Nov 23

भारतीय सूचना प्रौद्योगिकी अभिकल्पना, एवं विनिर्माण संस्थान, कांचीपुरम

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, DESIGN AND MANUFACTURING, KANCHEEPURAM

Non-Teaching Recruitment

Question Paper

Name of the Candidate	:	
Application No.	:	
Name of the Post	:	**Junior Technician (ECE)**
Exam Level	:	**Screening Test (Level-1)**
Date of Exam:	:	**18.11.2023**
Duration	:	**120 Minutes**
Total Marks	:	**100**

Instructions to the Candidates:

1. This Question paper contains printed pages with **100** questions.
2. All questions are multiple choice type questions (MCQs) with four choices (a), (b), (c), (d).
3. Candidates are not allowed to carry any paper, notes, books, gadgets etc. to the examination hall. Any candidate found using or in possession of such unauthorized materials or involved in copying or impersonation or adopting unfair means or behaviors will be disqualified and may be subjected to penal action.
4. There is only one correct answer. Choose the answer from among the four options given and mark the answer by darkening the appropriate bubble marked a, b, c, or d in the attached OMR.
5. Each question carries **ONE (1)** mark only. **1 mark** will be awarded for each correct answer; **0.25** mark will be deducted for each wrong answers. (Please refer instructions given at the back side of OMR Sheet)

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1. A 3.3 kV/240 V single phase transformer draws a no-load current of 0.7 A and absorbs 650 W on no-load, when 3.3kV is applied to the primary. The iron (core) loss component of the no-load current is
    a. 0.7 A
    b. 0.67 A
    c. 0.2 A
    d. 1 A
2. A single-phase transformer with a ratio of 440/110 V takes a no-load current of 4.5 A at a power factor of 0.23 lag when connected to 440 V AC mains. The secondary windings carry a current of 100 A at a power factor of 0.8 leading. The magnitude of the primary current is
    a. 23.5 A
    b. 4.5 A
    c. 104.5 A
    d. 20 A
3. Efficiency of a single phase transformer is maximum when
    a. Copper loss= Core loss
    b. 0.5 times copper loss =Core loss
    c. 2 times the copper loss =Core loss
    d. 0.25 times copper loss =Core loss
4. Which of the following losses can be mostly found from the open circuit test in a single phase transformer?
    a. Copper loss
    b. Both eddy current and hysteresis loss
    c. Only eddy current loss
    d. Only hysteresis loss
5. Secondary current in a single phase 230 V/115 V, 1 kVA step down transformer when load draws rated kVA in secondary is
    a. 4.3 A
    b. 8.7 A
    c. 10.9 A
    d. 6.96 A
6. The primary winding of a single phase transformer is connected to a 220 V, rms, 50 Hz supply. The secondary winding has 2000 turns. If the maximum value of the core flux is 0.003 wb, the number of turns on the primary winding is
    a. 100
    b. 662
    c. 117
    d. 331
7. The full load copper loss of a transformer is 1600W. At half of rated load, the copper loss will be
    a. 6400W
    b. 1600W
    c. 800W
    d. 400W
8. Which of the following is not a part of transformer installation?
    a. Exciter
    b. Breather
    c. Buchholz relay
    d. Conservator

9. If the frequency of the primary voltage supply is decreased in the transformer
   a. Iron losses will increase
   b. Iron losses will decrease
   c. Iron losses will not change
   d. Iron losses will become very high

10. In which of the following cases, the use of autotransformer is more economical than the conventional single phase two winding transformer?
   a. Voltage transformation ratio of 0.1
   b. Voltage transformation ratio of 0.5
   c. Voltage transformation ratio of 0.95
   d. Voltage transformation ratio of 0.75

11. An ideal 100 division, 1 A FS PMMC ammeter and a 100 division, 1 A FS ideal MI ammeter are connected in series and are reading an unknown dc current passing through a wire. If the number of divisions indicated by the pointer of the MI meter is 10. How many divisions the pointer of the PMMC meter indicate?
   a. Between 7^{th} and 8^{th} Division
   b. 10^{th} Division
   c. Between 14^{th} and 15^{th} Division
   d. 20^{th} Division

12. What is the result when the current coil and potential coil of the electrodynamic wattmeter of 10 W FS are swapped and is used to read 5 W?
   a. Current coil gets damaged, and wattmeter reads 0 W
   b. Potential coil gets damaged, and wattmeter reads 0 W
   c. Wattmeter reads 5 W
   d. Wattmeter reads – 5 W

13. For the measurement of low resistances following methods are used:
   (1). Loss of Charge Method
   (2). Potentiometer Method
   (3). Substitution Method
   (4). Kelvin Bridge

   Which of the following choices is correct?
   a. Use of methods (1) and (2)
   b. Use of methods (2) and (3)
   c. Use of methods (3) and (4)
   d. Use of methods (2) and (4)

14. In the measurement of which components is a bridge circuit commonly employed?
   a. Diode
   b. Transistor
   c. Op amp
   d. Resistance

15. A Schering bridge can be used for
   a. measuring voltages
   b. measuring currents
   c. testing capacitors
   d. protecting the circuit from high temperature

16. Turns ratio for a C.T. is _____. Here Np and Ns denote the number of turns in primary and secondary coils respectively.
    a. n = Np/Ns
    b. n = Ns/Np
    c. n = 1/Np
    d. n = Ns

17. A 5 A, 1 Ω PMMC FS ammeter is required to be extended to a 10 A FS ammeter. What is the modification required to be done?
    a. 0.5 Ω connected in series to the PMMC ammeter
    b. 0.5 Ω connected in parallel to the PMMC ammeter
    c. 1 Ω connected in series to the PMMC ammeter
    d. 1 Ω connected in parallel to the PMMC ammeter

18. The difference between the indicated value and the true value of a quantity under measurement is
    a. gross error
    b. absolute error
    c. dynamic error
    d. relative error

19. Select the waveform which is used as the time base signal for a CRO is
    a. Sine
    b. Square
    c. Triangle
    d. Sawtooth

20. Which signal is used to test the probe of a CRO?
    a. Sine
    b. Square
    c. Triangle
    d. Sawtooth

21. An analog voltage signal whose highest significant frequency is 2 kHz is to be converted into a digital signal with a resolution of 0.01 percent for a voltage range of 0 – 10 V. The minimum sampling frequency and the number of bits of the ADC should respectively be
    a. 2 kHz and 12
    b. 2 kHz and 14
    c. 4 kHz and 12
    d. 4 kHz and 14

22. With the help of a 4-1/2 digit voltmeter, the largest possible reading is
    a. 99999
    b. 49999
    c. 19999
    d. 10000

23. What is the expanded form of DMM?
    a. Direct Multi-Meter
    b. Digital Multi-Meter
    c. Direct Meter
    d. Digital Method of Measurement

24. The measurement precision of an instrument defines the smallest change in measured quantity that can be observed, which is called
    a. resolution of the instrument
    b. accuracy of the instrument
    c. precision of the instrument
    d. repeatability of the instrument

25. The Lissajous pattern on the screen of a CRO is an ellipse with major axis in quadrant 2 and quadrant 4. Then the phase difference between two signals can be
    a. 270°
    b. 210°
    c. 180°
    d. 300°

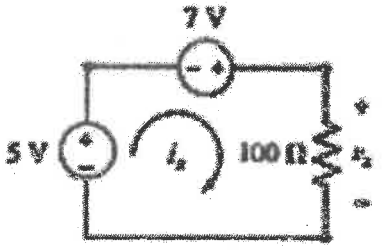
26. Across a 220 V, 50 Hz, single phase AC supply terminals in a house, an electric iron having a resistance of 50 Ω and two incandescent lamps of resistances 450 Ω and 800 Ω, respectively are connected in parallel. The total power drawn from the supply mains is
    a. 1000 W
    b. 1136 W
    c. 568 W
    d. 2272.5 W

27. A circuit consists of an inductor of 0.2 H and a resistor of 50 Ω in series. The power factor of the circuit, if an AC sinusoidal voltage of 230 V, rms 50 Hz is applied to the circuit is
    a. 0.62 lead
    b. 0.36 lag
    c. 0.62 lag
    d. 1

28. A circuit consists of a resistor of 12 Ω , an inductor of 0.1 H and a capacitor of 15 μF (micro farad) in series. The resonant frequency is
    a. 130 Hz
    b. 270 Hz
    c. 100 Hz
    d. 50 Hz

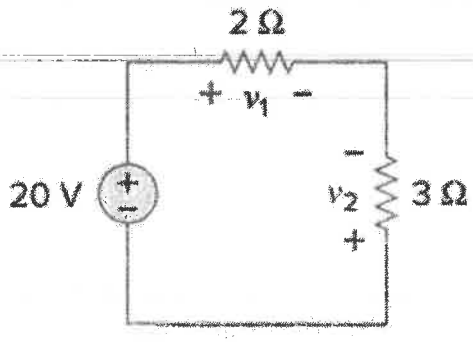
29. Each phase of a 3 phase delta connected generator supplies a full load current of 150 A at 230 V and 0.6 power factor lagging. The total active power delivered by the generator is
    a. 35.8 kW
    b. 62.1 kW
    c. 107.5 kW
    d. 11.93 kW

30. The value of v_x in the figure shown below is



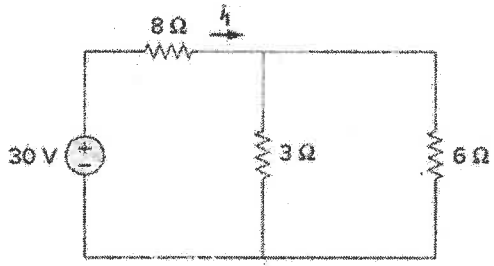
a. 12 V
b. 6 V
c. -6 V
d. -10 V

31. The value of v_1 and v_2 (in the polarities as indicated) , respectively in below figure is



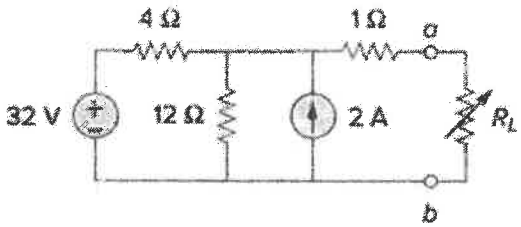
a. 8 V, 12 V
b. 8V, -12 V
c. -8 V,12 V
d. -8 V, -12 V

32. The value of current i_1 in below figure is



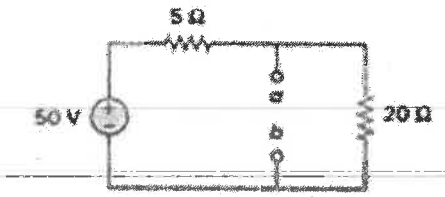
a. 1 A
b. 2A
c. -2 A
d. 3A

33. The value of maximum power transferred to the resistance R_L in the following figure is



a. 56.25 W
b. 100 W
c. 200.205 W
d. 162.25 W

34. In the below figure, the Thevenin resistance at the terminals a and b is



a. 25 Ω
b. 1.55 Ω
c. 4 Ω
d. 5 Ω

35. The current through a branch in a linear circuit is 3 A when the input source voltage is 10 V. If the voltage is reduced to 1 V and the polarity of the applied voltage source is reversed, the current through the branch is
    a. 3 A
    b. -0.3 A
    c. -3A
    d. 2 A

36. In a Δ-Δ system, a phase voltage of 100 V prod uces a line voltage of
    a. 100 V
    b. 173 V
    c. 86.6 V
    d. 300 V

37. A three-phase motor draws 5.6 kW when the line voltage is 220 V and the line current is 18.2 A. Assuming the motor to be a balanced star connected load, the power factor of the motor is
    a. 0.8 lead
    b. 0.8 lag
    c. 0.6 lag
    d. 1

38. The line current required for a 30-kW three-phase star connected load having a power factor of 0.85 lagging if it is connected to a balanced source with a line voltage of 550 V is
    a. 31.5 A
    b. 54.5 A
    c. 37.05 A
    d. 94.5 A

39. A single phase load draws 12 kV A at a power factor of 0.856 lagging from a 120-V rms sinusoidal source. The magnitude of the load impedance is
    a. 3.6 Ω
    b. 1.2 Ω
    c. 0.6 Ω
    d. 0.1 Ω

40. If an incandescent lamp of 80 ohms resistance takes a current of 0.75 ampere, what voltage across it?

a. 45 volts
b. 60 volts
c. 23 volts
d. 80 V

41. When two resistors are connected in series total resistance is 8Ω and when connected in parallel, equivalent resistance is 2Ω. Values of resistances are:—
    a. 5 Ω and 3 Ω
    b. 7 Ω and 1 Ω
    c. 4 Ω and 4 Ω
    d. 6 Ω and 2 Ω

42. A 3 ohm resistor carrying a 2 A current will dissipate the power of
    a. 12 W
    b. 6 W
    c. 1 W
    d. 24 W

43. A 5 V battery has an internal resistance of 0.01 Ω is supplying a load resistance. Current supplied by the battery if the load is shorted will be
    a. 50 A
    b. 200 A
    c. 100 A
    d. 500 A

44. An AC circuit consists of a 20-mH coil operating at a frequency of 1 kHz. The inductive reactance of the coil in Ohms is
    a. 20
    b. 62.8
    c. 0
    d. 125.7

45. When connected to a 120 V rms , 50 Hz, single phase source, a load absorbs 4kW at 0.8 power factor lag. The value of capacitance (in micro farads) necessary to raise the power factor to 0.95 lag is
    a. 100
    b. 208.9
    c. 372.6
    d. 50.127

46. BJT is said to be operating in the saturation region if
    a. Both the junctions are reverse biased
    b. Base-emitter junction is reverse-biased and base-collector junction is forward biased
    c. Base-emitter junction is forward biased and base-collector is reverse biased
    d. Both the junctions are forward biased

47. Negative feedback in amplifiers
    a. Improves the signal-noise ratio at the input
    b. Improves the signal to noise ratio at the output

c. Does not affect the signal to noise ratio at the output
d. Increases the voltage gain

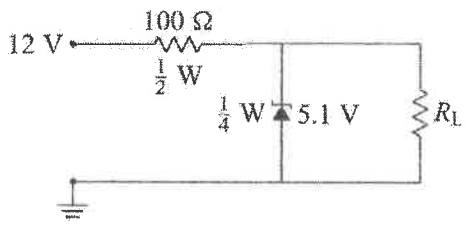
48. A Schmitt trigger uses
    a. Positive feedback
    b. Negative feedback
    c. compensating capacitors
    d. pull-up resistors

49. In a bipolar transistor at room temperature, if the emitter current is doubled, the voltage across its base-emitter junction
    a. doubles
    b. halves
    c. increases about 20 mV
    d. decreased about 20 mV

50. A half-wave rectifier uses a diode with a forward resistance of R_F. The input voltage applied is $V_m \sin \omega t$ and the load resistance is R_L. The DC current is given by
    a. $\frac{V_m}{\sqrt{2}R_L}$
    b. $\frac{V_m}{\pi(R_L+R_F)}$
    c. $\frac{2V_m}{\sqrt{\pi}}$
    d. $\frac{V_m}{R_L}$

51. If a transformer with an input voltage of 120 V rms has turns ratio of 1:10, the peak secondary voltage is (approximately)
    a. 12 V
    b. 1200 V
    c. 169.7 V
    d. 1697 V

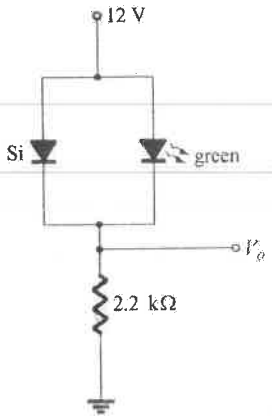
52. In the following circuit, what would happen if the load resistance is (i) shorted, (ii) removed ?



    a. The circuit works as normal
    b. The Zener diode starts malfunctioning in both cases
    c. The resistor may burn in case (i) and the diode may burn in case (ii)
    d. The diode may burn in case (i) and the resistor may burn in case (ii)

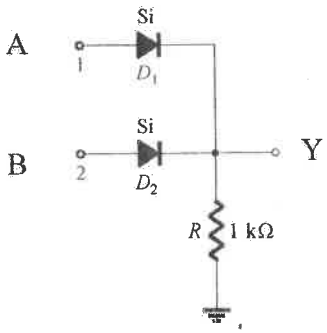
53. A common-base amplifier can be used when
    a. matching low to high impedance
    b. A voltage gain without a significant current gain is required
    c. A high-frequency amplifier is needed
    d. All of the above

54. In the following circuit, the turn-on voltage of the diode is 0.7V and whereas for the green LED is 2 V. Then the output voltage is



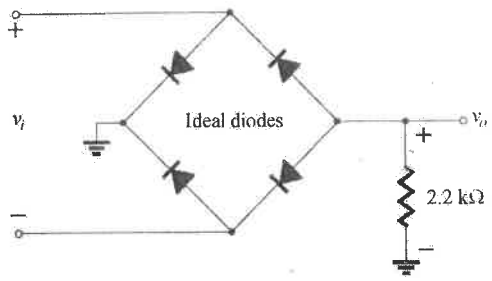
a. 9.3 V
b. 0.7 V
c. 2V
d. 11.3 V

55. The following circuit under positive logic performs



a. logical OR
b. logical AND
c. NOT
d. logical NAND

56. The output voltage of the following rectifier circuit when the input voltage is a sine wave with a peak voltage of 100V for (i) the case when the diodes are ideal and (ii) for the case when the diodes are real with a forward voltage drop of 0.7V each is

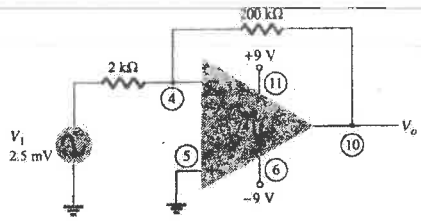


a. 100V in both cases
b. 100V for case (i) and 98.6 V for case (ii)
c. 98.6 V for case (i) and 100 V for case (ii)
d. 200V for case (i) and 197.2 V for case (ii)

57. With the same secondary voltage and filter, which of the following will have more ripple?
a. Half-wave rectifier
b. Full-wave bride rectifier

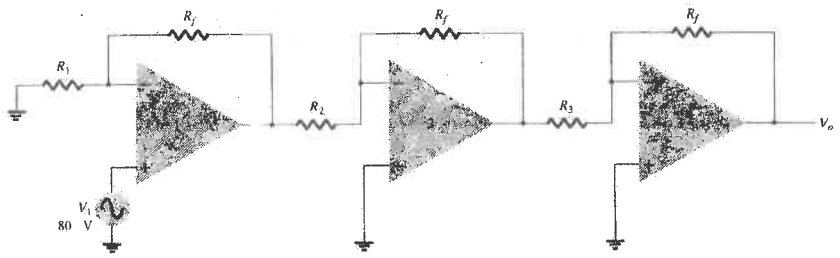
c. Full-wave center-tap rectifier
d. impossible to say

58. The output voltage of the following circuit for a sinusoidal input peak voltage of 2.5mV is



a. 0.25 Vpeak
b. 0.5 Vpeak
c. -0.25 Vpeak
d. -0.5 Vpeak

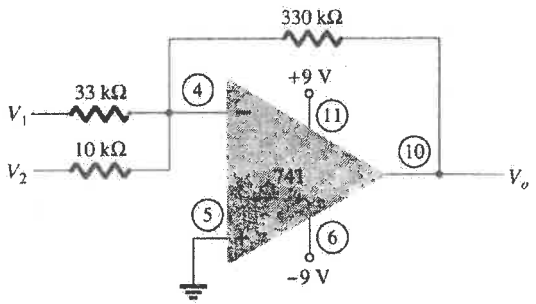
59. The output voltage of the circuit with $V_1 = 100\ \mu V$ with the resistor components of values $R_f = 470\ k\Omega$, $R_1 = 4.3\ k\Omega$, $R_2 = 33\ k\Omega$, and $R_3 = 33\ k\Omega$ is



a. 2.22V
b. 1.78 V
c. 5.39 V
d. 0.53 V

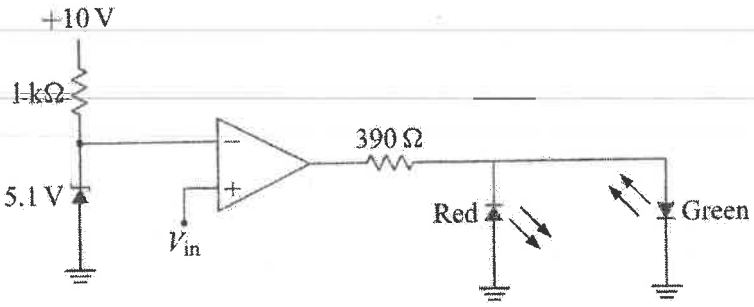
60. When the input terminals of a differential amplifier are grounded,
a. The base currents are equal
b. The collector currents are equal
c. An output error voltage usually exists
d. The ac output voltage is zero

61. The output voltage for the following circuit, when $V_1 = 50\ mV$ and $V_2 = 10\ mV$ is



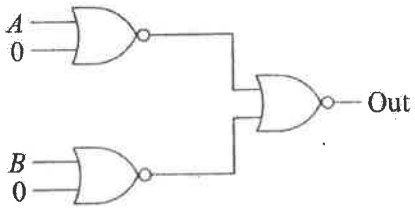
a. -170 mV
b. 330 mV
c. 500 mV
d. -830 mV

62. For the following circuit, when the input voltage is 7.5V, which of the following is mostly likely to happen?



a. Both the RED and GREEN LEDs glow
b. None of the LED lightup
c. GREEN LED turns up and RED LED is OFF
d. RED LED turns up and GREEN LED is OFF

63. The logic function that the following circuit performs is



a. AND
b. OR
c. NAND
d. NOR

64. Two-stages of amplifier has gains of 20 dB and 40dB, the voltage gain of the cascaded stages assuming perfect matching is
a. 1000
b. 10^6
c. 100
d. 1

65. If the cut-off frequency of a OPAMP is 15 Hz and the midband open-loop voltage gain is 1,000,000 then the unity-gain frequency is
a. 1.5 MHz
b. 25 MHz
c. 1.5 MHz
d. 15 MHz

66. For a superheterodyne receiver, the intermediate frequency is 20 MHz and the local oscillator frequency is 800 MHz. If the frequency of the received signal is greater than the local oscillator frequency, then the image frequency (in MHz) is
a. 780 MHz
b. 800 MHz

c. 820 MHz
d. 1600 MHz

67. Consider the signal $s(t) = m(t)\cos(2\pi f_c t) + \hat{m}(t)\sin(2\pi f_c t)$ where $\hat{m}(t)$ denotes the Hilbert transform of the message signal $m(t)$. The signal $s(t)$ is a
    a. double sideband suppressed carrier (DSBSC) signal
    b. conventional amplitude modulated (AM) signal
    c. single sideband (SSB) signal
    d. vestigial sideband (VSB) signal

68. A carrier signal $s(t) = 8\cos(2\pi f_c t)$ is amplitude modulated by a message signal $m(t) = 2\sin(2\pi f_m t)$. The modulation index of the resulting AM signal is
    a. 0.5
    b. 0.25
    c. 0.75
    d. 4

69. Consider an angle modulated signal $s(t) = 6\cos[2\pi 10^6 t + 2\,sin(8000\pi t) + 4\,cos(8000\pi t)]$ V. The average power of $s(t)$ is
    a. 10 W
    b. 28 W
    c. 20 W
    d. 18 W

70. The maximum power efficiency of an AM modulator is
    a. 25 %
    b. 33.33 %
    c. 50 %
    d. 66.66 %

71. The diagonal clipping in Amplitude Demodulation (using envelope detector) can be avoided if RC time-constant of the envelope detector satisfies the following condition, (here W is message bandwidth and ω_c is carrier frequency)
    a. $RC < \frac{1}{W}$
    b. $RC > \frac{1}{W}$
    c. $RC < \frac{1}{\omega_c}$
    d. $RC > \frac{1}{\omega_c}$

72. Consider the amplitude modulated signal $s(t) = [A_c + 2\cos(2\pi f_m t)]\cos(2\pi f_c t)$. For demodulating the signal, the minimum value of A_c should be
    a. 2
    b. 1
    c. 0.5
    d. 0.25

73. A speech signal is sampled at 8 kHz and encoded into PCM format using 8 bits/sample. The PCM data is transmitted through a baseband channel via 4-level PAM. The minimum bandwidth (in kHz) required for transmission is
    a. 8 kHz
    b. 16 kHz
    c. 32 kHz
    d. 64 kHz

74. A symbol stream contains alternate QPSK and 16-QAM symbols. If symbols from this stream are transmitted at the rate of 1 mega-symbols per second, the raw (uncoded) data rate is (in mega-bits per second) is
    a. 1
    b. 2
    c. 3
    d. 4

75. Which one of the following statements about differential pulse code modulation (DPCM) is true?
    a. The sum of message signal sample with its prediction is quantized
    b. The message signal sample is directly quantized, and its prediction is not used
    c. The difference of message signal sample and a random signal is quantized
    d. The difference of message signal sample with its prediction is quantized

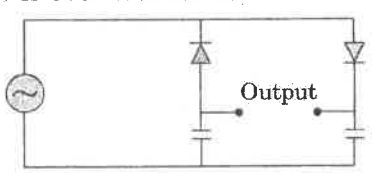
76. Four independent messages have bandwidths of 100 Hz, 100 Hz, 200 Hz and 400 Hz respectively. Each is sampled at the Nyquist rate, and the samples are time division multiplexed (TDM) and transmitted. The transmitted sample rate (in Hz) is
    a. 200
    b. 400
    c. 800
    d. 1600

77. The number of bits in a binary PCM system is increased from $\boldsymbol{n}$ to $\boldsymbol{(n+1)}$. As a result, the signal to quantization noise ratio will improve by a factor
    a. which is independent of n
    b. $(n+1)/n$
    c. $2^{(n+1)/n}$
    d. $\log((n+1)/n)$

78. The dominant charge in the channel region of a p-channel MOSFET in accumulation region is by
    a. holes
    b. electrons
    c. positively charged ions
    d. negatively charged ions

79. At room temperature, a possible value for electron mobility in the inversion layer of a Si n-channel MOSFET is
    a. 1450 cm^2/V-s
    b. 1800 cm^2/V-s
    c. 3500 cm^2/V-s
    d. 400 cm^2/V-s

80. The circuit below is best described as



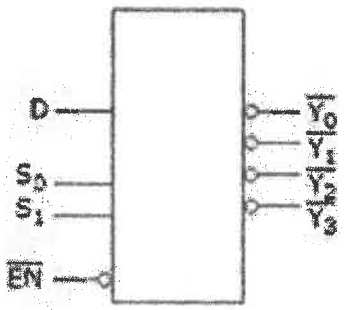
    a. rectifier
    b. frequency discriminator

c. voltage doubler
d. ring modulator

81. The 2's complement representation of -17 is
a. 101110
b. 101111
c. 111110
d. 110001

82. What is the minimum number of bits required to represent the numbers in the rangeof -6 to 33 using 2's complement method?
a. 4
b. 5
c. 6
d. 7

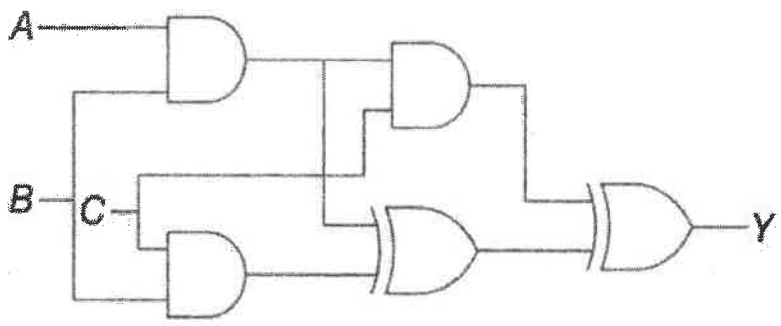
83. The functionality of the below logic gate is



a. De-Multiplexer
b. Multiplexer
c. Decoder
d. Encoder

84. How many two input NOR gates are required to realize Half adder circuit?
a. 4
b. 5
c. 6
d. 7

85. The simplified output of the combinational circuit given below is



a. AB + C
b. AB
c. B (A ⊕ C)
d. C (B ⊕ A)

86. How many cells will a n-input variable have in K-map ?
a. 2^n
b. n
c. n^2
d. $n/2$

87. Which of the following formulations of Boolean Algebra are correct from the given list?

(1) $x + x' = 1$
(2) $x.x' = 1$
(3) $x + x = 1$
(4) $x + x = x$

a. (1) and (3)
b. (1) and (4)
c. (1) or (2)
d. (1) and (3) and (4)

88. How many 3 to 8 decoders are needed to construct 4 to 16 decoder?

a. 2
b. 3
c. 4
d. 5

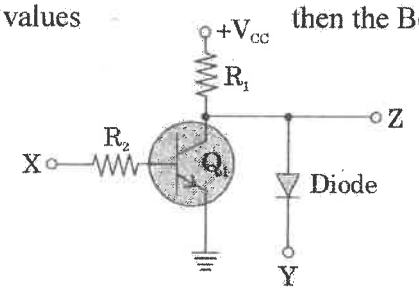
89. ECL stands for
a. emitter-collected logic
b. emitter-coupled logic
c. emitter-collector logic
d. emitter-cross coupled logic

90. Suppose $F = AB + \overline{AB}$, then $\overline{F}$ is
a. $AB + \overline{AB}$
b. $\overline{A}B$
c. $A\overline{B}$
d. $\overline{A}B + A\overline{B}$

91. How many binary bits are required to represent the decimal number in the range from 0 to 999?

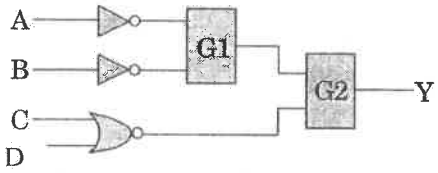
a. 8
b. 10
c. 12
d. 16

92. In the circuit shown below, Q_1 has negligible collector-to-emitter saturation voltage and the diode drops negligible voltage across it under forward bias. If V_{CC}, is +5 V and X, Y are digital logic values then the Boolean expression for Z is



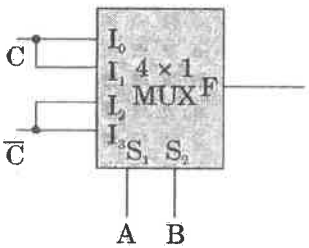
a. XY
b. $\bar{X}Y$
c. $X\bar{Y}$
d. $\bar{X}\bar{Y}$

93. In the figure shown below, Y is required to be $Y = AB + \bar{C}\bar{D}$. The gate G1 and G2 must be



a. NOR,OR
b. OR, NAND
c. NAND,OR
d. AND,NAND

94. The logic realized by the circuit shown below is



a. $F = AC$
b. $F = A \oplus C$
c. $F = BC$
d. $F = B \oplus C$

95. The resolution of a 4-bit counting ADC is 0.5 Volts. For an analog input of 6.6 Volts, the digital output of the ADC will be
a. 1011
b. 1100

c. 1101
d. 1110

96. When CPU is interrupted, it
a. stops execution of instructions
b. acknowledge interrupt and branches to a sub-routine
c. acknowledge interrupt and continues
d. acknowledge interrupt and waits for the next instruction from the interrupting device

97. To reduce the memory access time, Which of the following component is widely used?
a. SRAM
b. High density RAM
c. DRAM
d. Cache

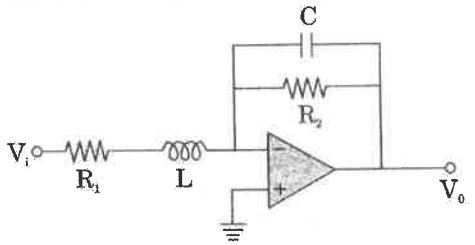
98. Consider the following statement with regard to the CMOS inverter shown below, where both the MOSFETs are of enhancement type and both have a threshold voltage of 2V.

Statement 1: T_1 conducts when V_i is greater than or equal to 2V.
Statement 2: T1 is always in saturation when $V_o = 0$ V.

Which of the following is correct?

a. Only statement 1 is TRUE
b. Only statement 2 is TRUE
c. Both statements are TRUE
d. Both the statements are FALSE

99. The OPAMP circuit shown below represents a



a. high-pass filter
b. low-pass filter
c. band-pass filter
d. band-reject filter

100. The maximum allowable current through a 10 kΩ, 1 W resistor is
a. 0.1 mA
b. 1 mA
c. 10 mA
d. 0.1 A

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