

Test Booklet Series



Test Booklet
(Electronics and Communication Engineering)

Test Booklet No.

Name of Applicant

Answer Sheet No.

Applicant ID/Roll No. :

Signature of Applicant :

Date of Examination :

Signature of the Invigilator(s)

Time of Examination :

1.

2.

Duration : 2 Hour]

[Maximum Marks : 100

IMPORTANT INSTRUCTIONS

- (i) The question paper is in the form of Test-Booklet containing **100 (Hundred)** questions. All questions are compulsory. Each question carries four answers marked (A), (B), (C) and (D), out of which only one is correct. Choose the correct option or the most appropriate option.
- (ii) On receipt of the Test-Booklet (Question Paper), the candidate should immediately check it and ensure that it contains all the pages, i.e., **100** questions. Discrepancy, if any, should be reported by the candidate to the invigilator immediately after receiving the Test-Booklet.
- (iii) A separate Answer-Sheet is provided with the Test-Booklet/Question Paper. On this sheet there are **100** rows containing four circles each. One row pertains to one question.
- (iv) The candidate should write his/her Application ID/Roll number at the places provided on the cover page of the Test-Booklet/Question Paper and on the Answer-Sheet and **NOWHERE ELSE**.
- (v) No second Test-Booklet/Question Paper and Answer-Sheet will be given to a candidate. The candidates are advised to be careful in handling it and writing the answer on the Answer-Sheet.
- (vi) For every correct answer of the question **One (1) mark will be awarded**.
- (vii) Marking shall be done only on the basis of answers responded on the Answer-Sheet.
- (viii) To mark the answer on the Answer-Sheet, candidate should darken the appropriate circle in the row of each question with Blue or Black pen.
- (ix) For each question only **one** circle should be **darkened** as a mark of the answer adopted by the candidate. If more than one circle for the question are found darkened or with one black circle any other circle carries any mark, the answer will be treated as incorrect.
- (x) The candidates should not remove any paper from the Test-Booklet/Question Paper. Attempting to remove any paper shall be liable to be punished for use of unfair means.
- (xi) Rough work may be done on the blank space provided in the Test-Booklet/Question Paper only.
- (xii) *Mobile phones (even in Switch-off mode) and such other communication/programmable devices are not allowed inside the examination hall.*
- (xiii) No candidate shall be permitted to leave the examination hall before the expiry of the time.

DO NOT OPEN THIS QUESTION BOOKLET UNTIL ASKED TO DO SO.

PART-A
(Research Methodology)

1. The main objective of fundamental/basic research is:
(A) To solve an immediate practical problem
(B) To discover new facts and develop theories
(C) To evaluate existing social programs
(D) To study historical events

2. The scientific method of research is characterized by:
(A) Subjectivity and intuition
(B) Empiricism, objectivity, and replicability
(C) Relying solely on authority
(D) Lack of logical reasoning

3. While selecting a research topic, which of the following is the LEAST important consideration?
(A) Feasibility of the study
(B) Researcher's interest
(C) Availability of funds and time
(D) Personal biases of the researcher

4. The ethical principle of "Informed Consent" implies that:
(A) Participants must be forced to participate for the greater good
(B) Participants must be fully aware of the research procedures and agree voluntarily
(C) Researchers can hide the true purpose of the study to avoid bias
(D) Data can be shared publicly without participant knowledge

5. Fabrication, falsification, and plagiarism in research are collectively known as:
(A) Research misconduct
(B) Sampling error
(C) Ethical compliance
(D) Research methodology

6. Which research design is primarily concerned with describing the characteristics of a population or phenomenon?
(A) Exploratory research design
(B) Descriptive research design
(C) Experimental research design
(D) Diagnostic research design

7. In an experimental research design, the variable that is intentionally manipulated by the researcher is the:
(A) Dependent variable
(B) Extraneous variable
(C) Independent variable
(D) Control variable

8. Research conducted to find out the causes of an event that has already happened, without manipulating variables, is known as:
- (A) Action research (B) Ex-post facto research
(C) Applied research (D) Pure research
9. The "Control Group" in an experimental design is used to:
- (A) Introduce the experimental treatment
(B) Serve as a baseline for comparison with the experimental group
(C) Eliminate the dependent variable
(D) Increase the sample size
10. Deductive reasoning in the scientific method moves from:
- (A) Specific observations to general theories
(B) General theories to specific hypotheses
(C) Empirical data to conceptualization
(D) Null hypothesis to alternative hypothesis
11. Internal validity in an experimental design refers to:
- (A) The generalizability of the findings to the real world
(B) The certainty that the independent variable caused the changes in the dependent variable
(C) The consistency of the measuring instrument
(D) The representativeness of the sample
12. If every member of the population has an equal and independent chance of being selected, the sampling technique is called:
- (A) Purposive sampling (B) Convenience sampling
(C) Simple random sampling (D) Quota sampling
13. When the population is heterogeneous with distinct subgroups (strata), the most appropriate probability sampling technique is:
- (A) Simple random sampling (B) Stratified random sampling
(C) Cluster sampling (D) Snowball sampling

- 14.** In cluster sampling, the sampling units selected are:
- (A) Individual elements
 - (B) Natural groupings or categories (e.g., districts, schools)
 - (C) Homogeneous subgroups
 - (D) Volunteers
- 15.** Snowball sampling is specifically used when:
- (A) The population size is very large
 - (B) The sampling frame is readily available
 - (C) The population is hidden, rare, or difficult to access
 - (D) The researcher needs a perfectly representative sample
- 16.** The difference between a sample statistic and the true population parameter is termed as:
- (A) Systematic error
 - (B) Sampling error
 - (C) Measurement error
 - (D) Non-sampling error
- 17.** Which measurement scale classifies data into mutually exclusive categories without any order or ranking?
- (A) Ordinal scale
 - (B) Interval scale
 - (C) Nominal scale
 - (D) Ratio scale
- 18.** A Likert scale (Strongly Disagree to Strongly Agree) is technically an example of:
- (A) Nominal scale
 - (B) Ordinal scale
 - (C) Interval scale
 - (D) Ratio scale
- 19.** Which scaling technique asks respondents to rate an object on a series of bipolar adjectives (e.g., Good-Bad, Fast-Slow)?
- (A) Likert scale
 - (B) Guttman scale
 - (C) Semantic Differential scale
 - (D) Thurstone scale

- 20.** The key difference between a questionnaire and a schedule is:
- (A) A questionnaire is filled by the enumerator, a schedule is filled by the respondent
 - (B) A questionnaire is filled by the respondent, a schedule is filled by the enumerator/ interviewer
 - (C) A schedule is mailed, a questionnaire is given face-to-face
 - (D) There is no difference between them
- 21.** Data collected by the researcher themselves for the specific purpose of the current study is called:
- (A) Secondary data
 - (B) Primary data
 - (C) Official data
 - (D) Documentary data
- 22.** The process of checking the raw data to ensure completeness, accuracy, and consistency before analysis is called:
- (A) Coding
 - (B) Editing
 - (C) Tabulation
 - (D) Classification
- 23.** Assigning numerical values or symbols to the responses for computational purposes is known as:
- (A) Editing
 - (B) Coding
 - (C) Transcription
 - (D) Tabulation
- 24.** A histogram is used to graphically represent the distribution of:
- (A) Discrete/categorical data
 - (B) Continuous data grouped into class intervals
 - (C) Qualitative characteristics
 - (D) Proportions of a whole
- 25.** A pie chart is most effective for representing:
- (A) Trends over time
 - (B) The relationship between two continuous variables
 - (C) The percentage breakdown of a whole
 - (D) Frequency distribution of continuous data

26. A hypothesis that states there is no significant difference or relationship is called:
- (A) Directional hypothesis
 - (B) Non-directional hypothesis
 - (C) Null hypothesis
 - (D) Alternative hypothesis
27. "Students who study using method A will score significantly higher than those who study using method B." This is an example of:
- (A) Null hypothesis
 - (B) Directional alternative hypothesis
 - (C) Non-directional alternative hypothesis
 - (D) Ex-post facto hypothesis
28. A Type I error in hypothesis testing occurs when:
- (A) We fail to reject a true null hypothesis
 - (B) We reject a true null hypothesis
 - (C) We fail to reject a false null hypothesis
 - (D) We reject a false null hypothesis
29. The probability of committing a Type I error is denoted by:
- (A) Beta (β)
 - (B) Alpha (α)
 - (C) P-value
 - (D) Standard error
30. A statistical test that makes assumptions about the population parameters (like normal distribution, homogeneity of variance) is called:
- (A) Non-parametric test
 - (B) Parametric test
 - (C) Chi-square test
 - (D) Distribution-free test
31. The Chi-square (χ^2) test is primarily used to test:
- (A) The difference between means of two groups
 - (B) The association between two categorical variables
 - (C) The significance of regression coefficients
 - (D) The variance within a single group

32. In a Chi-square test of independence, if the calculated value of χ^2 is greater than the critical/ table value at the 0.05 level, we:
- (A) Accept the null hypothesis
 - (B) Reject the null hypothesis
 - (C) Conclude the variables are independent
 - (D) Conclude the sample is biased
33. The formula for calculating expected frequency (E) in a Chi-square contingency table cell is:
- (A) (Row Total $\times$ Column Total) / Grand Total
 - (B) (Row Total + Column Total) / Grand Total
 - (C) Grand Total / (Row Total $\times$ Column Total)
 - (D) Row Total / Column Total
34. Analysis of Variance (ANOVA) is used instead of multiple t-tests to compare the means of three or more groups because:
- (A) ANOVA is easier to calculate
 - (B) Multiple t-tests increase the risk of Type I error
 - (C) ANOVA does not require normal distribution
 - (D) ANOVA uses nominal data
35. In a one-way ANOVA, the "one way" refers to:
- (A) One dependent variable and one independent variable with multiple levels
 - (B) One independent variable and multiple dependent variables
 - (C) Only one sample being tested
 - (D) One-tailed test of significance
36. The F-ratio in One-way ANOVA is calculated as:
- (A) Within-group variance / Between-group variance
 - (B) Between-group variance / Within-group variance
 - (C) Total variance / Residual variance
 - (D) Mean square error / Mean square total
37. The degrees of freedom for "Between Groups" in a One-Way ANOVA with 'k' groups is:
- (A) $N - 1$
 - (B) $N - k$
 - (C) $k - 1$
 - (D) $(N - 1) - (k - 1)$

38. Which of the following is a non-parametric alternative to One-way ANOVA?
(A) Kruskal-Wallis test (B) Mann-Whitney U test
(C) Wilcoxon signed-rank test (D) Chi-square goodness of fit
39. A multivariate statistical technique used to reduce a large number of interrelated variables to a smaller set of unobservable factors is:
(A) Cluster Analysis (B) Factor Analysis
(C) Discriminant Analysis (D) Conjoint Analysis
40. In Factor Analysis, the proportion of variance in a specific variable explained by the common factors is called:
(A) Communality (B) Eigenvalue
(C) Factor loading (D) Uniqueness
41. Which concept in Factor Analysis represents the total variance explained by a specific factor across all variables?
(A) Communality (B) Eigenvalue
(C) Factor score (D) Rotation
42. Multiple Regression is used to:
(A) Classify objects into groups
(B) Predict the value of a dependent variable based on two or more independent variables
(C) Reduce the number of variables
(D) Determine the association between two categorical variables
43. In Multiple Regression, the coefficient of multiple determination (R^2) represents:
(A) The correlation between two independent variables
(B) The proportion of variance in the dependent variable explained by all independent variables
(C) The regression coefficient of the strongest predictor
(D) The standard error of the estimate
44. Pearson's correlation coefficient (r) measures:
(A) The causal relationship between two variables
(B) The linear association between two continuous variables
(C) The association between two categorical variables
(D) The variance of a single variable

45. If the Pearson correlation coefficient between X and Y is -0.85 , it indicates:
- (A) A weak positive relationship (B) A strong positive relationship
(C) A strong negative relationship (D) No relationship
46. Which multivariate technique is used to group objects or individuals so that objects in the same group are highly similar to each other but different from objects in other groups?
- (A) Discriminant Analysis (B) Factor Analysis
(C) Cluster Analysis (D) Conjoint Analysis
47. The main difference between Cluster Analysis and Discriminant Analysis is that:
- (A) Cluster analysis requires predefined groups, discriminant analysis does not
(B) Discriminant analysis requires predefined groups, cluster analysis does not
(C) Cluster analysis uses metric data, discriminant analysis uses non-metric
(D) Discriminant analysis is for data reduction, cluster analysis is for prediction
48. Conjoint Analysis is primarily used in marketing research to:
- (A) Determine the optimal number of clusters
(B) Measure how consumers value different features of a product by analyzing trade-offs
(C) Reduce the dimensions of product features
(D) Classify customers into predefined demographic groups
49. The standard format for writing a quantitative research report is generally known by the acronym:
- (A) IMRAD (Introduction, Method, Results, And Discussion)
(B) PEST (Political, Economic, Social, Technological)
(C) SWOT (Strengths, Weaknesses, Opportunities, Threats)
(D) APA (American Psychological Association)
50. Which section of the research report contains a brief summary of the entire study, including the problem, methodology, major findings, and conclusions?
- (A) Introduction (B) Abstract/Executive Summary
(C) Literature Review (D) Discussion

PART-B

(Electronics and Communication Engineering)

51. For the circuit given in Fig. 1, the Thevenin's resistance across the terminals A and B is

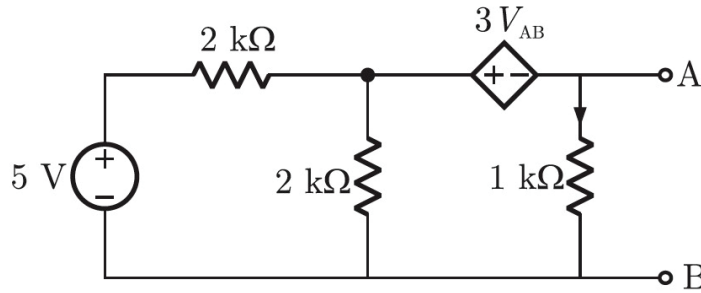


Fig. 1

- (A) $0.5\text{ k}\Omega$ (B) $0.2\text{ k}\Omega$
 (C) $1\text{ k}\Omega$ (D) $0.11\text{ k}\Omega$
52. In the circuit shown in Fig. 2. Switch SW_1 is initially closed and SW_2 is open. The inductor L carries a current of 10 A and the capacitor charged to 10 V with polarities as indicated. SW_2 is closed at $t = 0$ and SW_1 is opened at $t = 0$. The current through C and the voltage across L at $(t = 0^+)$ is

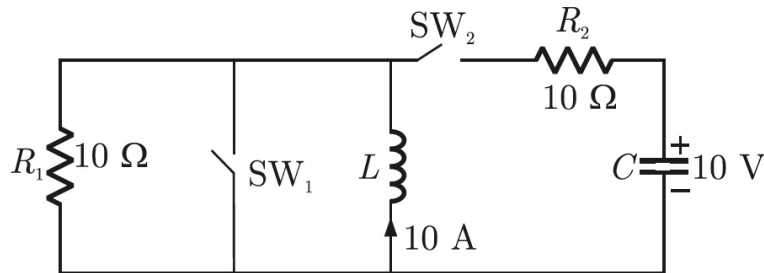


Fig. 2

- (A) 55 A, 4.5 V (B) 5.5 A, 45 V
 (C) 45 A, 5.5 A (D) 4.5 A, 55 V

53. The admittance parameters of the passive resistive two-port network as shown in Fig. 3 are : $Y_{11} = 5S$, $Y_{22} = 1S$, $Y_{12} = Y_{21} = -2.5S$. The power delivered to the load resistance R_L is:

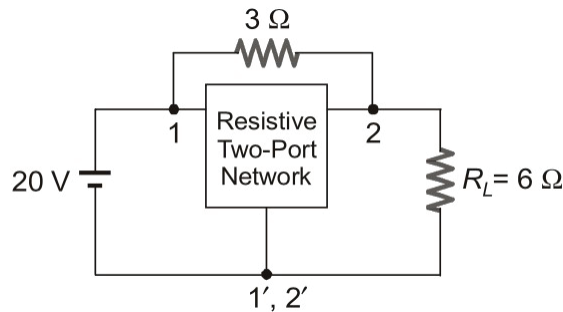


Fig. 3

- (A) 225 W (B) 250 W
(C) 238 W (D) 300 W
54. In the circuit of Fig. 4, the magnitudes of V_L and V_C are twice that of V_R . Given that $f = 50$ Hz, the inductance of the coil

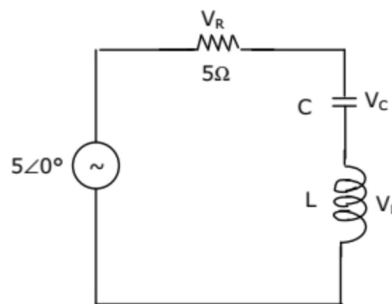


Fig. 4

- (A) 31.8 mH (B) 21.4 mH
(C) 5.30 H (D) 1.32 H
55. The first and the last critical frequencies (singularities) of a driving point impedance function of a passive network having two kinds of elements, are a pole and a zero respectively. The above property will be satisfied by
- (A) RL network only (B) RC network only
(C) LC network only (D) RC as well as RL networks

56. The short-circuit admittance matrix of a two-port network is $\begin{bmatrix} 0 & -\frac{1}{2} \\ \frac{1}{2} & 0 \end{bmatrix}$. The two-port network is

- (A) non-reciprocal and passive (B) reciprocal and passive
(C) reciprocal and active (D) non-reciprocal and active

57. Two causal discrete-time signals $x[n]$ and $y[n]$ are related as $y[n] = \sum_{m=0}^n x[m]$. If the z-transform of $y[n]$ is $\frac{2}{z(z-1)^2}$, the value of $x[2]$ is

- (A) 3 (B) 1.5
(C) 0 (D) 2

58. Two systems $H_1(z)$ and $H_2(z)$ are connected in cascade as shown in Fig. 5. The overall output $y(n)$ is the same as the input $x(n)$ with a one unit delay. The transfer function of the second system $H_2(z)$ is

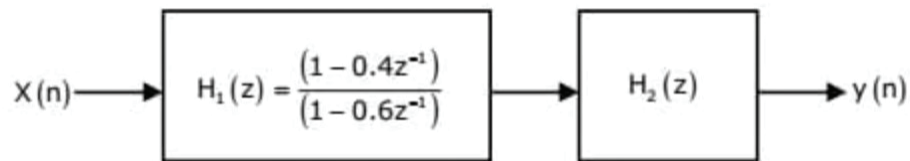


Fig. 5

- (A) $\frac{1-0.6z^{-1}}{z^{-1}(1-0.4z^{-1})}$ (B) $\frac{z^{-1}(1-0.4z^{-1})}{1-0.6z^{-1}}$
(C) $\frac{(1-0.4z^{-1})}{z^{-1}(1-0.6z^{-1})}$ (D) $\frac{z^{-1}(1-0.6z^{-1})}{(1-0.4z^{-1})}$

59. Which of the following cannot be the Fourier series expansion of a periodic signal?

- (A) $x(t) = 2 \cos t + 3 \cos 3t$ (B) $x(t) = \cos t + 0.5$
(C) $x(t) = 2 \cos \pi t + 7 \cos t$ (D) $x(t) = 2 \cos 1.5 \pi t + \sin 3.5 \pi t$

60. The unilateral Laplace transform of $f(t)$ is $\frac{1}{s^2 + s + 1}$. Which one of the following is the unilateral Laplace transform of $g(t) = t.f(t)$?
- (A) $\frac{2s}{(s^2 + s + 1)^2}$ (B) $\frac{2s + 1}{(s^2 + s + 1)^2}$
 (C) $\frac{-2s}{(s^2 + s + 1)^2}$ (D) $\frac{-(2s + 1)}{(s^2 + s + 1)^2}$
61. A uniformly doped silicon pn junction has dopant profile of $N_a = N_d = 50 \times 10^{16} \text{ cm}^{-3}$. If the peak electric field in the junction at breakdown is $E = 4 \times 10^5 \text{ V/cm}$, the breakdown voltage of this junction is
- (A) 35 V (B) 15 V
 (C) 45 V (D) 21 V
62. A semiconductor has parameters such as $\mu_n = 7500 \text{ cm}^2/\text{V-sec}$, $\mu_p = 300 \text{ cm}^2/\text{V-sec}$ and $n_i = 3.6 \times 10^{12} \text{ cm}^{-3}$. When conductivity is minimum, the hole concentration is
- (A) $1.8 \times 10^{13} \text{ cm}^{-3}$ (B) $7.2 \times 10^{11} \text{ cm}^{-3}$
 (C) $1.44 \times 10^{11} \text{ cm}^{-3}$ (D) $9 \times 10^{13} \text{ cm}^{-3}$
63. A diode has reverse saturation current $I_s = 10^{-18} \text{ A}$ and non-ideality factor $\eta = 1.05$. If diode has current of $70 \text{ }\mu\text{A}$, the diode voltage is
- (A) 0.87 V (B) 0.63 V
 (C) 0.93 V (D) 0.72 V
64. A pn junction biased at $V_a = 0.72 \text{ V}$ has DC bias current $I_{DQ} = 2 \text{ mA}$. The minority carrier lifetime is $1 \text{ }\mu\text{s}$ in both the n and p regions. The diffusion capacitance is in
- (A) 49.3 nF (B) 3.87 nF
 (C) 77.4 nF (D) 98.6 nF
65. A silicon pn junction diode has doping profile $N_a = N_d = 5 \times 10^{19} \text{ cm}^{-3}$. The space charge width at a forward bias voltage of $V_a = 0.4 \text{ V}$ is
- (A) 102 Å (B) 44 Å
 (C) 153 Å (D) 62 Å

66. A uniformly doped silicon epitaxial npn bipolar transistor is fabricated with a base doping of $N_B = 3 \times 10^{16} \text{ cm}^{-3}$ and a heavily doped collector region with $N_C = 5 \times 10^{17} \text{ cm}^{-3}$. The neutral base width is $x_B = 0.7 \text{ } \mu\text{m}$ when $V_{BE} = V_{BC} = 0$. The V_{BC} at punch-through is
 (A) 6.3 V (B) 18.3 V
 (C) 19.2 V (D) 26.3 V
67. 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 width modulation effect and assuming that the MOSFET is operating at saturation, the drain current for an applied V_{GS} of 1400 mV is
 (A) 4.5 mA (B) 5.0 mA
 (C) 3.5 mA (D) 4.0 mA
68. The current gain of the transistor shown in the circuit of Fig. 6 is $\beta = 100$. The values of Q-point (I_{CQ}, V_{CQ}) is

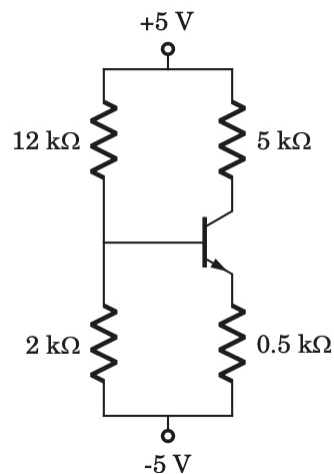


Fig. 6

- (A) 1.8 mA, 2.1 V (B) 1.5 mA, 2.5 V
 (C) 1.4 mA, 2.3 V (D) 2.0 mA, 3.2 V
69. For a voltage follower circuit using an op-amp, which of the following is true?
 (A) both input and output impedance are very large
 (B) input impedance is very large and the output impedance is very small
 (C) input impedance is very small and the output impedance is very large
 (D) both input and output impedance are very small

70. Introducing a resistor in the emitter of a common emitter amplifier stabilizes the dc operating point against variation in

- (A) Temperature and β (B) Temperature
(C) β of the transistor (D) None of these

71. The current through resistor R in Fig. 7 is given as:

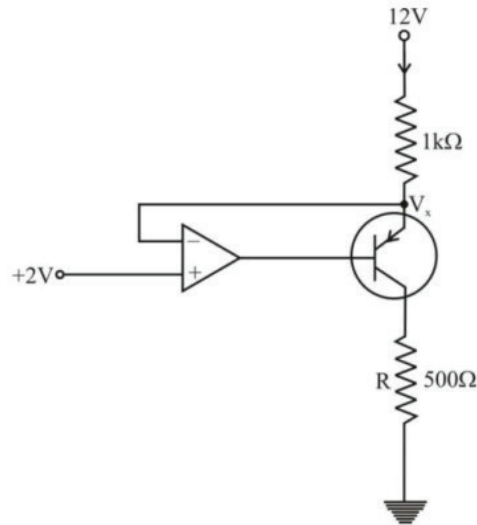


Fig. 7

- (A) 5 mA (B) 15 mA
(C) 10 mA (D) 1 mA

72. In order to increase the bandwidth of tuned amplifiers, one can use:

1. Double tuned amplifier with two tuned circuits coupled by mutual inductance.
2. Tuned circuit with inductance having high Q factor.
3. Staggered tuned amplifiers in which different tuned circuits which are cascaded are tuned to slightly different frequencies.

- (A) 1 and 2 only (B) 1, 2 and 3
(C) 2 and 3 only (D) 1 and 3 only

73. The circuit shown in Fig. 8 represents

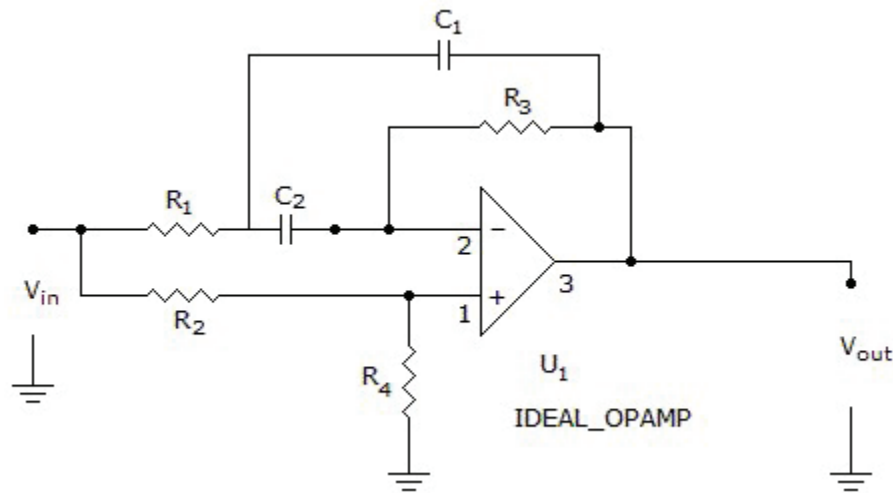


Fig. 8

- (A) Bandstop filter (B) Bandpass filter
(C) All pass filter (D) None of these
74. Implementation of the Boolean expression $X = ABC + AB + A\bar{C}$ results in
(A) three AND gates, one OR gate
(B) three AND gates, one NOT gate, one OR gate
(C) three AND gates, one NOT gate, three OR gates
(D) three AND gates, three OR gates
75. Which of the following is correct for a gated D flip-flop?
(A) The output toggles if one of the inputs is held HIGH
(B) Only one of the inputs can be HIGH at a time
(C) The output complement follows the input when enabled
(D) The Q output follows the input D when the enable is HIGH
76. How many BCD code bits and how many straight binary bits would be required to represent the decimal number 643?
(A) 12 BCD, 12 binary (B) 12 BCD, 8 binary
(C) 12 BCD, 10 binary (D) 10 BCD, 12 binary

77. A MOD-12 and a MOD-10 counter are cascaded. Determine the output frequency if the input clock frequency is 60 MHz

- (A) 500 kHz (B) 1500 kHz
(C) 6 MHz (D) 5 MHz

78. What decimal value in Fig. 9 is required to produce an output at "X"?

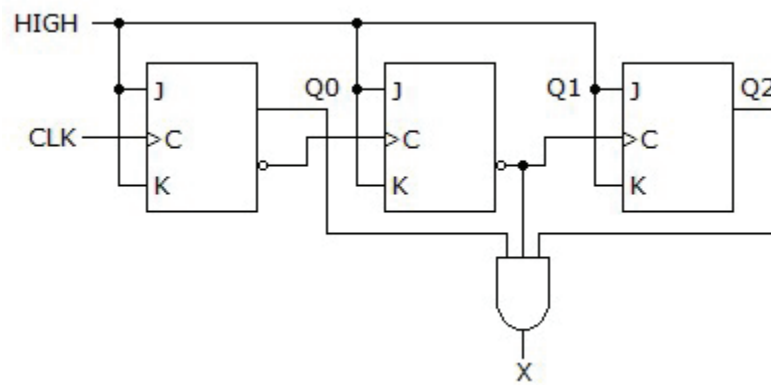


Fig. 9

- (A) 7 (B) 3
(C) 5 (D) 2

79. The following instruction is executed by 8085 microprocessors

Address (HEX)	Instruction
6010	LXI H, 8A79
6013	MOV A,L
6015	ADD H
6016	DAA
6017	MOV H,A
6018	PCHL

From which address will be next instruction be fetched?

- (A) 6019 H (B) 6820 H
(C) 6979 H (D) 6679 H

80. Which of the following points is NOT on the root locus of a system with the open loop transfer function $G(s)H(s) = \frac{K}{s(s+1)(s+2)}$
- (A) $s = -j\sqrt{3}$ (B) $s = -1.5$
 (C) $s = -3$ (D) $s = -\infty$
81. A system described by the transfer function $H(s) = \frac{1}{s^3 + \alpha s^2 + ks + 3}$ is stable. The constraints on α and k are,
- (A) $\alpha > 0, \alpha k < 3$ (B) $\alpha > 0, \alpha k < -3$
 (C) $\alpha < 0, \alpha k < 3$ (D) $\alpha > 0, \alpha k > 3$
82. An AM signal is detected using an envelope detector. The carrier frequency and modulation signal frequency are 1 MHz and 2 kHz respectively. An appropriate value for the time constant of the envelope detector is
- (A) 20 μsec (B) 500 μsec
 (C) 0.2 μsec (D) 1 μsec
83. The message bit sequence to a DPSK modulator is 1, 1, 0, 0, 1, 1. The carrier phase during the reception of the first two message bits is π, π . The carrier phase for the remaining four message bits is
- (A) $\pi, \pi, 0, \pi$ (B) $0, 0, \pi, \pi$
 (C) $0, \pi, \pi, \pi$ (D) $\pi, \pi, 0, 0$
84. In a baseband communication link, frequencies upto 3500 Hz are used for signalling. Using a raised cosine pulse with 75% excess bandwidth and for no inter symbol interference, the maximum possible signalling rate is symbols per sec is
- (A) 1750 (B) 4000
 (C) 3500 (D) 5250
85. A modulation signal is given by $s(t) = e^{-at} \cos [(\omega_c + \Delta\omega)t] u(t)$, where, ω_c and $\Delta\omega$ are positive constants, and $\omega_c \gg \Delta\omega$. The complex envelope of $s(t)$ is given by
- (A) $\exp(-at) \exp[j(\omega_c + \Delta\omega)t] u(t)$ (B) $\exp(j\Delta\omega t) u(t)$
 (C) $\exp[j(\omega_c + \Delta\omega)t]$ (D) $\exp(-at) \exp(j\Delta\omega t)$

86. Consider a message signal whose spectrum is given by : $M(f) = 1 - \frac{|f|}{10^4}$, $|f| \leq 10^4$ and zero elsewhere. The message signal amplitude modulates a carrier $f_c = 1$ MHz. The bandwidth of the modulated signal is
- (A) 10 kHz (B) 1 MHz
(C) 20 kHz (D) 1.5 MHz
87. An AM broadcast station transmits modulating frequencies up to 6 kHz. If the AM station is transmitting on a frequency of 894 kHz, the values for maximum and minimum upper and lower sidebands and the total bandwidth occupied by the AM station are:
- (A) 900 kHz, 888 kHz, 12 kHz (B) 894 kHz, 884 kHz, 12 kHz
(C) 894 kHz, 888 kHz, 6 kHz (D) 900 kHz, 888 kHz, 6 kHz
88. Consider the following:
1. Filter system
 2. Phase-shift method
 3. Balanced modulator
 4. Third Method
- Which of these can be used to remove unwanted side-bands in SSB?
- (A) 1, 3 and 4 (B) 1, 2 and 3
(C) 2, 3 and 4 (D) 1, 2 and 4
89. An antenna pointing in a certain direction has a noise temperature of 50 K. The ambient temperature is 290 K. The antenna is connected to a pre-amplifier that has a noise figure of 2 dB and an available gain of 40 dB over an effective bandwidth of 12 MHz. The effective input noise temperature T_e for the amplifier and the noise power P_{a0} at the output of the preamplifier, respectively, are
- (A) $T_e = 170.8$ K and $P_{a0} = 4.56 \times 10^{-10}$ W
(B) $T_e = 169.36$ K and $P_{a0} = 3.37 \times 10^{-10}$ W
(C) $T_e = 182.5$ K and $P_{a0} = 3.85 \times 10^{-10}$ W
(D) $T_e = 160.62$ K and $P_{a0} = 4.6 \times 10^{-10}$ W

90. Match List-I with List-II and select the correct answer using the options given below:

List-I	List-II
a. IF Noise	1. Ganged tuning
b. Image frequency	2. Spurious response
c. Station selector	3. Mixer Stage
d. Excessive hum	4. Leaky filter capacitor
(A) a-2, b-1, c-4, d-3	(B) a-1, b-2, c-4, d-3
(C) a-4, b-2, c-1, d-3	(D) a-3, b-2, c-1, d-4

91. Determine whether the following statements are true or false with respect to Pulse Amplitude Modulation.

- Instantaneous sampling of the message signal $m(t)$ every T_s seconds, where the sampling rate $f_s = \frac{1}{T_s}$ is chosen in accordance with the sampling theorem.
 - Lengthening the duration of each sample obtained to some constant value T .
- (A) 1 False, 2 False (B) 1 True, 2 True
(C) 1 False, 2 True (D) 1 True, 2 False

92. Match List-I with List-II and select the correct answer using the options given below: (Notations have their usual meaning)

List-I	List-II
a. Permeability	1. QE
b. Force	2. $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$
c. Velocity of EM wave	3. $\mu_0 \mu_r$
d. Displacement Density	4. $\sqrt{\frac{\mu}{\epsilon}}$
	5. ϵE
(A) a-3, b-2, c-4, d-5	(B) a-4, b-1, c-2, d-3
(C) a-4, b-2, c-5, d-3	(D) a-3, b-1, c-2, d-5

93. Two linearly polarised plane waves A and B travelling in free space in the +ve X direction meet at a point. Wave A is polarised in the Y direction and Wave B is polarised in the Z direction. If the two waves are of equal amplitude and are in phase quadrature, the resultant wave will be
- (A) Circularly polarized (B) Elliptically polarized
(C) Linearly polarized (D) Vertically polarized
94. Poisson's equation for a non-homogeneous medium is
- (A) $\epsilon \nabla^2 V = -\rho$ (B) $\nabla^2(\epsilon V) = -\rho$
(C) $\nabla \cdot (\epsilon \nabla V) = -\rho$ (D) $\nabla^2(\nabla \epsilon V) = -\rho$
95. For a lossy transmission line, short-circuited at the receiving end, the input impedance is given by (Notations have their usual meaning)
- (A) $Z_0 \coth \gamma l$ (B) $Z_0 \cot \gamma l$
(C) $Z_0 \tan \gamma l$ (D) $Z_0 \tanh \gamma l$
96. A 50Ω characteristic impedance line is connected to load which shows a reflection coefficient of 0.268. If $V_{in} = 15$ V, then the net power delivered to the load will be
- (A) 0.139 W (B) 1.39 W
(C) 0.278 W (D) 2.78 W
97. A recent survey shows that 65% of tobacco users were advised to stop consuming tobacco. The survey also shows that 3 out of 10 tobacco users attempted to stop using tobacco. Based only on the information in the above passage, which one of the following options can be logically inferred with certainty?
1. A majority of tobacco users who were advised to stop consuming tobacco made an attempt to do so.
 2. Approximately 30% of tobacco users successfully stopped consuming tobacco.
 3. Approximately 65% of tobacco users successfully stopped consuming tobacco.
 4. A majority of tobacco users who were advised to stop consuming tobacco did not attempt to do so.
- (A) Option 1 only (B) Option 1 and Option 3
(C) Option 3 and Option 4 (D) Option 4 only

98. The digit in the unit's place of the product $3^{999} \times 7^{1000}$ is ____.

- (A) 9 (B) 3
(C) 7 (D) 1

99. A square with sides of length 6 cm is given in Fig. 10. The boundary of the shaded region is defined by two semi-circles whose diameters are the sides of the square, as shown in Fig.10. The area of the shaded region is ____ cm².

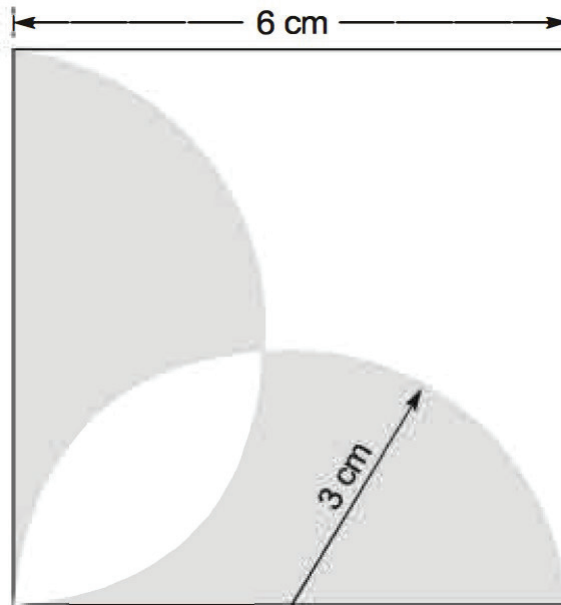


Fig. 10

- (A) 9π (B) 18
(C) 20 (D) 6π

100. The families of curves represented by the solution of the equation

$$\frac{dy}{dx} = -\left(\frac{x}{y}\right)^n$$

for $n = -1$ and $n = +1$, respectively, are

- (A) Hyperbolas and Circles (B) Hyperbolas and Parabolas
(C) Parabolas and Circles (D) Circles and Hyperbolas

ROUGH WORK