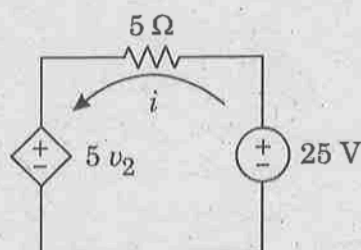


PART III

17 - INSTRUMENTATION, ELECTRONICS AND CONTROL ENGINEERING

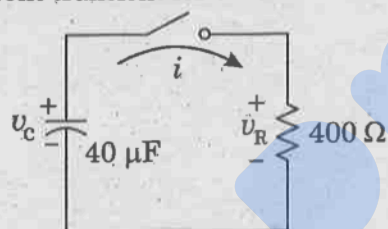
(Answer ALL questions)

56. The current i in the circuit shown when $v_2 = 4V$ is



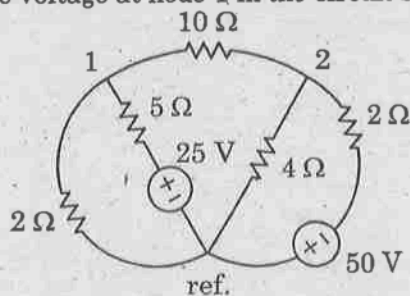
- a. 1 A
b. -1 A
c. 9 A
d. -9 A

57. In the circuit shown at $t = 0^-$ before switch is closed the capacitor voltage is $v_c = 100V$. The current transient for $t > 0$ is



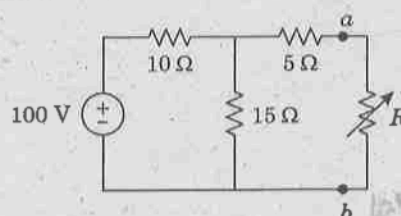
- a. $i = 2.5e^{-16t}$
b. $i = 2.5e^{-62.5t}$
c. $i = 0.25e^{-16t}$
d. $i = 0.25e^{-62.5t}$

58. The voltage at node 1 in the circuit shown is



- a. 4.96 V
b. 3.23 V
c. 2.61 V
d. 1.42 V

59. The value of variable resistance R in the circuit which results in maximum power transferred to it is

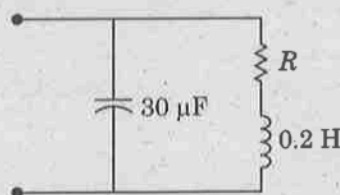


- a. 11 Ω
b. 12.5 Ω
c. 15 Ω
d. 25 Ω

60. A series RL circuit with $R = 10\Omega$ and $L = 20 \text{ mH}$ has a current of $i = 2 \sin 500t$ under steady state. Then the angle by which the current i will lag the source voltage is

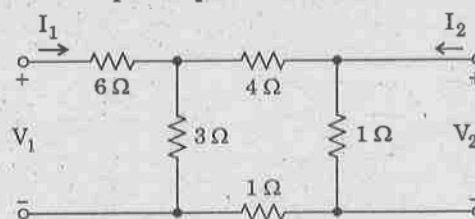
- a. 25°
b. 35°
c. 45°
d. 55°

61. The resonant frequency of the circuit shown when $R = 50 \Omega$ is

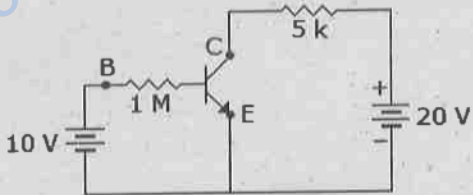


- a. 65 Hz
b. 60.2 Hz
c. 54.6 Hz
d. 51.4 Hz

62. In the two-port network shown the open circuit input impedance is



- a. 0.33 Ω
b. 0.88 Ω
c. 3 Ω
d. 8 Ω

63. The auto-correlation of the sequence $\{1, 2, 1, 1\}$ is given by
- $\{1, 4, 6, 6, 5, 2, 1\}$
 - $\{1, 3, 5, 7, 5, 3, 1\}$
 - $\{6, 6, 6, 7\}$
 - $\{6, 6, 6, 6\}$
64. Fourier Transform of the sequence $x(n) = 2^n u(n)$ is
- $1/[1 - 2e^{-j\omega}]$
 - $1/[1 - e^{-j2\omega}]$
 - $1/[1 + 2e^{-j\omega}]$
 - Fourier Transform does not exist
65. For the signal $e^{j\omega_0 n}$ to be periodic with period N , the condition to be satisfied is (assume m is an integer):
- $\omega_0 = 2\pi m / N$
 - $2\pi \omega_0 / N = m$
 - $2\pi / N\omega_0 = m$
 - $\omega_0 = 2\pi N / m$
66. The System Function of a DT-LTI system is given by $H(z) = 1/[(1-0.5z^{-1})(1-2z^{-1})]$, $|z| > 2$
 The system can be characterized as
- Causal and stable
 - Stable but not causal
 - Causal but not stable
 - Neither causal nor stable
67. For N -point DFT, the speed improvement factor obtained in Radix-2 FFT algorithm over the direct computation is given by
- $(N/2)\log_2 N$
 - $\log_2 N$
 - $2N/(\log_2 N)$
 - $(\log_2 N)/(2N)$
68. Limit Cycle oscillations occur in _____ (i) _____ due to _____ (ii) _____
- (i) FIR filter (ii) Gibbs Phenomenon
 - (i) FIR filter (ii) Finite Precision arithmetic
 - (i) IIR filter (ii) Gibbs Phenomenon
 - (i) IIR filter (ii) Finite Precision arithmetic
69. When compared to Hanning window, Hamming Window offers?
- Reduction in main lobe width
 - Increase in main lobe width
 - Better attenuation of side lobe level
 - Poor attenuation of side lobe level
70. For a base current of $10\mu A$, what is the value of collector current in common emitter if $\beta_{dc} = 100$
- $10\mu A$
 - $100\mu A$
 - $1mA$
 - $10mA$
71. In a BJT circuit a pnp transistor is replaced by npn transistor. To analyze the new circuit
- replace all calculated voltages and currents by reverse values
 - all calculations done earlier have to be repeated
 - replace all calculated voltages by reverse values
 - replace all calculated currents by reverse values
72. In figure, what is the base current if $V_{BE} = 0.7V$
- 
- $10mA$
 - $9.3mA$
 - $10\mu A$
 - $9.3\mu A$
73. A forward voltage of 10 V is applied to a diode in series with a 1 kΩ load resistor. The voltage across load resistor is zero. It indicates that
- diode is short circuited
 - diode is open circuited
 - resistor is open circuited
 - diode is neither short circuited nor open circuited

74. A source follower with r_s = source resistance and r_d = drain resistance, has a voltage gain of
- $g_m r_d$
 - $g_m r_s$
 - $g_m r_s / (1 + g_m r_s)$
 - $g_m r_d / (1 + g_m r_d)$
75. An instrumentation amplifier has a high
- Output impedance
 - Power gain
 - CMRR
 - Supply voltage.
76. When the gate – to – source voltage (V_{GS}) of a MOSFET with a threshold of 400 mV, working in saturation is 900 mV, the drain current is observed to be 1 mA. Neglecting the channel width modulation effect and assuming that the MOSFET is operating at saturation, the drain current for an applied V_{GS} of 1400 mV is
- 0.5 mA
 - 2.0 mA
 - 3.5 mA
 - 4.0 mA
77. $(A + B \cdot C) \cdot (A + B' + C')$ would simplify to
- A
 - $A + B' + C'$
 - $A + B \cdot C$
 - $A \cdot B \cdot C$
78. Of the logic families mentioned below, the one that consumes the least power is
- low power TTL
 - low power Schottky TTL
 - CMOS
 - ECL
79. A data selector is also called a
- De-multiplexer
 - Priority encoder
 - Multiplexer
 - Decoder
80. The minimum number of comparators required to build an eight-bit simultaneous or flash A/D converter is
- 127
 - 63
 - 8
 - 255
81. The percentage resolution of an n-bit D/A converter can be computed by
- $[1/(2^n - 1)] \times 100$
 - $n/100$
 - $100/2^n$
 - $(2^{n-1})/100$
82. SHIFT LEFT instruction causes all bits shifted one position to the left with right-most bit set to zero. The effect is to
- multiply by 2
 - divide by 2
 - SET the most significant bit
 - RESET the most significant bit
83. The processor architecture that uses separate memory for program instructions and data is
- Von Neumann architecture
 - Pipeline architecture
 - Harvard architecture
 - Princeton architecture
84. A Schering bridge can be used for the measurement of _____
- Voltage
 - Current
 - Resistance
 - Capacitance
85. The opposite two ends of a Wheatstone bridge consists of _____
- Voltage and current source
 - e.m.f. and null detector
 - Resistance and capacitance
 - Inductance and impedance

86. Two resistance $R_1 = 100 \pm 5 \Omega$ and $R_2 = 150 \pm 15 \Omega$ are connected in series. If the error is specified as standard deviations, the resultant error will be _____
- $\pm 10 \Omega$
 - $\pm 10.6 \Omega$
 - $\pm 15.8 \Omega$
 - $\pm 20 \Omega$
87. A 0–400 V voltmeter has a guaranteed accuracy of 1% of full scale reading. The voltage measured by this instrument is 250 V. Calculate the limiting error in percentage.
- 4%
 - 2%
 - 2.5%
 - 1%
88. The power in a 3 phase four wire circuit can be measured by using _____
- 2 wattmeter
 - 4 wattmeter
 - 3 wattmeter
 - 1 wattmeter
89. Error in a transducer due to its slow response to input change is called
- Gross error
 - Limit error
 - Static error
 - Dynamic error
90. The standardization of AC potentiometer is done by
- Using DC standard source and d'Arsonval galvanometer
 - Using AC standard sources and transfer instruments
 - Directly using AC standard voltage sources
 - Using DC standard sources and transfer instruments
91. Thermistor can be preferred over RTD for its
- Accuracy and stability
 - Sensitivity and accuracy
 - Sensitivity and quick response time
 - Accuracy, stability and quick response time
92. A potentiometer is used to measure the displacement of a hydraulic ram. The potentiometer is 25 cm long, has a total resistance of 2500 ohms and is operating at 4W with a voltage source. It has linear resistance-displacement characteristics. Determine the sensitivity of the potentiometer in volts/cm
- 0.2 V/cm
 - 2 V/cm
 - 0.4 V/cm
 - 4 V/cm
93. The law that governs the working principle of IR thermometer is
- Peltier effect
 - Stephen Boltzmann law
 - Nernst equation
 - Beer Lambert's law
94. Which of the flow meter has the lowest pressure loss for a given range of flow?
- Orifice meter
 - Venturi meter
 - Flow nozzle
 - Dall tube
95. Which of the following represents relation for kinematic viscosity?
- Absolute Viscosity / mass density
 - Absolute frictional force $\times$ mass density
 - Absolute density $\times$ (mass density)²
 - Absolute Viscosity / (mass density)²
96. A d/p cell used to measure liquid level has a "suppressed zero." This means
- The transmitter uses filter circuits to suppress noise to a zero level
 - The liquid is less dense than water
 - The transmitter is located below the 0% liquid level mark
 - The elevation of the vessel is below sea level
97. The seismic mass of a spring mass accelerometer is 50g and the spring constant is 5000 N/m. The amplitude of the mass displacement is ± 2 cm. The natural frequency of oscillation of the system is about
- 50 Hz
 - 60 Hz
 - 70 Hz
 - 80 Hz

98. The pH of a liquid solution is a measure of:
- Dissolved salt content
 - Hydrogen ion activity
 - Hydroxyl ion molarity
 - Electrical conductivity
99. A chromatograph separates and distinguishes different molecule types in a fluid stream by:
- Emitted light spectra
 - Atomic mass (weighing)
 - Electric charge
 - Adsorption time-delay
100. According to the Nernst equation, the voltage developed by the electrodes will _____ when temperature increases and all other factors remain the same.
- Approach zero
 - Decrease
 - Fluctuate
 - Increase
101. NMR is the study of absorption of _____ by nuclei in a magnetic field?
- Radioactive radiation
 - IR radiation
 - Radio frequency radiation
 - Microwaves
102. Detectors used in IR spectroscopy
- PMT
 - Electron capture detector
 - Thermal detectors
 - Photocell
103. What is a cell constant 'K' in a conductivity meter?
- It is equal to the distance in cm between the probe's electrodes divided by the surface area of the electrodes in cm^2
 - It is equal to the distance in cm between the probe's electrodes
 - It is equal to the surface area of the electrodes in cm^2 divided by the distance in cm between the probe's electrodes
 - It is equal to the surface area of the electrodes in cm^2
104. A method for achieving frequency translation is to multiply the modulating signal $f(t)$ with a _____ carrier signal.
- Sinusoidal
 - Ramp
 - Step
 - Impulse
105. The bandwidth requirement of the Frequency Division Multiplexing (FDM) is _____ when compared to that of the Time Division Multiplexing (TDM) system.
- the same
 - higher
 - lower
 - zero
106. A band limited signal having no frequency components higher than f_m Hz is completely described by its sample values at uniform intervals less than or equal to _____ seconds apart.
- $2f_m$
 - $\frac{1}{2f_m}$
 - $\frac{2f_m}{3}$
 - $\frac{f_m}{2}$
107. The spectral range of a function extends from 10.0 MHz to 10.2 MHz. Find the minimum sampling rate
- 0.5 MHz
 - 0.2 MHz
 - 0.4 MHz
 - 0.6 MHz
108. Compared with the laser, the LED has a,
- higher output power, slower switching speed and lower spectral width
 - lower output power, faster switching speed and lower spectral width
 - higher output power, faster switching speed and lower spectral width
 - lower output power, slower switching speed and greater spectral width

109. In Ruby laser the atoms are excited by

- Optical flash tube
- Electron beam
- Semi-transparent mirror
- Mechanical vibration

110. The closed loop transfer function of a unity feedback system is given as $\frac{C(s)}{R(s)} = \frac{30}{s^2 + 5s + 36}$.

The steady state error for unit step input is

- 0
- 0.0277
- 0.1667
- infinity

111. A state model for a second-order system is

$$\dot{X} = \begin{bmatrix} 1 & 1 \\ -2 & -1 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t) \text{ and } Y = [1 \ 0] X.$$

The system is

- state controllable and observable
- uncontrollable and observable
- state controllable and unobservable
- uncontrollable and unobservable

112. Lead compensator is a

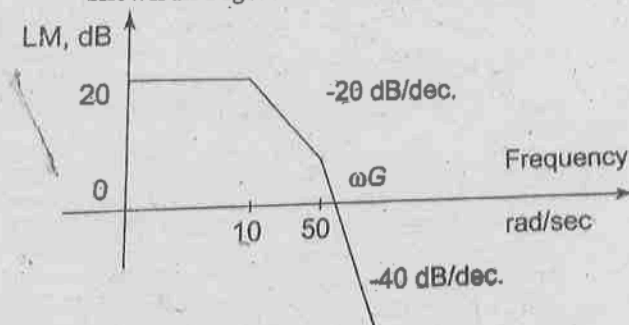
- Low Pass Filter
- High Pass Filter
- Band Pass Filter
- Band Reject Filter

113. The open-loop transfer function of a negative feedback system is $G(s)H(s) = \frac{K}{s(s+1)(s+2)}$.

The critical gain of the system is

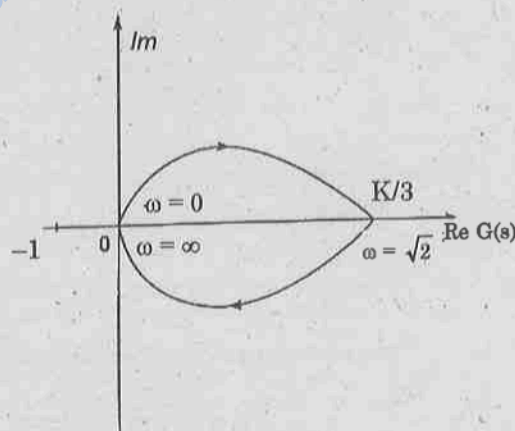
- 2
- 4
- 6
- 8

114. The transfer function of log magnitude plot shown in Fig. is



- $\frac{50}{(s+10)(s+50)}$
- $\frac{500}{(s+10)(s+50)}$
- $\frac{5000}{(s+10)(s+50)}$
- $\frac{500}{s(s+10)(s+50)}$

115. The Nyquist plot of the unity feedback system with open-loop transfer function $G(s) = \frac{Ks}{(s+1)(s+2)}$ is shown in Fig. The closed loop system is



- Absolutely stable
- Marginally stable
- Critically stable
- Unstable