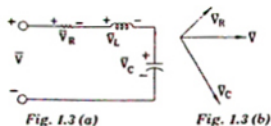


GATE - 1992

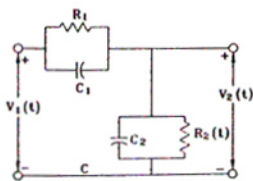
Electronics and communication Engineering

(40 × 2 = 80 marks)

- 1.1. Relative to a given fixed tree of a network,
 (a) Link currents form an independent set,
 (b) Branch voltage form an independent set
 (c) Link currents form an independent set
 (d) Branch voltage form an independent set
- 1.2. For a 2-port network to be reciprocal,
 (a) $z_{11} = z_{22}$ (b) $y_{21} = y_{12}$
 (c) $h_{21} = -h_{12}$ (d) $AD - BC = 0$
- 1.3. For the series R-L circuit of the given first figure, the partial fissure diagram at a certain frequency is shown in the given second figure. The operating frequency of the circuit is

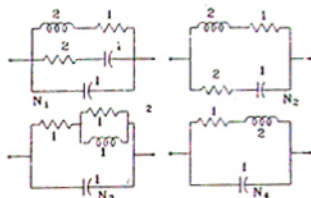


- (a) equal to the resonance frequency
 (b) less than the resonance frequency
 (c) greater than resonance frequency
 (d) not zero.
- 1.4. For the compensated attenuator of the given figure, the impulse response under the condition $R_1 C_1 = R_2 C_2$ is



- (a) $\frac{R_2}{R_1 + R_2} \left[1 - e^{-\frac{t}{R_1 C_1}} \right] u(t)$
 (b) $\frac{R_2}{R_1 + R_2} \delta(t)$
 (c) $\frac{R_2}{R_1 + R_2} u(t)$
 (d) $\frac{R_2}{R_1 + R_2} \left(1 - e^{-\frac{t}{R_1 C_1}} \right) u(t)$

- 1.5. Of the four networks, N_1, N_2, N_3 and N_4 of the given figure, the networks having identical driving point functions are



- (a) N_1 and N_3 (b) N_2 and N_4
 (c) N_1 and N_3 (d) N_1 and N_4
- 1.6. A linear time-invariant system is described by the state variable model

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -1 & 0 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \quad u = [1 \ 2] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

- (a) The system is completely controllable
 (b) The system is not completely controllable
 (c) The system is completely observable
 (d) The system is not completely observable.
- 1.7. A process with open-loop model $G(s) = \frac{k e^{-sT_d}}{s+1}$

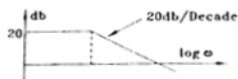
is controlled by a PID controller.

For this process

- (a) the integral mode improves transient performance
 (b) the integral mode improves steady-state performance
 (c) the derivative mode improves transient performance
 (d) the derivative mode improves steady-state performance.

- 1.8. A linear discrete-time system has the characteristic equation, $z^3 - 0.81z = 0$. The system
- is stable
 - is marginally stable
 - is unstable
 - stability cannot be assessed from the given information.

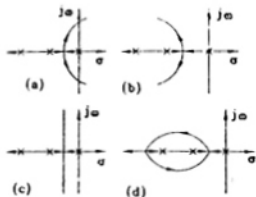
- 1.9. Bode plot of a stable system is shown in the given figure. The transfer function of the system is - - -



- 1.10. Given a unity feedback system with open-loop

transfer function, $G(s) = \frac{K}{s(s+1)(s+2)}$. The root

locus plot of the system is of the form.



- 1.11. A semiconductor is irradiated with light such that carriers are uniformly generated throughout its volume. The semiconductor is *n*-type with $N_D = 10^{19}$ per cm^3 . If the excess electron concentration in the steady state is $\Delta n = 10^{15}$ per cm^3 and if $\tau_p = 10 \mu\text{sec}$ [minority carrier life time] the generation rate due to irradiation
- is 10^{20} *e-h* pairs/ cm^3/s
 - is 10^{24} *e-h* pairs/ cm^3/s
 - is 10^{10} *e-h* pairs/ cm^2/s
 - cannot be determined as the given data is insufficient.

- 1.12. A P - N junction in series with a 100 ohms resistor, is forward biased so that a current of 100 mA flows. If the voltage across this

combination is instantaneously reversed to 10 V at $t = 0$, the reverse current that flows through the diode at $t = 0$ is approximately given by

- 0 mA
- 100 mA
- 200 mA
- 50 mA

- 1.13. An infrared LED is usually fabricated from

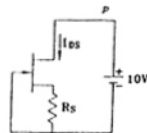
- Ge
- Si
- Ga As
- Ga As P.

- 1.14. In a transistor having finite β , the forward bias across the base emitter junction is kept constant and the reverse bias across the collector-base junction is increased. Neglecting the leakage across the collector-base junction and the depletion region generation current, the base current will _____ (increase/decrease/remains constant).

- 1.15. An *n*-channel JFET has a pinch-off voltage of $V_p = -5$ V, $V_{DS}(\text{max}) = 20$ V, and $\delta_m = 2\text{mA/V}$. The minimum 'ON' resistance is achieved in the JFET for

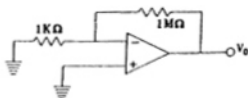
- $V_{GS} = -7$ V and $V_{DS} = 0$ V
- $V_{GS} = 7$ V and $V_{DS} = 0$ V
- $V_{GS} = 0$ V and $V_{DS} = 20$ V
- $V_{GS} = -7$ V and $V_{DS} = 20$ V

- 1.16. The JFET in the circuit shown in the given figure has an $I_{DSS} = 10$ mA and $V_p = 5$ V. The value of the resistance R_s for a drain current $I_{DS} = 6.4$ mA is (select the nearest value)



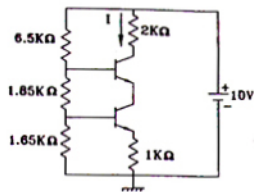
- 150 ohms
- 470 ohms
- 560 ohms
- 1 kilo ohm.

- 1.17. An op. amp. has an offset voltage of 1 mV and is ideal in all other respects. If this op. amp. is used in the circuit shown in the given figure, the output voltage will be (select the nearest value)



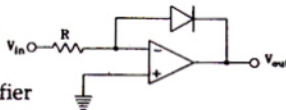
- 1 mV
- 1 V
- ± 1 V
- 0 V.

- 1.18. If the transistors in the given figure have high values of β and a V_{BE} of 0.65 volt, the current I , flowing through the 2 kilo ohms resistance will be

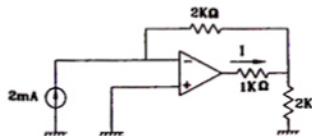


- 1.19. The circuit of given figure, uses an ideal op amp. For small positive values of V_{in} , the circuit works as

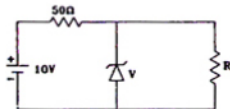
- (a) a halfwave rectifier
 (b) a differentiator
 (c) a logarithmic amplifier
 (d) an exponential amplifier.



- 1.20. Assume that the operational amplifier in given figure is ideal. The current, I , through the 1 K ohm resistor is

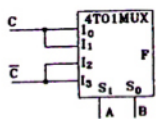


- 1.21. The 6 V Zener diode shown in given figure has zero zener resistance and a knee current of 5 mA. The minimum value of R so that the voltage across it does not fall below 6 V is



- (a) 1.2K ohms
 (b) 80 ohms
 (c) 50 ohms
 (d) 0 ohms

- 1.22. The logic realized by the circuit shown in given figure is

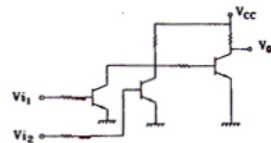


- (a) $F = A \cdot C$
 (b) $F = A + C$
 (c) $F = B \cdot C$
 (d) $F = B + C$

- 1.23. Choose the correct statement(s) for the following

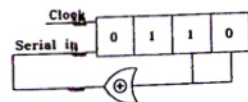
- (a) PROM contains a programmable AND array and a fixed OR array
 (b) PLA contains a fixed AND array and a programmable OR array
 (c) PRQM contains a fixed AND array and a programmable OR array
 (d) PLA contains a programmable AND array and a programmable OR array.

- 1.24. Given figure shows the circuit of a gate in the Resistor Transistor Logic (RTL) family. The circuit represents a



- (a) NAND
 (b) AND
 (c) NOR
 (d) OR

- 1.25. The initial contents of the 4-bit serial-in-parallel-out, right-shift, Shift Register shown in given figure is 0110. After three clock pulses are applied, the contents of the Shift Register will be



- (a) 0000
 (b) 0101
 (c) 1010
 (d) 1111.

- 1.26. In an 8085 microprocessor system with memory mapped I/O,

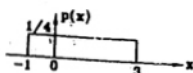
- (a) I/O devices have 16-bit addresses
 (b) I/O devices are accessed using IN and OUT instructions
 (c) there can be a maximum of 256 input devices and 256 output devices
 (d) arithmetic and logic operations can be directly performed with the I/O data.

- 1.27. The following program is run on 8085 microprocessor :

Memory Address in hex	Instruction
2000	LXI SP, 1000
2003	PUSH H
2004	PUSH D
2005	CALL 2050
2008	POP H
2009	HLT

At the completion of execution of the program, the program Counter of the 8085 contains _____ and the Stack Pointer contains _____.

- 1.28. Dual-slope integration type Analog-to-digital converters provide
- higher speeds compared to all other types of A/D converters
 - very good accuracy without putting extreme requirements on component stability
 - good rejection of power supply hum
 - better resolution compared to all other types of A/D converters for the same number of bits.
- 1.29. Which of the following signals is/are periodic ?
- $S(t) = \cos 2t + \cos 3t + \cos 5t$
 - $S(t) = \exp(j8\pi t)$
 - $S(t) = \exp(-7t) \sin 10\pi t$
 - $S(t) = \cos 2t \cos 4t$
- 1.30. If $G(f)$ represents the Fourier transform of a signal $g(t)$ which is real and odd symmetric in time, then
- $G(f)$ is complex
 - $G(f)$ is imaginary
 - $G(f)$ is real
 - $G(f)$ is real and non-negative.
- 1.31. The maximum power efficiency of an AM modulator is
- 25 %
 - 50 %
 - 75 %
 - 100 %
- 1.32. For a random variable x following the probability density function, $p(x)$, shown in given figure the mean and the variance are, respectively,



- 1/2 and 2/3
 - 1 and 4/3
 - 1 and 2/3
 - 2 and 4/3.
- 1.33. The bit stream 01001 is differentially encoded using 'Delay and Ex OR' scheme for DPSK transmission. Assuming the reference bit as a '1' and assigning phases of '0' and π for 1's and 0's respectively, in the encoded sequence, the transmitted phase sequence becomes
- $\pi \ 0 \ \pi \ 0$
 - $0 \ \pi \ 0 \ 0$
 - $0 \ \pi \ \pi \ 0$
 - $\pi \ \pi \ 0 \ \pi$
- 1.34. Coherent demodulation of FSK signal can be effected using
- correlation receiver
 - Bandpass filters and envelope detectors
 - matched filter
 - discriminator detection.
- 1.35. Source encoding in a data communication system is done in order to
- enhance the information transmission rate
 - reduce the transmission errors
 - conserve the transmitted power
 - facilitate clock recovery in the receiver.
- 1.36. A transmission line whose characteristic impedance is a pure resistance
- must be a lossless line
 - must be a distortionless line
 - may not be a lossless line
 - may not be a distortionless line.
- 1.37. Which of the following statements is/are correct ?
- All the resonant frequencies of a microwave cavity are harmonics of a single frequency
 - No two of the resonant frequencies of a microwave cavity are harmonics of a single frequency
 - Resonant frequencies of a microwave cavity form distinct sets of harmonically related frequency
 - None of the above, because a microwave cavity does not resonate at a number of frequencies.
- 1.38. Two dissimilar antennas having their maximum directivities equal,
- must have their beamwidths also equal
 - cannot have their beamwidths equal because they are dissimilar antennas
 - may not necessarily have their maximum power gains equal
 - must have their effective aperture areas (capture areas) also equal.

1.39. The beamwidth-between-first null of uniform linear array of N equally-spaced (element spacing = d), equally-excited antennas is determined by

- (a) N alone and not by d
- (b) d alone and not by N
- (c) the ratio, (N/d)
- (d) the product, (Nd)

1.40. In a multicavity magnetron, strapping is employed primarily

- (a) to prevent mode jumping
- (b) to increase the separation between the resonant frequencies in the π -mode and in the adjacent modes
- (c) to reduce the back heating of the cathode
- (d) to increase the output of the magnetron.

ANSWERS

- | | | | | | | | | | |
|------------|------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|
| 1. 1 (a,d) | 1. 2 (b,c) | 1. 3 (b,d) | 1. 4 (b) | 1. 5 (c) | 1. 6 (b,c) | 1. 7 (b,c) | 1. 8 (a) | 1. 9 (*) | 1. 10 (a) |
| 1. 11 (a) | 1. 12 (b) | 1. 13 (c) | 1. 14 (*) | 1. 15 (b) | 1. 16 (a) | 1. 17 (c) | 1. 18 (*) | 1. 19 (c) | 1. 20 (*) |
| 1. 21 (a) | 1. 22 (b) | 1. 23 (c,d) | 1. 24 (d) | 1. 25 (c) | 1. 26 (a,d) | 1. 27 (*) | 1. 28 (b,c) | 1. 29 (a,b) | 1. 30 (b) |
| 1. 31 (b) | 1. 32 (b) | 1. 33 (d) | 1. 34 (a,c) | 1. 35 (a,b) | 1. 36 (c,d) | 1. 37 (c) | 1. 38 (c) | 1. 39 (d) | 1. 40 (a,b) |