and the CPU register takes place through two registers, namely,

(a) General purpose register and MDR

(b) Accumulator and Program counter

(c) MAR and MDR

(d) MAR and Accumulator

103. In a binary tree, the number of internal nodes of degree 1 is 3, and the number of internal nodes of degree 2 is 6. The number of leaf nodes in the binary tree is

(a) 7

(b) 8

(c) 9

(d) 10

104. Consider the following :

1. Operation code

2. Source operand reference

3. Result operand reference

4. Next instruction reference

Which of the above are typical elements of machine instructions ?

(a) 1, 2 and 3 only

(b) 1, 2 and 4 only

(c) 3 and 4 only

(d) 1, 2, 3 and 4

105. Which addressing mode helps to access table data in memory efficiently ?
   (a) Indirect mode
   (b) Immediate mode
   (c) Auto-increment or Auto-decrement mode
   (d) Index mode

106. Converting an analog signal to a digital signal is done by Sampling and
   (a) Companding
   (b) Mixing
   (c) Quantizing
   (d) Pre-emphasis

107. A computer employs RAM chips of 256 bytes and ROM chips of 1024 bytes. If the computer system needs 1 kB of RAM and 1 kB of ROM, then how many address lines are required to access the memory ?
   (a) 10
   (b) 11
   (c) 12
   (d) 13

108. A computer system has a cache with access time 10 ns, a hit ratio of 80% and average memory access time is 20 ns. Then what is the access time for physical memory ?
   (a) 50 ns
   (b) 40 ns
   (c) 30 ns
   (d) 20 ns

109. In a synchronous TDM, there are four inputs and data rate of each input connection is 3 kbps. If 1 bit at a time is multiplexed, what is the duration of each frame ?
   (a) 0·02 ms
   (b) 0·03 ms
   (c) 0·33 ms
   (d) 0·22 ms

110. Consider the following statements comparing static RAM with dynamic RAM :
   1. In static RAM typical cell requires more number of transistors than the dynamic RAM.
   2. Power consumption per bit of static RAM is less than that of dynamic RAM.
   3. Dynamic RAM is less expensive than the static RAM.
   Which of the above statements are correct ?
   (a) 1, 2 and 3
   (b) 1 and 2 only
   (c) 2 and 3 only
   (d) 1 and 3 only

111. An addressing mode in which the location of the data is contained within the mnemonic, is known as
   (a) Immediate addressing mode
   (b) Implied addressing mode
   (c) Register addressing mode
   (d) Direct addressing mode

112. A processor has 32-bit architecture. Each instruction is 1 word long (32 bits). It has 64 registers. It supports 50 instructions, which have 2 register operands + 1 immediate operand. Assuming that the immediate operand is an unsigned integer, what is its maximum value ?
   (a) 16383
   (b) 32767
   (c) 65536
   (d) 1024

113. Microwave resonators are used in
   1. Microwave oscillators
   2. Microwave narrow band amplifiers
   3. Microwave frequency meters
   Which of the above are correct ?
   (a) 1 and 2 only
   (b) 1 and 3 only
   (c) 2 and 3 only
   (d) 1, 2 and 3

114. The serial connection of interrupt lines for establishing hardware priority is known as

   (a)   Daisy Chaining Priority

   (b)   Parallel Priority

   (c)   Polling

   (d)   Serial-line Priority

Directions : *Each of the next **six** (6) items consists of two statements, one labelled as the 'Statement (I)' and the other as 'Statement (II)'. Examine these two statements carefully and select the answers to these items using the codes given below :*

Codes :

   (a)   Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I).

   (b)   Both Statement (I) and Statement (II) are individually true but Statement (II) is **not** the correct explanation of Statement (I).

   (c)   Statement (I) is true but Statement (II) is false.

   (d)   Statement (I) is false but Statement (II) is true.

115. *Statement (I) :*

   PAM can be demodulated using a suitable integrator.

   Statement (II) :

   A suitable integrator practically acts as an envelope detector.

116. *Statement (I) :*

   The direction flag D in 8086 selects increment or decrement mode for DI and/or SI registers.

   Statement (II) :

   If D = 0, the registers are automatically decremented.

117. *Statement (I) :*

   An antenna of length $\frac{\lambda}{2}$ will have radiation pattern of two lobes.

   Statement (II) :

   An antenna of length $\frac{3\lambda}{2}$ will have radiation pattern of two lobes and two minor lobes.

118. *Statement (I) :*

   The complex conjugate poles and zeros of the open-loop transfer function have no effect on the root-loci on the real axis.

   Statement (II) :

   Angle contribution of such a pair of conjugate poles or zeros is 2π radians on the real axis.

119. *Statement (I) :*

   A basic memory unit of a flip-flop is a bistable multivibrator.

   Statement (II) :

   A flip-flop has two stable states. It remains in one state until it is directed by an input signal to switch over.

120. *Statement (I) :*

   Multimode fibres are now used for long distance communication.

   Statement (II) :

   Multimode fibres have larger core-radius than single-mode fibres.

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