ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ ਜਲੰਧਰ

PUNJAB TECHNICAL UNIVERSITY JALANDHAR

Max. Marks: 90 **Time: 90 Mins.**

Entrance Test for Enrollment in Ph.D. Programme

Important Instructions

- *Fill all the information in various columns, in capital letters, with blue/black ball point pen.*
- *Use of calculators is not allowed.*
- *All questions are compulsory. No negative marking for wrong answers.*
- *Each question has only one right answer.*
- *Questions attempted with two or more options/answers will not be evaluated.*

Stream:(Engg/Arch/Pharm/Mgmt/App.Sci/life Sci/Lang/Humanities) ……..

Discipline **Electronics and communication Engineering.**

Name ……..

Fathers Name ……..

Roll Number ……..**Date: 15-07-2012**

Signature of Candidate: ……..

Signature of Invigilator ……..

1. The drain of an n-channel MOSFET is shorted to the gate so that $V_{GS} = V_{DS}$. The threshold voltage, V_T of MOSFET is 1 V. If the drain current, I_D is 1 mA for $V_{GS} = 2V$, then for $V_{GS} = 3V$, I_D is

A) 2 mA

B) 3 mA

C) 9 mA

D) 4 mA

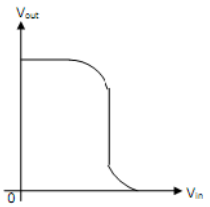
2. Figure shown is the voltage transfer characteristics of

A) an NMOS inverter with enhancement mode transistor as load

B) an NMOS inverter with depletion mode transistor as load

C) a CMOS inverter

D) a BJT inverter



3. For a current source load differential amplifier with NMOS input transistor, the differential voltage gain is given by

A) $-\sqrt{\dfrac{\mu_N\left(\dfrac{W}{L}\right)_N}{\mu_P\left(\dfrac{W}{L}\right)_P}}$

B) $-g_{mN}\left(r_{oN}+r_{oP}\right)$

C) $-\dfrac{g_{mN}}{g_{mP}}$

D) $-g_{mP}\left(r_{oN}+r_{oP}\right)$

4. The noise is mainly contributed in two stage OPAMP by the transistors in

A) Input stage driver

B) Input stage load

C) Output stage driver

D) compensation capacitor

5. An 8-bit D/A converter has a full scale output voltage of 20 V. The output voltage when the input is 11011011 is

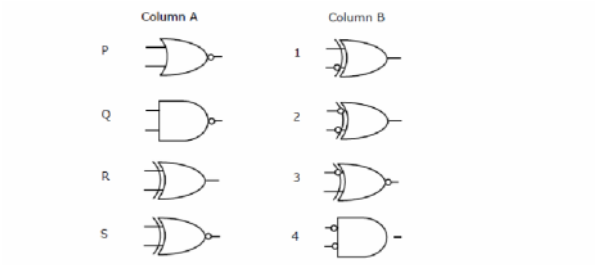
A) 160 mV

B) 78 mV

C) 20 V

D) 17 V

6. Match the logic gates in Column A with their equivalents in column B.



A) P – 4, Q – 2, R – 3, S – 1
B) P – 2, Q – 4, R – 1, S – 3
C) P – 2, Q – 4, R – 3, S – 1
D) P – 4, Q – 2, R – 1, S – 3

7. The intrinsic carrier concentration of silicon sample of 300 K is 1.5 X 1016/m3. If after doping, the number of majority carriers is 5 X 1020/m3, the minority carrier density is

A) 4.50 x 10 11/m3
B) 3.33 x 104/m3
C) 5.00 x 1020/m3
D) 3.00 x 10-5/m3

8. Choose proper substitutes for X and Y to make the following statement correct Tunnel diode and Avalanche photodiode are operated in X bias and Y bias respectively -

A) X : reverse , Y: reverse
B) X : reverse, Y : forward
C) X : forward, Y : reverse
D) X : forward, Y : forward

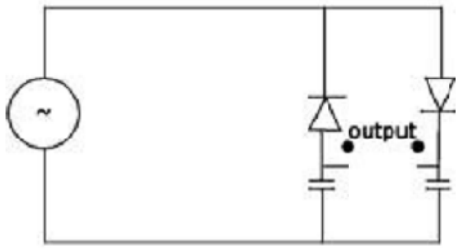
9. A series resonant circuit has an inductive reactance of 1000Ω, a capacitive reactance 1000Ω and a resistance of 0.1Ω. If the resonant frequency is 10MHz, then the bandwidth of the circuit will be

A) 0.1kHz B) 1kHz
C) 10kHz D) 1MHz

10. A series LCR circuit with R=10Ω, |XL|=20Ω and |XC|=20Ω is connected across an AC supply of 200Vrms. The rms voltage across the capacitor is

A) 200 ∟–900 V
B) 200 ∟+900 V
C) 400 ∟+900 V
D) 400 ∟–900 V

11. The circuit shown in figure is best described as a



A) Bridge rectifier
B) Ring modulator
C) Voltage doubler
D) Frequency discriminatory

12. The ratio of available power from the dc component of a full-wave rectified sinusoid to the available power of the rectified sinusoid is

A) 8/π
B) 2
C) 4/π
D) 8/π2

13. In a two-terminal network, the open-circuit voltage measured at the given terminals by an electronic voltmeter is 100V. A short-circuit current measured at the same terminals by an ammeter of negligible resistance is 5A. If a load resistor of 80Ω is connected at the same terminals, then the current in the load resistor will be

A. 1A
B. 1.25A
C. 6 A
D. 6.25 A

14. An amplifier without feedback has a voltage gain of 50, input resistance 1KΩ and output resistance of 2.5KΩ. The input resistance of the current-shunt negative feedback amplifier using the above amplifier with a feedback factor of 0.2 is

A) 1/11 K Ω B)1/5 K Ω
C) 5 K Ω D) 11 K Ω

15. P(s)=s4+s3+2s2+4s+3
Q(s)=s5+3s3+s
Which one of the following statements is correct for above P(s) and Q(s) polynomials?

A) Both P(s) and Q(s) are Hurwitz
B) Both P(s) and Q(s) are non-Hurwitz
C) P(s) is non-Hurwitz, but Q(s) is Hurwitz
D) P(s) is Hurwitz, but Q(s) is non-Hurwitz

16. A two-port network has Z11 =13/35, Z12 = Z21 =2/35, Z22 =3/35. Its Y11 and Y12 parameters will respectively be

A) 3, 2
B) 3, – 2
C) 13, – 2
D) 13, 2

17. The Fourier series representations of a periodic current [2+(6√2)cos(ωt)+(√48)sin(2ωt)] A.
The effective value of the current is

A) (2+6+(√24)) A
B) 8 A
C) 6 A
D) 2 A

18. A voltage signal v(t) has the following Fourier transform:
V(jω)=exp(–jωd) for |ω|<1
zero for |ω|>1
The energy that would be dissipated in a 1Ω resistor fed from v(t) is

A) 2/π Joules
B) 2exp(–2d)/π Joules
C) 1/π Joules
D) 1/2π Joules

19. The Fourier transform of u(t) is

A) 1/jω B) jω
C) 1/(1+jω) D) πδ(ω)+1/jω

20. The Fourier transform of exp(–αt2) is

A) (1/α)exp(–αf2)
B) (π/α)0.5exp(–π2f2/α)
C) (πα)–0.5exp(–π2f2)
D) (πα)0.5exp(–f2/(π2α))

21. The Fourier transform X(f) of the periodic delta tions, $x(t)=\sum_{k=-\infty}^{\infty}\delta(t-kT)$ is

A) $T\sum_{k=-\infty}^{\infty}\delta(f-kT)$
B) $T\sum_{k=-\infty}^{\infty}\delta\left(f-\frac{k}{T}\right)$
C) $T^{-1}\sum_{k=-\infty}^{\infty}\delta\left(f-\frac{k}{T}\right)$
D) $T^{-1}\sum_{k=-\infty}^{\infty}\delta(f-kT)$

22. The relationship between the input x(t) and the output y(t) of a system is $\frac{d^2y}{dt^2}=x(t-2)u(t-2)+\frac{d^2x}{dt^2}$.
The transfer function of the system is

A) $1+s^2/\exp(2s)$
B) $1+(\exp(-2s))/s^2$
C) $1+\exp(2s)/s^2$
D) $1+s^2/\exp(-2s)$

23. Given that x1(t)=exp(k1t)u(t) and x2(t)=exp(–k2t)u(t). Which one of the following gives their convolution?

A) (exp(k1t)–exp(–k2t))/(K1+K2)
B) (exp(k1t)–exp(–k2t))/(K2–K1)
C) (exp(k1t)+exp(–k2t))/(K1+K2)
D) (exp(k1t)+exp(–k2t))/(K2–K1)

24. What is the output of the system with h[n]=(1/2)nu(n) in response to the input
x[n]=3+cos(πn+π/3)

A) y[n]=3+(1/3)cos(πn+π/3)
B) y[n]=3+(2/3)cos(πn+π/3)
C) y[n]=1+(2/3)sin(πn+π/3)
D) y[n]=6+(2/3)cos(πn+π/3)

25. What is the Nyquist rate for the signal
x(t)=cos(2000πt)+3sin(6000πt)?

A) 2kHz B) 4kHz
C) 6kHz D) 12kHz

26. What is the phase angle of the composite sinusoidal signal resulting from the addition of v1(n)=(√2)sin(5πn) and v2(n)=(√2)cos(5πn).

A) +5π B) –5π
C) –π D) +π/4

27. For same SNR, which of the following is correct

A) BER(QPSK) > BER(BPSK)
B) BER(BPSK) > BER(QPSK)
C) BER(QPSK) = BER(BPSK)
D) BER(QPSK) = BER(8PSK)

28. Consider an indoor wireless LAN with fc = 900 MHz, cells of radius 100 m, and non-directional antennas. Under the free-space path loss model, what transmit power is required at the access point such that all terminals within the cell receive a minimum power of 10 µW. (Antenna gain =1 for non directional antennas)

A) 1.61 dBW. B) 1.94 dBW
C) 1.48 dBW D) 1.53 dBW

29. For the Alamouti Scheme which of following is correct

A)channel known at receiver
B)channel known at transmitter
C)channel known both at transmitter and receiver
D)channel unknown to transmitter and receiver

30. The fading distribution

$$pz(z) = \frac{2m^m z^{2m-1}}{\Gamma(m)P_r^m}\exp\left[\frac{-mz^2}{P_r}\right]$$

For m=1 and 0.5 becomes distribution for

A) Nakagami fading and Rayleigh fading respectively.
B) Rayleigh fading and Nakagami fading respectively.
C) Rayleigh fading and Rician fading respectively.

Rayleigh fading and no fading respectively

31. A uniform plane wave is incident upon a very short lossless dipole (l <<λ). Find the maximum effective area assuming that the radiation resistance of the dipole is Rr = 80(πl/λ)2, and the incident field is linearly polarized along the axis of the dipole.

A) 0.39 λ2 B) 0.119 λ2
C) 0.79 λ2 D) 0.212 λ2

32. In M-ary modulation maximum Entropy will not exceed

A) log2M bits/message
B) 1/M bits/message
C) log2(1/M) bits/message
D) none of above

33. An event has 6 possible outcomes with probabilities p1=1/2, p2=1/4, p3=1/8, p4=1/16, p5=1/32, p6=1/32. Find the rate of information if there is 16 outcomes per second

A) 15 bits/second
B) 16 bits/second
C) 31 bits/second
D) 32 bits/ second

34. Walsh 0 is used by _____ Walsh 32 is used by _____ Walsh 1-7 is used for _____ channe in CDMA system

A) Sync Channel, Paging Channel, Pilot Channel
B) Pilot Channel, Sync Channel, Paging Channel
C) Pilot Channel ,Traffic Channel, Sync Channel
D) Pilot Channel, Sync Channel, Traffic Channel

35. Different cells and cell sectors all use the same short code, but use different phases or shifts, which is how the mobile differentiates one base station from another. The phase shift is known as the

A) PN Roll
B) PN Offset
C) PN Delay
D) None of the above

36. Match the following

1)High Doppler spread	I) Frequency Selective Fading.
2)Coherence time > symbol period	II) Fast fading.
3)Delay spread > symbol period	III) Flat fading.
4)Bandwidth of signal < bandwidth of channel	IV) Slow Fading.

A) 1-IV, 2-I, 3-III, 4-II
B) b)1-III, 2-IV, 3-II, 4-I
C) 1-II, 2-IV, 3-III, 4-I
D) 1-II, 2-IV, 3-I, 4-III

37. A signal x(t) = 100cos(24□ x 103)t is ideally sampled with a sampling period of 50□sec and then passed through an ideal low-pass filter with cutoff frequency of 15KHz. Which of the following frequencies is / are present at the filter output?

(A) 12KHz only
(B) 8KHz only
(C) 12KHz and 8KHz
(D) 12KHz and 9KHz

38. Consider the set of signals

$s_i(t) = \sqrt{2E/T}\cos(2\Pi f^c t + i\Pi/4) \qquad 0 \le t \le T$

$0 \qquad \text{elsewhere}$

Where i=1, 2, 3, 4, and $f^c = n/T$ for some fixed integer n^c. The dimensionality, N of the space spanned by this set of signals is

A) 1
B) 2
C) 4
D) 8

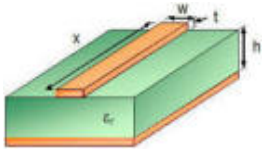
39. What is the power of a 2 $V_{pk\text{-}pk}$ sine wave across a 50 ohm load?

A) +10.0dBm
B) +19.0dBm
C) -20.0dBm
D) -10.0 dBm

40. An ideal directional coupler has a directivity of 25 dB and an isolation of 40 dB. What is its coupling value?

A) 65 dB
B) 40 dB
C) 15 dB
D) 25 dB

41. What type of transmission line is shown below?



A) Coaxial
B) Microstrip
C) Stripline
D) None of the above

42. In the following pdf's , compute the constant B for proper normalization:

$$f(x) = \begin{cases} Bx^2 e^{-x^2/\alpha^2} & x > 0 \\ 0 & \text{otherwise} \end{cases}$$

A) $\frac{4}{\alpha\sqrt{\pi}}$

B) $\frac{4}{\alpha^2\sqrt{\pi}}$

C) $\frac{4}{\alpha^3\sqrt{\pi}}$

D) $\frac{4}{\alpha^4\sqrt{\pi}}$

43. The amplitude of a random signal is uniformly distributed between -5V and 5V. If the signal to quantization noise ratio required in uniformly quantizing the signal is 43.5dB, the step size of the quantization is approximately

A) 0.10V
B) 0.0333V
C) 0.05V
D) 0.0667V

44.

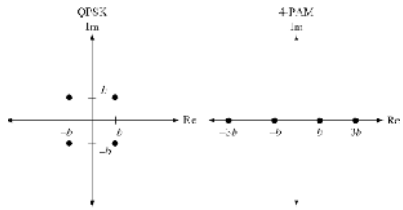
The vector H in the far field of an antenna satisfies

(a) $\nabla.\overline{H} = 0$ and $\nabla \times \overline{H} = 0$
(b) $\nabla.\overline{H} \neq 0$ and $\nabla \times \overline{H} \neq 0$
(c) $\nabla.\overline{H} = 0$ and $\nabla \times \overline{H} \neq 0$
(d) $\nabla.\overline{H} \neq 0$ and $\nabla \times \overline{H} = 0$

45. In the Selection combining technique, with increase in number of transmit antennas the average SNR gain and corresponding array gain.

A) increases linearly
B) increases non linearly
C) does not change
D) First decreases then increases

46. Two signal constellations are shown in figure 1 and 2. The ratio of average energy of constellation 1 to the average energy of constellation 2 is



A) 5
B) 2/5
C) 5/2
D) 2

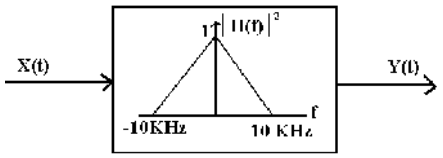
47. Assume four branch diversity (SC) is used, where each branch receives an independent Rayleigh fading signal. If the average SNR is 20 dB, determine the probability that the output SNR will drop below 10 dB.

A) 0.095
B) 0.082
C) 0.000082
D) 0.000095

48. Consider a continuous random variable Y defined by Y=X+N where, X and N are statistically independent. The conditional differential entropy of Y, given X, (H(Y/X)) equals

A) H(N)
B) H(X)
C) H(Y)
D) H(X,Y).

49. A white noise process X(t) with two sided power spectral density 1 X 10-10 W/Hz is input to a filter whose magnitude squared response is shown below. Then the power of the output process Y(t) is given by



A) 10-4 Watt
B) 10-6 Watt
C) 2X103 Watt
D) 105 Watt

50. If the number of bits per sample in a Pulse Coded Modulation (PCM) system is increased from 5 bits to 6 bits, the improvement in signal to quantization noise ratio will be

A) 0 dB
B) 3 dB
C) 2 pi dB
D) 6 dB

51. What happens to the noise floor of a spectrum analyzer when the input filter resolution bandwidth is decreased by two decades?

A) 20 dB increase
B) 20 dB decrease
C) 40 dB decrease
D) 40 dB increase

52. The Hamming distance between two codewords can be calculated

A)by XORing the code-words bit-by-bit and counting the number of 0s in the result
B)by XORing the code-words bit-by-bit and counting the number of 1s in the result.
C)by ORing the code-words bit-by-bit and counting the number of 1s in the result.
D)by ORing the code-words bit-by-bit and counting the number of 0s in the result.

53. The antenna array having $\psi = kd\cos\theta + \beta = 0$, and nulls at $\theta n = \cos{-1}(\pm n\lambda/Nd)$ for n = 1, 2, 3, . . . and $n \neq N, 2N, 3N, \ldots$ and maxima at $\theta n = \cos{-1}(1 - n\lambda/Nd)$ for n = 1, 2, 3, . . . and $n \neq N, 2N, 3N, \ldots$ represent

A)Broadside array and end fire array respectively
B)End fire array and broadside array respectively
C)Hansen-Woodyard End-Fire Array and broadside array respectively
D)Binomial and broadside array respectively

54. Which of the following WLAN standards is on a different frequency band than the others?

A) 802.11a
B) 802.11b
C) 802.11g
D) 802.11n

55. The discrete time equation y(n+1) + 0.5n y (n) = 0.5 x(x+1) is not attributable to a

A) Causal System
B) Memory less system
C) Time varying system
D) Linear System

56. The inverse Fourier transform of the function $F(\omega) = (1/j\omega)\ \pi\delta(\omega)$ is

A) sin ωt
B) cos ωt
C) sin (t)
D) u(t)

57. Optical packet switching is

A)A technique where incoming packets are switched all-optically without being converted to electrical signal
B)A technique where incoming packets are switched all-optically with being converted to electrical signal
C)A technique where incoming packets are switched all-electrically without being converted to optical signal
D)None of above

58. Total number of modes in multimode graded index fiber is

A) M = V2/2
B) M = V2/4
C) M = V2/8
D) M = V2/12

59. Gallium Arsenide (GaAs) is preferred to silicon for use in Gunn diode because it has

A) Lower noise at high frequencies
B) High ion mobility
C) Suitable empty energy band which silicon does not have
D) Better frequency stability

60. Which one of the following modes of transmission will not be supported by a rectangular wave guide?

A) TE10 B) TE11
C) TM11 D) TM10

61. In an air filled rectangular wave guide, the cut off frequency of a TE10 mode is 5 GHz where as that of TE01 mode is 12 GHz, the dimensions of the guide are

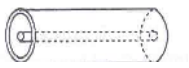
A) 3 cm and 1.25 cm
B) 1.25cm and 3 cm
C) 6 cm and 2.5cm
D) 2.5 cm and 6 cm

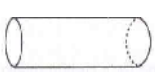
62. Scattering parameters are more suited than impedance parameters to describe a waveguide junction because.

A)The scattering parameters are frequency invariant whereas the impedance parameters are not so
B)Scattering matrix is always unitary.
C) Impedance parameters vary over unacceptably wide ranges.
D)Scattering parameters are directly measurable but impedance matrix are not so.

63. Which of the following statement is true regarding the fundamental mode of the metallic waveguides shown?

P: coaxial



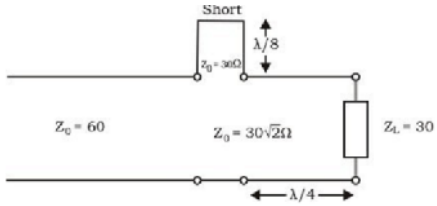


Q: Cylindrical

R: Rectangular

A) Only P has no cut-off frequency.
B) Only Q has no cut-off frequency.
C) Only R has no cut-off frequency.
D) All three has cut-off frequencie

64. In the circuit shown, all the transmission line sections are lossless. The Voltage standing Wave Ratio (VSWR) on the 60ohm line is



A) 1.00
B) 1.64
C) 2.50
D) 3.00

65. If the total power to an antenna is Wt, the radiated power is Wr, and the radiation intensity is Φ, the match list-I with list-II and select the correct answer using the code given below the lists:

List-I	List-II
a. Power gain b. Directive gain c. Average power radiated d. Efficiency of the antenna.	1. W_r/W_t 2. $W_r/4\pi$ 3. $4\pi\Phi/w_t$ 4. $4\pi\Phi/w_r$

Code

	a	b	c	d
A)	3	4	2	1
B)	4	3	2	1
C)	3	4	1	2
D)	4	3	1	2

66. The following differential equation has

3(d2y/dt2) + 4(dy/dt)3 + y2 + 2 = x

A) Degree = 2, Order = 1
B) Degree = 3, Order = 2
C) Degree = 4, Order = 3
D) Degree = 2, Order = 3

67. rank of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ is

A) 0 B) 1

C) 2 D) 3

68. A probability density function is of the form P(x) = K exp[$-\alpha|x|$], $x \in$ **(-∞ , ∞)**

The value of K is

A) 0.5 B) 1

C) 0.5 α D) α

69. The Eigen values and the corresponding Eigen vectors of 2 x 2 matrix are given by

Eigen value	Eigenvector
$\lambda_1 = 8$	$V_1 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$
$\lambda_2 = 4$	$V_2 = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$

The matrix is

A) $\begin{bmatrix} 4 & 8 \\ 8 & 4 \end{bmatrix}$ B) $\begin{bmatrix} 2 & 4 \\ 4 & 2 \end{bmatrix}$

C) $\begin{bmatrix} 4 & 6 \\ 6 & 4 \end{bmatrix}$ D) $\begin{bmatrix} 6 & 2 \\ 2 & 6 \end{bmatrix}$

70. If E denotes expectation, the variance of a random variable X is given by

A) E[X2] – E2[X]

B) E[X2] + E2[X]

C) E[X2]

D) E2[X]

71. Which one of the following function is strictly bounded?

A) $1/x^2$

B) e^x

C) x^2

D) e^{-x^2}

72. The equation sin (z) = 10 has

A) No real or complex solution

B) Exactly two distinct complex solutions

C) A unique solution

D) An infinite number of complex solutions

73. If G(f) represents the Fourier transform of a signal g(t) which is real and odd symmetric in time, then

A) G(f) is complex

B) G(f) is imaginary

C) G(f) is real

D) G(f) is real and non-negative

74. The positive and negative halves of a complex wave are symmetrical when

A) it contains even harmonics

B) phase difference between even harmonics and fundamental is 0 or π

C) it contains odd harmonics

D) phase difference between even harmonics and fundamental is either π/2 or 3π/2

75. The ROC of $x(n) = \alpha^n u(n)$ is

A) $|Z| \succ |\alpha|$

B) $|Z| \succ |1|$

C) $|Z| \prec |\alpha|$

D) $|Z| \prec |1|$

76. The Laplace transform F(s) is

$$F(s) = \frac{2}{s}\frac{(s+1)}{(s+a)}$$

The inverse f(t) at $t \to \infty$ has the value ½. Then 'a' is given by

A) 8 B) 4

C) 2 D) 1

77. The system function $H(s)=\frac{1}{(s+2)}$. The input signal is cos(t), then the steady state response is

A) $e^{-2t}\cos 2t$

B) $\frac{1}{2\sqrt{2}}\cos\left(2t-\frac{\pi}{4}\right)$

C) $\cos\left(2t-\frac{\pi}{4}\right)$

D) $\frac{1}{2\sqrt{2}}\cos\left(2t+\frac{\pi}{4}\right)$

78. Cycle stealing mode of DMA operation involves

A) DMA-controller taking on the address, data and control buses, while a block of data is transformed between memory and on I/O device.

B) while the μP is executing a programme, an interface circuit takes control of the address, data and control buses, when not in use by the μP

C) Data transfer takes place, between the I/O device and memory, during every alternate clock cycle.

D) the DMA controller working for the μP to finish execution of the programme and then takes over the buses.

79. The Laplace transform of a continuous time signal x(t) is $X(s)=\frac{5-s}{s^2-s-2}$. If the Fourier transform of this signal exists, then x(t) is

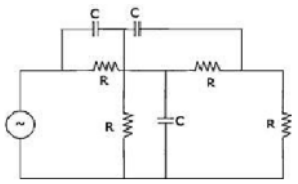
A) $e^{2t}u(t)-2e^{-t}u(t)$

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

C) $-e^{2t}u(-t)-2e^{-t}u(t)$

D) $e^{2t}u(-t)-2e^{-t}u(t)$

80. The minimum number of equations required to analyze the circuit shown in the figure is



A) 3

B) 4

C) 6

D) 7

81. The Laplace transform of i(t) is given by I (s) = 2/(s(1+s)). As t → ∞, the value of i(t) tends to

A) 0

B) 1

C) 2

D) ∞

82. Let x (t) be the input to a liner, time-invariant system. The required output is 4x (t-2). The transfer function of the system should be

A) 4 exp(j4 πf)

B) 2 exp(– j8 πf)

C) 4 exp(- j4 πf)

D) 2 exp(j8 πf)

83. A sequence x (n) with the z-transform $X(z) = z^4 + z^2 – 2z + 2 – 3z – 4$ is applied as an input to a linear, time-invariant system with the impulse response h (n) = 2 δ(n - 3) where

$$\delta(n)=\begin{cases}1 & n=1\\ 0 & otherwise\end{cases}$$

The output at n = 4 is

A) – 6 B) 0

C) 2 D) -4

84. Match items in Group 1 with items in Group 2, most suitable.

	Group 1		Group 2
P	LED	1	Heavy doping
Q	Avalanche photodiode	2	Coherent radiation
R	Tunnel diode	3	Spontaneous emission
S	LASER	4	Current gain

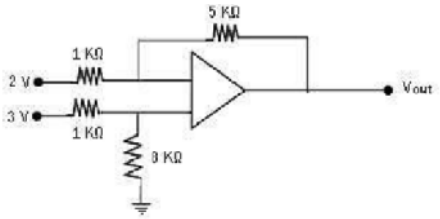
A) P -1, Q-2, R -4, S-3

B) P -2, Q-3, R -1, S-4

C) P -3, Q-4, R -1, S-2

D) P -2, Q-1, R -4, S-3

85. If the op-amp in the figure is idea, the output voltage Vout will be equal to



A) 1 V

B) 6 V

C) 14 V

D) 17 V

86. Let X and Y be two statistically independent random variables uniformly distributed in the ranges (-1, 1) and (-2, 1) respectively. Let Z = X+Y. Then the probability that [Z ≤-2] is

A) Zero

B) 1/6

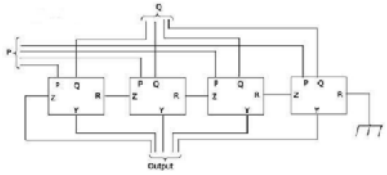
C) 1/3

D) 1/12

87. The circuit shown in the figure has 4 boxes each described by inputs P,Q,R and outputs Y, Z with

Y = P⊕Q⊕R

Z= RQ + $\overline{P}R + Q\overline{P}$



The circuit acts as a

A) 4 bit adder giving P + Q

B) 4 bit subtractor giving P – Q

C) 4 bit subtractor giving Q – P

D) 4 bit adder giving P +Q+ R

88. An event has 6 possible outcomes with probabilities p1=1/2, p2=1/4, p3=1/8, p4=1/16, p5=1/32, p6=1/32. Find the rate of information if there is 16 outcomes per second

A) 15 bits/second

B) 16 bits/second

C) 31 bits/second

D) 32 bits/ second

89. The line of sight communication requires the transmit and receive antennas to face each other. If the transmit antenna is vertically polarized, for best reception the receive antenna should be

A)horizontally polarized

B)vertically polarized

C)at 45 degrees with respect to horizontal polarization

D)at 45 degrees with respect to vertical polarization

90. Consider a lossless antenna with a directive gain of +6dB. If 1 mW of power is fed to it the total power radiated by the antenna will be

A) ¼ mW B) 1mW

C) 3mW D) 4mW