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

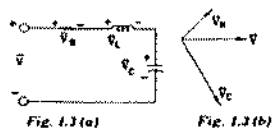
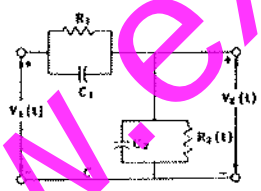


Fig. 1.3 (a) Fig. 1.3 (b)

(*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 $R_1C_1 = R_2C_2$ is



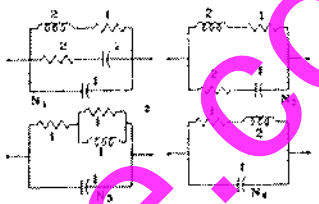
(*a*) $\frac{R_2}{R_1 + R_2}\left[1 - e^{-\frac{1}{R_1C_1}}\right] u(t)$

(*b*) $\frac{R_2}{R_1 + R_2}\delta(t)$

(*c*) $\frac{R_2}{R_1 + R_2} u(t)$

(*d*) $\frac{R_2}{R_1 + R_2} 1 - e^{-\frac{1}{R_1C_1}} . u(t)$

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_2 (*d*) N_1 and N_4

1.6. A linear time-invariant system is described by the state variable model

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

(*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 $G(s) = \frac{k e^{-sT_0}}{ts + 1}$

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

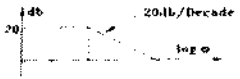
(*a*) is stable

(*b*) is marginally stable

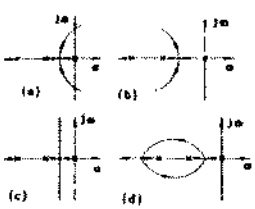
(*c*) is unstable

(*d*) 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 $\tau_p = 10\mu$ sec [minority carrier life time] the generation rate due to irradiation

(*a*) is 10^{20} *e-h* pairs/cm^3/s

(*b*) is 10^{24} *e-h* pairs/cm^3/s

(*c*) is 10^{15} *e-h* pairs/cm^3/s

(*d*) 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

(*a*) 0 mA (*b*) 100 mA

(*c*) 200 mA (*d*) 50 mA

1.13. An infrared LED is usually fabricated from

(*a*) Ge (*b*) Si

(*c*) Ga As (*d*) Ga As P.

1.14. In a transistor having finite B, 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 generatin current, the base current will_____ (increase/decrease/remain constant).

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

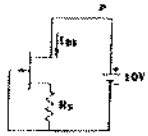
(*a*) $V_{GS} = -7$ V and $V_{DS} = 0$ V

(*b*) $V_{GS} = 7$ V and $V_{DS} = 0$ V

(*c*) $V_{GS} = 0$ V and $V_{DS} = 20$ V

(*d*) $V_{GS} = -7$ 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)



(*a*) 150 ohms (*b*) 470 ohms

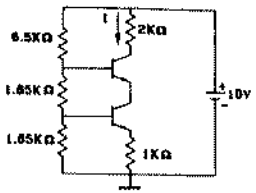
(*c*) 560 ohms (*d*) 1 kilo ohm.

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)

(*a*) 1 mV (*b*) 1 V

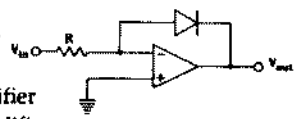
(*c*) ± 1 V (*d*) 0 V.

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 .....

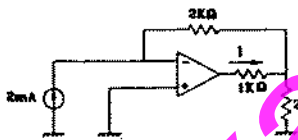


1.19. The circuit of given figure, uses an ideal op amp. For small positive values of V_{in}, the circuit works as

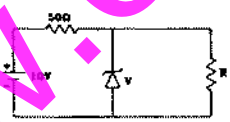
(*a*) a halfwave rectifier
(*b*) a differentiator
(*c*) a logarithmic amplifier
(*d*) an exponential amplifier.



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

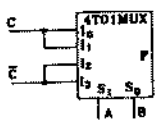


1.21. The 6 V Zener diode shown in given figure has zero zener resistance and a knee current of 5 mA. The minimum value of R so that the voltage across it does not fall below 6 V is



(*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 . C (*b*) F = A + C
(*c*) F = B . C (*d*) F = B + C

1.23. Choose the correct statement(s) fror the following

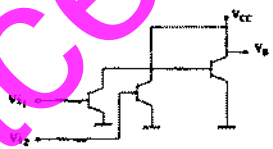
(*a*) PROM contains a programmable AND array and a fixed OR array

(*b*) PLA contains a fixed AND array and a programmable OR array

(*c*) PROM contains a fixed AND array and a programmable OR array

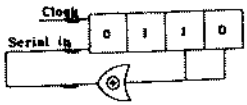
(*d*) PLA contains a programmable AND array and a programmable OR array.

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*) 0 0 0 0 (*b*) 0 1 0 1
(*c*) 1 0 1 0 (*d*) 1 1 1 1.

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 Pointeer contains_____ .

1.28. Dual-slope integration type Analog-to-digital converters provide

(*a*) higher speeds compared to all other types of A/D converters

(*b*) very good accuracy without putting extreme requirements on component stability

(*c*) good rejection of power supply hum

(*d*) 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 ?

(*a*) $S(t) = \cos 2t + \cos 3t + \cos 5t$

(*b*) $S(t) = \exp(j8\pi t)$

(*c*) $S(t) = \exp(-7t) \sin 10\pi t$

(*d*) $S(t) = \cos 2t \cos 4t$

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

(*a*) G (*f*) is complex

(*b*) G (*f*) is imaginary

(*c*) G (*f*) is real

(*d*) G (*f*) is real and non-negative.

1.31. The maximum power efficiency of an AM modulator is

(*a*) 25 % (*b*) 50 %

(*c*) 75 % (*d*) 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,

(*a*) 1/2 and 2/3 (*b*) 1 and 4/3

(*c*) 1 and 2/3 (*d*) 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

(*a*) $\pi\ 0\ \pi\pi\ 0$ (*b*) $0\ \pi\pi 00$

(*c*) $0\ \pi\pi\pi 0$ (*d*) $\pi\pi\ 0\pi\pi$

1.34. Coherent demodulation of FSK signal can be effected using

(*a*) correlation receiver

(*b*) Bandpass filters and envelope detectors

(*c*) matched filter

(*d*) discriminator detection.

1.35. Source encoding in a data communication system is done is order to

(*a*) enhance the information transmission rate

(*b*) reduce the transmission errors

(*c*) conserve the transmitted power

(*d*) facilitate clock recovery in the receiver.

1.36. A transmission line whose characterstic impedance is a pure resistance

(*a*) must be a lossless line

(*b*) must be a distortionless line

(*c*) may not be a lossless line

(*d*) may not be a distortionless line.

1.37. Which of the following statements is/are correct ?

(*a*) All the resonant frequencies of a microwave cavity are harmonics of a single frequency

(*b*) No two of the resonant frequencies of a microwave caity are harmonics of a single frequency

(*c*) Resonant frequencies of a microwave cavity form distinct sets of harmonically related frequency

(*d*) 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,

(*a*) must have their beamwidths also equal

(*b*) cannot have their beamwidths equal because they are dissimilar antennas

(*c*) may not necessarily have their maximum power gains equal

(*d*) must have their effictive 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 seperation 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** (c)	**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)