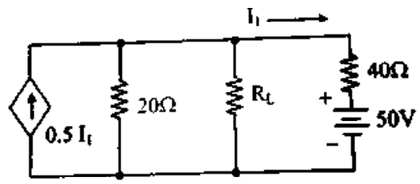
PART–B
ELECTRONIC ENGGINEERING

51. In this network of Fig., the maximum power is delivered to R_L if its value is



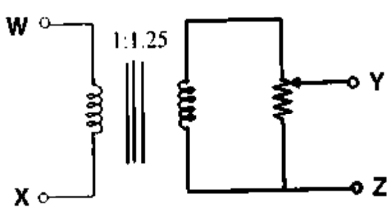
(A) 16Ω

(B) (40/3)Ω

(C) 60Ω

(D) 20Ω

52. The following arrangement consists of an ideal transformer and an attenuator which attenuates by a factor of 0.8. An ac voltage V_{WX1} = 100 V is applied across WX to get open circuit voltage V_{YZ1} across YZ. Next, an ac voltage V_{YZ2} = 100 V is applied across YZ to get an open circuit voltage V_{WX2} across WX. Then, V_{YZ1}/V_{WX1}, V_{WX2}/V_{YZ2} are respectively,



(A) 125/100 and 80/100

(B) 100/100 and 80/100

(C) 100/100 and 100/100

(D) 80/100 and 80/100

53. The time domain behavior of an RL circuit is represented by

$$L\frac{di(t)}{dt} + Ri = V_0(1 + Be^{-Rt/L}\sin t)\,u(t)$$

For an initial current of i(0) = V_0 / R, the steady state value of the current is given by

(A) i(t) $\to$ V_0 / R

(B) i(t) $\to$ $2V_0$ / R

(C) i(t) $\to$ V_0 / R (1+B)

(D) i(t) $\to$ $2V_0$ / (1+B)

54. A 230 V rms source supplies power to two loads connected in parallel. The first load draws 10 kW at 0.8 leading power factor and the second one draws 10 kVA at 0.8 lagging power factor. The complex power delivered by the source is

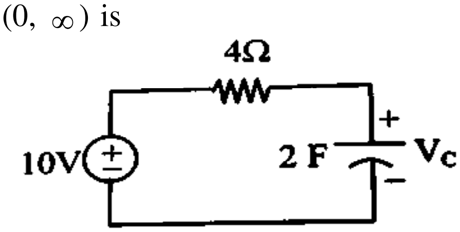
(A) (18 + j 1.5) kVA

(B) (18 – j 1.5) kVA

(C) (20 + j 1.5) kVA

(D) (20 – j 1.5) kVA

55. In the circuit of Fig., energy absorbed by the 4Ω resistor in the time interval (0, ∞) is



$V_C(0) = 6$ V

(A) 36 Joules

(B) 16 Joules

(C) 256 Joules

(D) None of the above

56. An LC tank circuit consists of an ideal capacitor C connected in parallel with a coil of inductance L having an internal resistance R. The resonant frequency of the tank circuit is

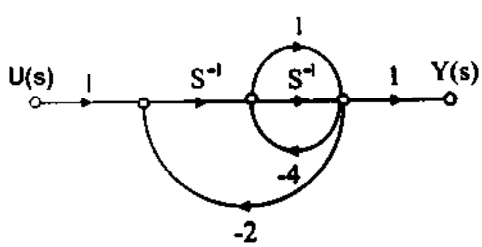
(A) $\frac{1}{2\pi\sqrt{LC}}$

(B) $\frac{1}{2\pi\sqrt{LC}}\sqrt{1-R^2\frac{C}{L}}$

(C) $\frac{1}{2\pi\sqrt{LC}}\sqrt{1-\frac{L}{R^2C}}$

(D) $\frac{1}{2\pi\sqrt{LC}}\left(1-R^2\frac{C}{L}\right)$

57. The signal flow graph for a system is given below. The transfer function $\frac{Y(s)}{U(s)}$ for this system is



(A) $\frac{s+1}{5s^2+6s+2}$

(B) $\frac{s+1}{s^2+6s+2}$

(C) $\frac{s+1}{s^2+4s+2}$

(D) $\frac{1}{5s^2+6s+2}$

58. A causal system having the transfer function $G(s) = \frac{1}{s+2}$ is excited with 10 u(t). The time at which the output reaches 99% of its steady state value is

(A) 2.7 sec

(B) 2.5 sec

(C) 2.3 sec

(D) 2.1 sec

59. The unit step response of an under damped second order system has steady value of –2. Which one of the following transfer functions has these properties?

(A) $\frac{-2.24}{s^2+2.59s+1.12}$

(B) $\frac{-3.82}{s^2+1.91s+1.91}$

(C) $\frac{-2.24}{s^2-2.59s+1.12}$

(D) $\frac{-3.82}{s^2-1.91s+1.91}$

60. The root locus of the system

$G(s)\,H(s) = \frac{K}{s(s+2)(s+3)}$,

has the break-away point located at

(A) (–0.5, 0)

(B) (–2.548, 0)

(C) (–4, 0)

(D) (–0.784, 0)

61. The gain margin for the system with open-loop transfer function G(s)H(s) $= \frac{2(1+s)}{s^2}$ is

(A) ∞

(B) 0

(C) -1

(D) $-\infty$

62. The magnitude of frequency response of an underdamped second order system is 5 at 0 rad/sec and peaks to $\frac{10}{\sqrt{3}}$ at $5\sqrt{2}$ rad/sec. The transfer function of the system is

(A) $\frac{500}{s^2+10s+100}$

(B) $\frac{375}{s^2+5s+75}$

(C) $\frac{720}{s^2+12s+144}$

(D) $\frac{1125}{s^2+25s+225}$

63. Silicon is doped with boron to a concentration of 4×10^{17} atoms/cm^3. Assume the intrinsic carrier concentration of silicon to be 1.5×10^{10} /cm^3 and the value of $\frac{KT}{q}$ to be 25 mV at 300°K. Compared to undoped silicon, the Fermi level of doped silicon

(A) Goes down by 0.13 eV

(B) Goes up by 0.13 eV

(C) Goes down by 0.427 eV

(D) Goes up by 0.427 eV

64. At 300°K for a diode current of 1mA a certain germanium diode requires a forward bias of 0.1435 V. Whereas a certain silicon diode requires a forward bias of 0.718 V. Under the conditions stated above the closed approximation of the ratio of reverse saturation current in Ge diode to that in silicon diode is

(A) 1

(B) 5

(C) 4×10^3

(D) 8×10^3

65. If the base width in a bipolar junction transistor is doubled, which one of the following statements will be TRUE?

(A) Current gain will increase

(B) Unity gain frequency will increase

(C) Emitter-base junction capacitance will increase

(D) Early voltage will increase

66. A long-channel NMOS transistor is biased in the linear region V_{DS} = 50 mV and is used as a resistance. Which one of the following statements is NOT correct?

(A) If the device width W is increased, the resistance decreases

(B) If the threshold voltage is reduced, the resistance decreases

(C) If the device length L is increased, the resistance increases

(D) If V_{GS} is increased, the resistance increases

67. For an n-channel enhancement type MOSFET if the source is connected at a higher potential than that of the bulk (i.e. $V_{SB} > 0$), the threshold voltage V_T of the MOSFET will

(A) remain unchanged

(B) decrease

(C) change polarity

(D) increase

68. When the gate-to-source voltage (V_{GS}) of a MOSFET with threshold voltage of 400 mV, working in saturation is 900 mV, the drain current is observed to be 1 mA, Neglecting the channel Length modulation effect and assuming that the MOSFET is operating at saturation. The drain current for an applied V_{GS} of 1400 mV is

(A) 0.5 mA

(B) 2.0 mA

(C) 3.5 mA

(D) 4.0 mA

69. If the emitter resistance in a common-emitter voltage amplifier is not bypassed, it will

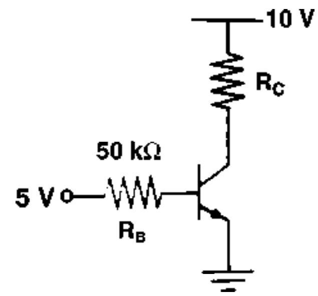
(A) reduce both the voltage gain and the input impedance

(B) reduce the voltage gain and increase the input impedance

(C) increase the voltage gain and reduce the input impedance

(D) increase both the voltage gain and the input impedance

70. In the circuit shown, the silicon BJT has $\beta = 50$. Assume $V_{BE} = 0.7$ V and $V_{CE(sat)} = 0.2$ V. Which one of the following statements is correct?



(A) For $R_c = 1$ kΩ, the BJT operates in the saturation region.

(B) For $R_c = 3$ kΩ, the BJT operates in the saturation region.

(C) For $R_c = 20$ kΩ, the BJT operates in the cut-off region.

(D) For $R_c = 20$ kΩ, the BJT operates in the linear region.

71. An amplifier using an Op-Amp with a Slew-Rate SR = 1 V/μsec, has a gain of 40 dB. If this Amplifier has to faith fully amplify sinusoidal signals from dc to 20 KHz. Without introducing any Slew Rate induced distortion, then the input signal level must not exceed

(A) 795 mV

(B) 395 mV

(C) 79.5 mV

(D) 39.5 mV

72 An amplifier without feedback has a voltage gain of 50, input resistance of 1 kΩ and output resistance of 2.5 kΩ. 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 kΩ

(B) 1/5 kΩ

(C) 5 kΩ

(D) 11 kΩ

73. A power amplifier delivers 50 W output at 50% efficiency. The ambient temperature is 25°C. If the maximum allowable junction temperature is 150°C, then the maximum thermal resistance θ_{Jc} that can be tolerated is

(A) 5°C/W

(B) 2.5°C/W

(C) 4.5°C/W

(D) 2.8°C/W

74. If the unregulated voltage increases by 20% the power dissipation across the transistor Q_1

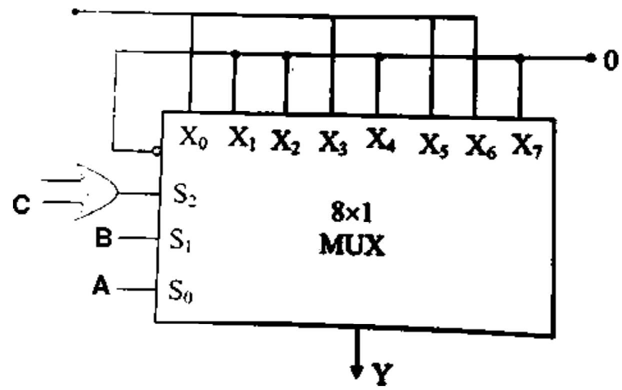
(A) increases by 20%

(B) increases by 50%

(C) remains unchanged

(D) decreases by 20%

75. In the TTL circuit in the figure, S_2 and S_0 are select lines and X_7 and X_0 are input lines. S_0 and X_0 are LSB's. The output Y is



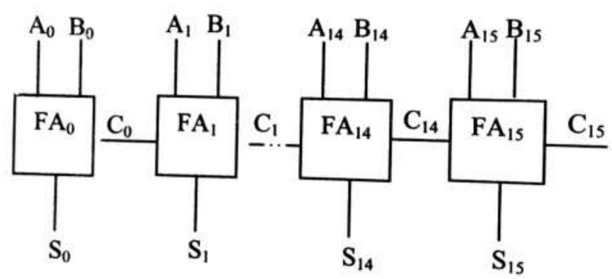
(A) Indeterminate

(B) $A \oplus B$

(C) $\overline{A \oplus B}$

(D) $\overline{C}(\overline{A \oplus B}) + C(A \oplus B)$

76. A 16-bit ripple carry adder is realized using 16 identical full adders (FA) as shown in the figure. The carry-propagation delay of each FA is 12 ns and the sum-propagation delay of each FA is 15 ns. The worst case delay (in ns) of this 16-bit adder will be



(A) 195 ns

(B) 180 ns

(C) 200 ns

(D) 420 ns

77. A pulse train with a frequency of 1 MHz is counted using a modulo-1024 ripple-counter built with J-K flip flops. For proper operation of the counter, the maximum permissible propagation delay per flip flop stage is _________

(A) 200 ns

(B) 300 ns

(C) 100 ns

(D) 150 ns

78. A 0 to 6 counter consists of 3 flip-flops and a combination circuit of 2 input gate(s). The combination circuit consists of

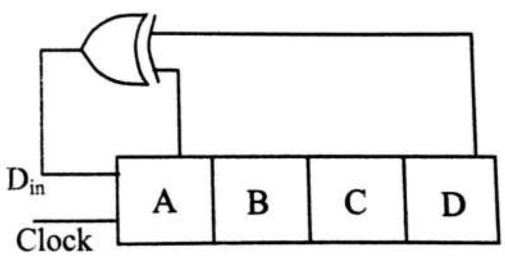
(A) one AND gate

(B) one OR gate

(C) one AND gate and one OR gate

(D) two AND gates

79. A 4-bit shift register circuit configured for right-shift operation is $D_{in} \rightarrow A, A \rightarrow B, B \rightarrow C, C \rightarrow D$ is shown. If the present state of the shift register is ABCD = 1101, the number of clock cycles required to reach the state ABCD = 1111 is



(A) 10

(B) 11

(C) 09

(D) 12

80. A logic family has threshold voltage V_T = 2 V, minimum guaranteed output high voltage V_{OH} = 4 V, minimum accepted input high voltage V_{IH} = 3 V, maximum guaranteed output low voltage V_{OL} = 1 V, and maximum accepted input low voltage V_{IL} = 1.5 V. Its noise margin is

(A) 2 V

(B) 1 V

(C) 1.5 V

(D) 0.5 V

81. The following sequence of instructions are executed by an 8085 microprocessor :

1000 : LXI SP, 27FF

1003 : CALL 1006

1006 : POP H

The contents of the stack pointer (SP) and the HL register pair on completion or execution of these instructions are :

(A) SP = 27FF, HL = 1003

(B) SP = 27FD, HL = 1003

(C) SP = 27FF, HL = 1006

(D) SP = 27FD, HL = 1006

82. Following is the segment of a 8085 assembly language program :

LXI SP, EFFFH

CALL 3000H

3000H: LXI H, 3CF4H

PUSH PSW

SPHL

POP PSW

RET

On completion of RET execution, the contents of SP is

(A) 3CF0H

(B) 3CF8H

(C) EFFDH

(D) EFFFH

83. The value of the integral $\int_{-\infty}^{\infty} \sin c^2(5t)dt$ is

(A) 0.1

(B) 0.2

(C) 0.5

(D) 0.4

84. A 5-point sequence x[n] is given as x[–3] = 1, x[–2] = 1, x[–1] = 0, x[0] = 5, x[1] = 1. Let $X(e^{j\omega})$ denote the discrete-time Fourier transform of x[n]. The value of $\int_{-\pi}^{\pi} X(e^{j\omega})d\omega$ is

(A) 5

(B) 10π

(C) 16π

(D) $5 + j\ 10\pi$

85. A continuous-time speech signal $x_a(t)$ is sampled at a rate of 8 kHz and the samples are subsequently grouped in blocks each of size N. The DFT of each block is to be computed in real time using the radix-2 decimation-in-frequency FFT algorithm. If the processor performs all operations sequentially, and takes 20 μs for computing each complex multiplication (including multiplications by 1 and –1) and the time required for addition/subtraction is negligible, then the maximum value of N is ....

(A) 2098

(B) 4096

(C) 2048

(D) 1024

86. The z-transform of a signal is given by $C(z) = \frac{1}{4}\frac{z^{-1}(1-z^{-4})}{(1-z^{-1})^2}$. Its final value is

(A) 1/4

(B) zero

(C) 1.0

(D) infinity

87. The response of an initially relaxed linear constant parameter network to a unit impulse applied at t = 0 is $4e^{-2t}$ u(t). The response of this network to a unit step function will be

(A) $2[1 - e^{-2t}]$ u(t)

(B) $4[e^{-t} - e^{-2t}]$ u(t)

(C) sin 2t

(c) $(1 - 4e^{-4t})$ u(t)

88. A causal LTI system is described by the difference equation
$2y[n] = \alpha y[n-2] - 2x[n] + \beta x[n-1]$.
The system is stable only if
(A) $|\alpha| = 2, |\beta| < 2$
(B) $|\alpha| > 2, |\beta| > 2$
(C) $|\alpha| < 2$, any value of β
(D) $|\alpha| < 2$, any value of α

89. A system with the transfer function $\frac{Y(s)}{X(s)} = \frac{s}{s+p}$ has an output $y(t) = \cos\left(2t - \frac{\pi}{3}\right)$ for the input signal $x(t) = p\cos\left(2t - \frac{\pi}{2}\right)$. Then, the system parameter 'p' is
(A) $\sqrt{3}$
(B) $\frac{2}{\sqrt{3}}$
(C) 1
(D) $\frac{\sqrt{3}}{2}$

90. A signal, $f(t) = e^{-at}u(t)$, where u(t) is the unit step function, is applied to the input of a low-pass filter having
$$|H(\omega)| = \frac{b}{\sqrt{\omega^2 + b^2}}$$
Calculate the value of the ratio, $\frac{a}{b}$, for which 50% of the input signal energy is transferred to the output.
(A) 1
(B) 2/3
(C) 3
(D) 4/5

91. A super heterodyne receiver is to operate in the frequency range 550 kHz – 1650 kHz, with the intermediate frequency of 450 kHz. Let $R = \frac{C_{max}}{C_{min}}$ denote the required capacitance ratio of the local oscillator and I denote the image frequency (in kHz) of the incoming signal. If the receiver is tuned to 700 kHz, then
(A) R = 4.41, I = 1600
(B) R = 2.10, I = 1150
(C) R = 3.0, I = 1600
(D) R = 9.0, I = 1150

92. A message signal with bandwidth 10 kHz is Lower-Side Band SSB modulated with carrier frequency $f_{c1} = 10^6$ Hz. The resulting signal is then passed through a Narrow-Band Frequency Modulator with carrier frequency $f_{c2} = 10^9$ Hz. The bandwidth of the output would be
(A) 4×10^4 Hz
(B) 2×10^6 Hz
(C) 2×10^9 Hz
(D) 2×10^{10} Hz

93. A modulating signal given by $x(t) = 5\sin(4\pi 10^3 t - 10\pi\cos 2\pi 10^3 t)$ V is fed to a phase modulator with phase deviation constant $k_p = 5$ rad/V. If the carrier frequency is 20 kHz, the instantaneous frequency (in kHz) at t = 0.5 ms is ____
(A) 150 kHz
(B) 70 kHz
(C) 75 kHz
(D) 100 kHz

94. The input to a 1-bit quantizer is a random variable X with pdf $f_x(x) = 2e^{-2x}$ for $x \geq 0$ and $f_x(x) = 0$ for $x < 0$. For outputs to be of equal probability, the quantizer threshold should be ________

(A) 0.345

(B) 0.5

(C) 0.25

(D) 0.125

95. In a PCM system, the signal $m(t) = \{\sin(100\pi t) + \cos(100\pi t)\}$ V is sampled at the Nyquist rate. The samples are processed by a uniform quantizer with step size 0.75 V. The minimum data rate of the PCM system in bits per second is __________

(A) 400 bps

(B) 200 bps

(C) 100 bps

(D) 300 bps

96. A fair coin is tossed repeatedly until a 'Head' appears for the first time. Let L be the number of tosses to get this first 'Head'. The entropy H(L) in bits is _______

(A) 2 bits

(B) 4 bits

(C) 1 bit

(D) 0

97. Consider a vector field $\overline{A}(\overline{r})$. The closed loop line integral $\oint \vec{A} \bullet \vec{dl}$ can be expressed as

(A) $\oiint (\nabla \times \vec{A}) \bullet d\vec{s}$ over the closed surface bounded by the loop

(B) $\oiiint (\nabla \bullet \vec{A}) dv$ over the closed volume bounded by the loop

(C) $\iiint (\nabla \bullet \vec{A}) dv$ over the open volume bounded by the loop

(D) $\iint (\nabla \times \vec{A}) \bullet d\vec{s}$ over the open surface bounded by the loop

98. A plane wave of wavelength λ is travelling in a direction making an angle 30° with positive x-axis and 90° with the positive y-axis. The $\vec{E}$ field of the plane wave can be represented as (E_0 is a constant)

(A) $\vec{E} = \hat{y} E_0 \, e^{j\left(\omega t - \frac{\sqrt{3}\pi}{\lambda} x - \frac{\pi}{\lambda} z\right)}$

(B) $\vec{E} = \hat{y} E_0 \, e^{j\left(\omega t - \frac{\pi}{\lambda} x - \frac{\sqrt{3}\pi}{\lambda} z\right)}$

(C) $\vec{E} = \hat{y} E_0 \, e^{j\left(\omega t + \frac{\sqrt{3}\pi}{\lambda} x + \frac{\pi}{\lambda} z\right)}$

(D) $\vec{E} = \hat{y} E_0 \, e^{j\left(\omega t - \frac{\pi}{\lambda} x + \frac{\sqrt{3}\pi}{\lambda} z\right)}$

99. If the electric field of a plane wave is

$$\vec{E}(z,t) = \hat{x}3\cos(\omega t - kz + 30^\circ) - \hat{y}4\sin(\omega t - kz + 45^\circ) \text{ (mV/m)}$$

The polarization state of the plane wave is

(A) left elliptical

(B) left circular

(C) right elliptical

(D) right circular

100. A rectangular waveguide of internal dimensions (a = 4 cm and b = 3 cm) is to be operated in TE_{11} mode. The minimum operating frequency is

(A) 6.25 GHz

(B) 6.0 GHz

(C) 5.0 GHz

(D) 3.75 GHz

ROUGH WORK

ROUGH WORK

Answer Key: Electronics Engg

51. A

52. B

53. A

54. B

55. B

56. B

57. A

58. C

59. B

60. D

61. B

62. A

63. C

64. C

65. D

66. D

67. D

68. D

69. B

70. B

71. C

72. B

73. B

74. B

75. B

76. A

77. C

78. D

79. A

80. D

81. C

82. B

83. B

84. B

85. B

86. C

87. A

88. C

89. B

90. A

91. A

92. B

93. B

94. A

95. B

96. A

97. D

98. A

99. A

100. A