PART III

11 - BIO-MEDICAL ENGINEERING

(Answer ALL questions)

41. Which type of collagen represents 90% to 95% of the collagen in ECM and forms fibrils and fibres interwines with proteoglycan aggregates?
    a. Type II
    b. Type I
    c. Type IX and X
    d. Type L

42. Which of the following is the cardiac output?
    a. Stroke volume/heart rate
    b. Stroke volume × heart rate
    c. Stroke volume × resistance
    d. Heart rate/resistance

43. During respiration, the gaseous exchange takes place in
    a. Trachea and larynx
    b. Alveoli and throat
    c. Throat and Lungs
    d. Lungs and Alveoli

44. Centre for Pressure and Touch lies in
    a. Midbrain
    b. Occipital lobe
    c. Frontal lobe
    d. Parietal lobe

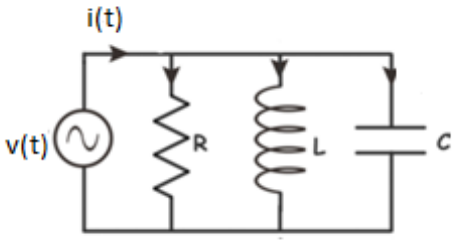
45. Which of the following is the TCA cycle metabolite used in the detoxification of ammonia in brain?
    a. Ornithine
    b. α -ketoglutarate
    c. Oxaloacetate
    d. Glycine

46. Which of the following does not have a negative effect on PFK?
    a. ATP
    b. Citrate
    c. pH
    d. AMP

47. Which of the following inhibits acetyl-coA carboxylase in fatty acid synthesis?
    a. ATP
    b. Malonyl coA
    c. Palmitic acid
    d. Glucose

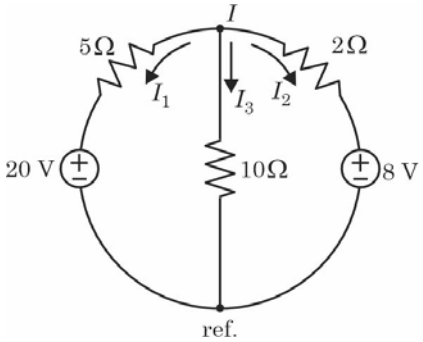
48. Which of the following behaves as a precursor for the synthesis of TGL and PL?
    a. Glycerol-3-phosphate
    b. Pyruvic acid
    c. Acetyl coA
    d. 2-Phospho glycerate

49. Find i(t) in the following circuit, given $R = 1/3\,\Omega$, L = 1/4 H, C = 3F and $v(t) = \sin 2t$



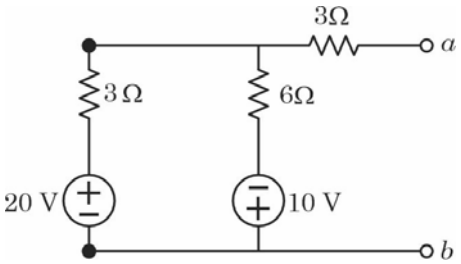
    a. $5\sin(2t + 53.1°)$
    b. $5\sin(2t - 53.1°)$
    c. $25\sin(2t + 53.1°)$
    d. $25\sin(2t - 53.1°)$

50. Find I_1, I_2 and I_3 for the following circuit



    a. –2A, –1A and 1A respectively
    b. 2A, 1A and 1A respectively
    c. –2A, 1A and 1A respectively
    d. –2A, 2A and 1A respectively

51. Find V_{th} and R_{th} for the following circuit



a. V_{th} = 10V and R_{th} = 5 Ω respectively

b. V_{th} = 20V and R_{th} = 5 Ω respectively

c. V_{th} = 10V and R_{th} = 9 Ω respectively

d. V_{th} = 20V and R_{th} = 9 Ω respectively

52. The voltage v = 12 cos (60t + 45°) is applied to a 0.1-H inductor. Find the steady-state current through the inductor.

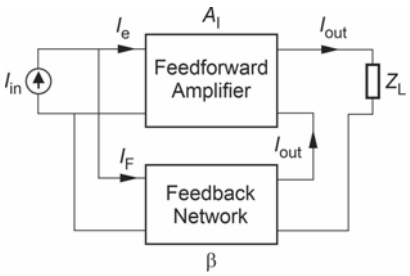
a. i(t) = 2 sin (60t –45°) A

b. i(t) = 2 cos (60t - 45°) A

c. i(t) = 2 cos (60t + 45°) A

d. i(t) = 2 sin (60t + 45°) A

53. Consider the negative feedback system shown in the Fig. with Ro as output resistance of the feedforward amplifier. The overall output resistance of the negative feedback amplifier is



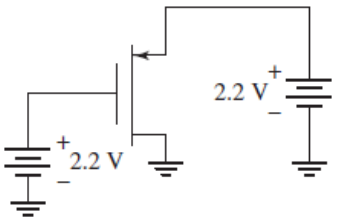
a. $Ro(1 + A_I\beta)$

b. $\dfrac{R_o}{1 + A_i\beta}$

c. $R \circ \beta$

d. $\dfrac{R_o}{\beta}$

54. For the MOSFET transistor shown in the below Figure, operating region of the transistor is



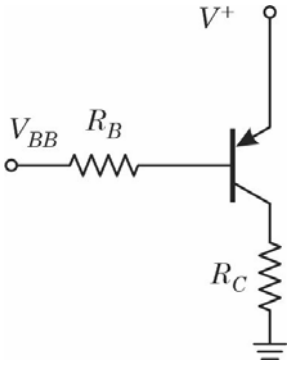
a. Triode

b. Saturation

c. Cutoff

d. Velocity Saturation

55. What is the slope of the output load line characteristic for the circuit shown in the below Figure?



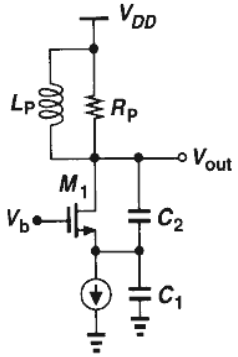
a. $-1/R_C$

b. $-1/(R_C + R_B)$

c. $-1/(R_B)$

d. $-1/(R_C \parallel R_B)$

56. What is the minimum voltage gain required for the Colpitts Oscillator shown in the below Figure for sustained oscillation is?



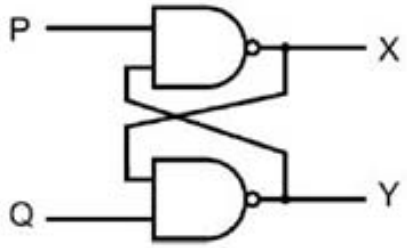
a. 1

b. 3

c. 4

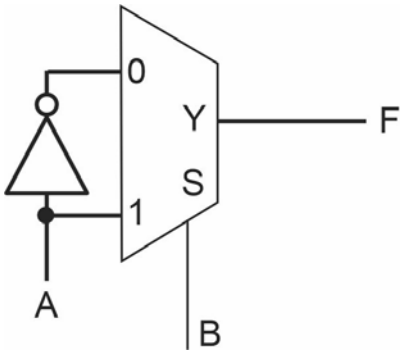
d. 2

57. What are the invalid inputs in the following flip flop?



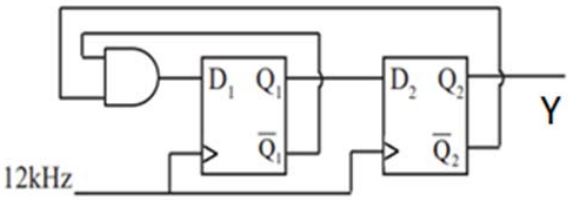
a. P = 0, Q = 0
b. P = 0, Q = 1
c. P = 1, Q = 0
d. P = 1, Q = 1

58. Which is the boolean expression at F in the following figure?



a. F = AB
b. F = A + B
c. F = A XOR B
d. F = A XNOR B

59. What is the frequency of the waveform at Y?



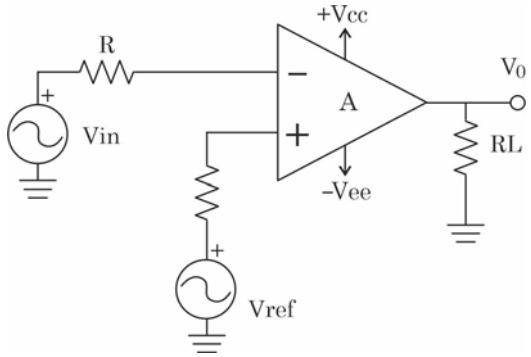
a. 2 kHz
b. 3 kHz
c. 4 kHz
d. 6 kHz

60. Which is the Hexadecimal equivalent of 1100101011101011_2?
a. 6FA3
b. CAEB
c. ED2F
d. 4FAB

61. The basic step of an 8-bit DAC is 12.4 mV. If the binary input 00000000 represents 0V. Determine the output, if the input is 10110111?
a. 1.36 V
b. 2.27 V
c. 5.45 V
d. 3.25 V

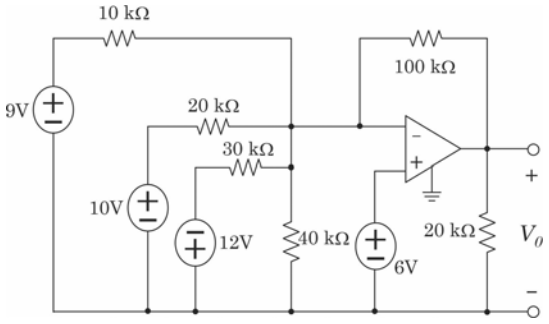
62. Which IC is a fixed positive voltage regulator?
a. LM78XX
b. LM79XX
c. LM2576
d. LM2596

63. Which is the correct option for the circuit shown below to get an output Vo as -Vcc?



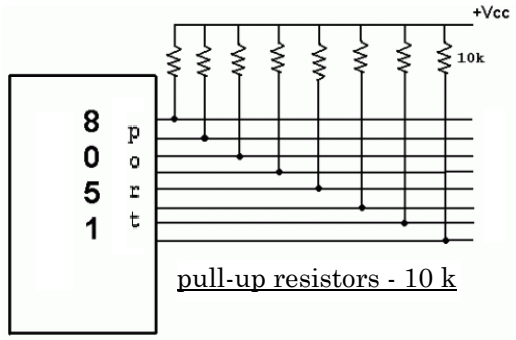
a. $V_{ref} > V_{in}$
b. $V_{ref} < V_{in}$
c. $V_{ref} = V_{in}$
d. None of the above

64. What is the output voltage Vo for the circuit shown below?



a. 31
b. 12
c. 21
d. 11

65. Which port in 8051microcontroller requires external pull up as shown below?



a. Port 0
b. Port 1
c. Port 2
d. Port 3

66. The instruction XLAT in 8086 microprocessor is used to
a. Translate a byte in AL using a table index
b. Transfer data from source to destination
c. Push the contents of specified source on to the stack
d. Exchange the contents of source with destination

67. In 8085 microprocessor, two address lines namely A13 and A6 have become faulty and are stuck at logic 0. Which of the following address locations cannot be accessed in the memory?
a. 0000H
b. 1F1FH
c. 1FFFH
d. 1F0FH

68. For the given 8086 microprocessor instructions below, which of the following is an invalid instruction?
a. MOV BX, [0301 H]
b. MOV CX, 037AH
c. MOV AL,BL
d. MOV DS, 4100H

69. Consider a system output $y(t)$ is related to its input $x(t)$ as, $y(t) = x(t) + \cos(x(t))$. This system is
a. linear and time invariant
b. linear and time variant
c. non-linear and time invariant
d. non-linear and time variant

70. A continuous system is described by $y(t) = x(t)\cos(200\pi t)$. If $x(t)$ is a two tone signal with frequencies 25 Hz & 50 Hz then, the frequency components present in $y(t)$ will be
a. 25 Hz & 50 Hz
b. 100 Hz
c. 50 Hz, 75 Hz, 125 Hz & 150 Hz
d. 25 Hz, 50 Hz, 75 Hz & 150 Hz

71. Let a discrete time signal $x(n)$ has Z-transform $X(z) = 1/(1+2\ z^{-1})$, $|z| > 2$. If its Fourier transform is denoted as $X(e^{j\omega})$ then,
a. $X(e^{j\omega}) = 1/(1+2e^{j\omega})$
b. $X(e^{j\omega}) = 1/(j\omega+2)$
c. $X(e^{j\omega}) = 1/(1+2\ e^{-j\omega})$
d. $X(e^{j\omega})$ does not exist

72. A single tone real signal $x[n]$ has its 8 point DFT denoted by $X(k)$ which has $X(2) = 2$. Then, the signal $x[n]$ will be equal to
a. $2e^{j\pi n/4}$
b. $2\cos(\pi n/2)$
c. $2\sin(\pi n/2)$
d. $4\cos(\pi n/2)$

73. The number of stages in radix-2 DIT FFT for N = 8 is
a. 5
b. 3
c. 4
d. 1

74. The minimum number of delay elements and multipliers required to implement linear phase filter with impulse response $h(n)$ defined for $n > 0$ and $n < 8$ are
a. 7, 8
b. 7, 4
c. 6, 6
d. 7, 5

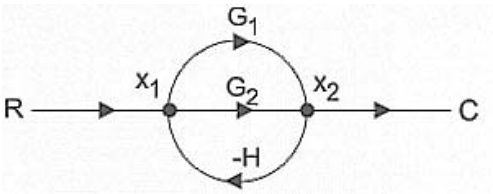
75. In 1024 point DFT of a signal sampled at 8192 Hz, k = 8 corresponds to a frequency of

a. 64 Hz
b. 32 Hz
c. 16 Hz
d. 8 Hz

76. The width of the transition band of a linear phase band pass FIR filter is given as 0.1π. The order of the filter designed using Blackman window is

a. 12
b. 25
c. 54
d. 110

77. Use mason's gain formula to find the transfer function of the given figure



a. G_1+G_2
b. $G_1+G_1/1-G_1H+G_2H$
c. $G_1+G_2/1+G_1H+G_2H$
d. G_1-G_2

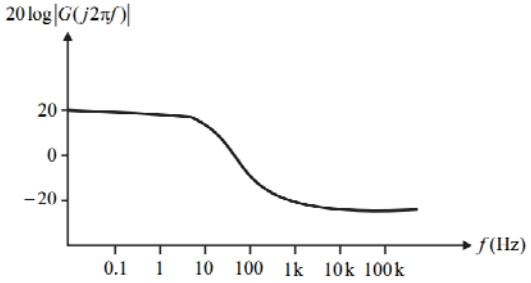
78. The transfer function of the system is $G(s) = 100/(s+1)(s+100)$. For a unit step input to the system the approximate settling time for 2% criterion is:

a. 100 sec
b. 4 sec
c. 1 sec
d. 0.01 sec

79. The range of K for the stability of system is $0 < K < 100$. For $K = 10$, The gain Margin of the system

a. 10
b. 5
c. 0.1
d. 0.5

80. A Bode magnitude plot for the transfer function $G(s)$ of a plant is shown below. Which one of the following transfer functions best describes the plant?



a. $\frac{1000(s+10)}{s+100}$
b. $\frac{10(s+10)}{s(s+1000)}$
c. $\frac{s+1000}{10s(s+10)}$
d. $\frac{s+1000}{10(s+10)}$

81. Which of following techniques requires timing synchronization between transmitter and receiver?

a. AM
b. FM
c. FDMA
d. TDMA

82. If a uniform quantizer with sinusoidal input signal produces the output SNR of 43.76 dB, determine the number of quantization levels used

a. 256
b. 128
c. 32
d. 64

83. An AM modulator develops an unmodulated power of 400 W and power of 450 W when modulated with modulation index of μ across the resistive load. Then the value of μ is

a. 0.5
b. 0.6
c. 0.7
d. 0.8

84. If a discrete memory less source emits symbols with probabilities 0.2, 0.2, 0.2, 0.2 and 0.2, determine the entropy of the source
a. 2
b. 3
c. 2.32
d. 3.23

85. Respiration rate is measured using _____.
a. RTD
b. Strain gauge
c. Ultrasonics
d. Thermocouple

86. The impedance of Biopotential electrode is _____ at high frequency.
a. Low
b. High
c. Moderate
d. Zero

87. Muscle artifacts in ECG signal are eliminated using
a. Highpass filter with cutoff frequency 0.05 Hz
b. Highpass filter with cutoff frequency 100 Hz
c. Lowpass filter with cutoff frequency 0.05 Hz
d. Lowpass filter with cutoff frequency 100 Hz

88. The greatest volume of gas that can be inspired by voluntary effort after maximum expiration is a
a. Inspiratory capacity
b. Total lung capacity
c. Vital capacity
d. Tidal Volume

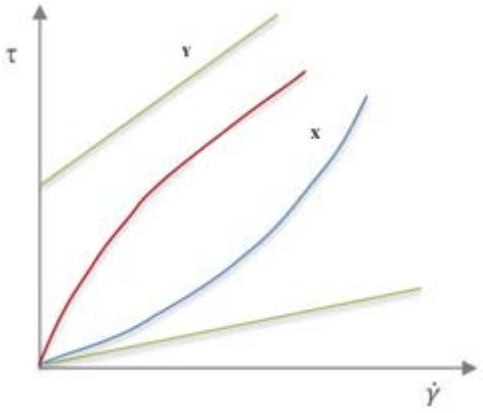
89. In surgical diathermy when the needle point electrode are stuck into the tissue and kept steady. This refers to
a. Electrotomy
b. Fulguration
c. Coagulation
d. Desiccation

90. Which of the following are the requirements for a single channel ECG telemetry system?
a. Muscle potential interference alone should be kept maximum
b. Motion artifacts and muscle potential interference to be kept maximum
c. Motion artifacts and muscle potential interference to be kept medium
d. Motion artifacts and muscle potential interference to be kept minimum

91. The equipment used for extra corporeal circulation of blood during cardiac surgery is called
a. Ventilator
b. Dialyser
c. Heart lung machine
d. Pacemaker

92. The membrane used for dialysis is made of
a. Polyethylene
b. Cellulose
c. Polyvinyl Chloride
d. Chitin

93. From the given graph of shear stress Vs strain rate the *X* and *Y* depicts _____ fluid property.



a. X-Pseudo plastic, Y-Newtonian
b. X-Dilatant, Y-Bingham plastic
c. X-Newtonian, Y-Thixotropic
d. X-Thixotropic, Y-Dilatant

94. A high strength steel rod E = 200 GPa and poisons ratio is 0.31 with a diameter of 5 cm is being subjected to a compressive load of 10 KN and experiencing a stress of 5 MPa. Compute the axial strain and the lateral strain.

a. Axial strain-25 μ strain, Lateral strain-8 μ strain

b. Axial strain-25 μ strain, Lateral strain-78 μ strain

c. Axial strain-78 μ strain, Lateral strain-25 μ strain

d. Axial strain-8 μ strain, Lateral strain-25 μ strain

95. A small artery has a length of 1.1 mm and a radius of 25 μ m. If the pressure drop across the artery is 1.3 KPa, calculate the flow rate. The viscosity of the blood is 3 Pa.second.

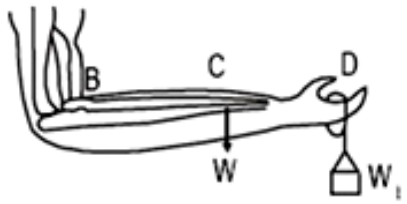
a. 16×10^{-16} m^3/sec

b. 25×10^{-17} m^3/sec

c. 6×10^{-14} m^3/sec

d. 32×10^{-15} m^3/sec

96. For the given figure BC = 15 cm, BD = 35 cm, W = 20 N, W1 = 80 N compute the net moment at the joint B



a. 19 Nm

b. 31 Nm

c. 28 Nm

d. 300 Nm

97. Which one of the following is not a characteristic of PET?

a. Positron emitters

b. Lead collimators

c. 511 keV photons

d. Absolute attenuation correction

98. The visibility of anatomical detail in a CT image will increase when:

a. The field of view is increased.

b. The matrix size is decreased.

c. The smoothing filter algorithm is used.

d. The slice thickness is decreased

99. S1: Ultrasound velocity in bone is greater than in the brain

S2: Ultrasound acoustic impedance is not related to the density of matter

a. S1 is True & S2 True

b. S1 is True & S2 False

c. S1 is False & S2 False

d. S1 is False & S2 True

100. What is T1 Relaxation time?

a. Spin-Lattice relaxation

b. Spin-Spin relaxation

c. Spin-recovery relaxation

d. Spin-echo relaxation