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T.B.C. : **FGT-B-ELX**

Test Booklet Series

Serial **1018509**

A

TEST BOOKLET

ELECTRONICS & TELECOMMUNICATION ENGINEERING

Time Allowed : Three Hours

Maximum Marks : 300

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET *DOES NOT* HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.

2. Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series Code A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet. Any omission/discrepancy will render the Answer Sheet liable for rejection.

3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. *DO NOT* write *anything else* on the Test Booklet.

4. This Test Booklet contains **150** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case, you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **ONLY ONE** response for each item.

5. You have to mark all your responses **ONLY** on the separate Answer Sheet provided. See directions in the Answer Sheet.

6. All items carry equal marks.

7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.

8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator *only the Answer Sheet*. You are permitted to take away with you the Test Booklet.

9. Sheets for rough work are appended in the Test Booklet at the end.

10. **Penalty for wrong answers :**
    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE.

    (i)   There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0·33)** of the marks assigned to that question will be deducted as penalty.

    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.

    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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1. A white noise of magnitude 0·001 µW/Hz is applied to an RC low-pass filter of R = 1 kΩ and C = 0·1 µF. The output noise power of the RC low-pass filter is

   (a) 0·5 µW

   (b) 1·5 µW

   (c) 2·5 µW

   (d) 3·5 µW

2. The two random variables X and Y are uncorrelated if and only if their covariance is

   (a) 0

   (b) 1

   (c) −1

   (d) infinity

3. The antenna current of an AM transmitter is 8 A when only the carrier signal is transmitted. What is the antenna current when the carrier signal is modulated by sinusoidal signal V(t) = 1·4 sin 2π × 500t with modulation index 0·8 ?

   (a) 3·2 A

   (b) 7·2 A

   (c) 9·2 A

   (d) 11·2 A

4. A 10 MHz carrier signal is frequency-modulated by analog-modulating signal. The maximum frequency deviation is 75 kHz. If the frequency of the modulating signal is 300 kHz, then the modulation index and the approximate transmission bandwidth of the FM signal are respectively,

   (a) 0·25, 750 kHz

   (b) 0·25, 600 kHz

   (c) 0·75, 750 kHz

   (d) 0·75, 450 kHz

5. Consider the following statements for baseband transmission model :

   1. Channel signal-to-noise ratio is defined as the ratio of the average power of the modulated signal to the average power of noise in the message bandwidth, both measured at the receiver input.

   2. Channel signal-to-noise ratio is defined as the ratio of the average power of the modulated signal to the average power of noise in the message bandwidth, both measured at the receiver output.

   3. Figure of merit = $\dfrac{(SNR)_o}{(SNR)_c}$, where o stands for output and c stands for channel.

   4. Figure of merit = $\dfrac{(SNR)_c}{(SNR)_o}$, where o stands for output and c stands for channel.

   Which of the above statements are correct ?

   (a) 1 and 3 only

   (b) 2 and 3 only

   (c) 1 and 4 only

   (d) 2 and 4 only

6. What is the entropy of a communication system that consists of six messages with probabilities 1/8, 1/8, 1/8, 1/8, 1/4 and 1/4 respectively ?

   (a) 1 bit/message

   (b) 2·5 bits/message

   (c) 3 bits/message

   (d) 4·5 bits/message

7. Discrete samples of an analog signal are uniformly quantized to PCM. If the maximum value of analog sample is to be represented within 0·1% accuracy, then the minimum number of binary digits required per sample is

(a) 4

(b) 8

(c) 10

(d) 12

8. Six analog information signals, each band-limited to 4 kHz, are required to be time-division multiplexed and transmitted by a TDM system. The minimum transmission bandwidth and the signalling rate of the PAM/TDM channel are respectively,

(a) 24 kHz and 48 kbps

(b) 24 kHz and 8 kbps

(c) 48 kHz and 48 kbps

(d) 48 kHz and 16 kbps

9. A 2000 bps binary information data signal is required to be transmitted in half-duplex mode using BFSK digital modulation technique. If the separation between two carrier frequencies is 4000 Hz, then the minimum bandwidth of the BFSK signal is

(a) 4 kHz

(b) 6 kHz

(c) 8 kHz

(d) 12 kHz

10. If voice activity interference reduction factor is 2·5, antenna sectorization gain factor is 2·5 and interference increase factor is 1·6, then the performance improvement factor in CDMA digital cellular system is

(a) 1·2

(b) 2·5

(c) 3·1

(d) 3·9

11. The temperature at a particular place varies between 14°C and 34°C. For the purpose of transmitting the temperature record of that place using PCM, the record is sampled at an appropriate sampling rate and the samples are quantized. If the error in representation of the samples due to quantization is not to exceed ± 1% of the dynamic range, what is the minimum number of quantization levels that can be used ?

(a) 100

(b) 50

(c) 30

(d) 15

12. A multimode step index fiber with a core diameter of 80 μm and a relative index difference of 1·5% is operating at a wavelength of 0·85 μm. If the core refractive index is 1·48, then the normalized frequency for the fiber is

(a) 37·9

(b) 75·8

(c) 151·6

(d) 303·2

13. The even and odd components of the signal $x(t) = e^{-2t} \cos t$ are respectively,

(a) $\cos 2t \cos t$ and $-\sin 2t \cos t$

(b) $\sinh 2t \sin t$ and $-\cosh 2t \cos t$

(c) $\cos 2t \sin t$ and $-\sin 2t \cos t$

(d) $\cosh 2t \cos t$ and $-\sinh 2t \cos t$

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14. What is the convolution integral c(t) for a system with input x(t) and impulse response h(t), where x(t) = u(t − 1) − u(t − 3) and h(t) = u(t) − u(t − 2) ?

(a) $c(t) = \begin{cases} 0, & t < 1 \\ t - 1, & 1 \le t < 3 \\ 5 - t, & 3 \le t < 5 \\ 0, & t \ge 5 \end{cases}$

(b) $c(t) = \begin{cases} 0, & t < 1 \\ t - \dfrac{1}{2}, & 1 \le t < 2 \\ \dfrac{3}{2} - t, & 2 \le t < 5 \\ 0, & t \ge 5 \end{cases}$

(c) $c(t) = \begin{cases} 0, & t < 1 \\ 5 - t, & 1 \le t < 4 \\ 0, & t \ge 4 \end{cases}$

(d) $c(t) = \begin{cases} 2, & 1 \le t \le 2 \\ 1, & 3 \le t \le 5 \\ 0, & \text{otherwise} \end{cases}$

15. The power and energy of the unit step sequence are respectively,

(a) 1/2 and 0

(b) 1/2 and infinity

(c) 2 and 0

(d) 2 and infinity

16. Which one of the following is correct for the given system ?

y[n] = x[n] − x[n − 1]

(a) Time invariant and causal

(b) Time variant and non-causal

(c) Time variant and causal

(d) Time invariant and non-causal

17. Two vectors V_1 and V_2 are orthogonal if their dot product is

(a) 1

(b) 0

(c) infinity

(d) 0·5

18. A discrete-time LTI system with rational system function H(z) is causal if and only if

(a) the ROC is the exterior of a circle outside the outermost pole.

(b) the ROC is the interior of a circle outside the outermost pole.

(c) the ROC is the exterior of a circle outside the innermost pole.

(d) the ROC is the interior of a circle outside the innermost pole.

19. A feedback system has an open-loop transfer function of

$$G(s)\, H(s) = \frac{K(1 - s)}{s(s^2 + 5s + 9)}.$$

By using the Routh criterion, the maximum value of K for the closed-loop system to be stable is

(a) 2·5

(b) 5

(c) 7·5

(d) 9

20. The steady-state error of type 1 system with input $r(t) = \dfrac{t^2}{2}$, $t \ge 0$; is

(a) 0

(b) 1/2

(c) 1

(d) ∞

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21. Which one of the following statements is correct regarding constant N circles ?

(a) The locus of constant, closed-loop magnitude frequency response for unity feedback systems.

(b) The locus of constant, closed-loop phase frequency response for unity feedback systems.

(c) A subsystem inserted into the forward or feedback path for the purpose of improving the transient response or steady-state error.

(d) A system that monitors its output and corrects for disturbances. It is characterized by feedback paths from the output.

22. Which one of the following digital modulation schemes has the bit error rate as

$$\frac{1}{2} \text{erfc}\left(\sqrt{\frac{E_b}{N_0}}\right) \text{?}$$

(a) Coherent binary PSK

(b) Coherent binary FSK

(c) DPSK

(d) Noncoherent binary FSK

23. Which one of the following conditions is justifying a second-order approximation ?

(a) Closed-loop zeros near the closed-loop second-order pole pair are nearly cancelled by the close proximity of higher-order closed-loop poles.

(b) Closed-loop zeros cancelled by the close proximity of higher-order closed-loop poles are far removed from the closed-loop second-order pole pair.

(c) Closed-loop zeros near the closed-loop second-order pole pair are not cancelled by the close proximity of higher-order closed-loop poles.

(d) Closed-loop zeros cancelled by the close proximity of higher-order closed-loop poles are far removed from the closed-loop second-order zero pair.

24. Consider the following statements regarding the disadvantages of a passive lead network over an active PD controller :

1. No additional power supplies are required.

2. Noise due to differentiation is reduced.

3. Additional pole does not reduce the number of branches of the root locus that cross the imaginary axis into the right half-plane.

4. Addition of the single zero of the PD controller tends to reduce the number of branches of the root locus that cross into the right half-plane.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) 3 and 4 only

(d) 1, 2 and 4 only

25. Which one of the following characteristics is correct regarding RISC processor ?

(a) Relatively very large addressing modes

(b) Multi-cycle instruction execution

(c) All operations are not done within the registers of the CPU

(d) Relatively few instructions

26. Which one of the following instructions in a stack computer consists of an operation code only with no address field ?

(a) PUSH X

(b) POP X

(c) ADD

(d) LOAD A

27. Which one of the following statements is correct regarding arithmetic and logical operations ?
    (a) When two 3-bit unsigned numbers are multiplied, the result is an 8-bit product that must be stored in three memory words.
    (b) When two 16-bit unsigned numbers are multiplied, the result is a 32-bit product that must be stored in two memory words.
    (c) Operations that are implemented in a computer with one machine instruction are said to be implemented by software.
    (d) Operations implemented by a set of instructions that constitute a program are said to be implemented by hardware.

28. Which one of the following techniques inherits the simplicity of the direct mapping technique in terms of determining the target set ?
    (a) Set-associative-mapping technique
    (b) Set-associative-direct mapping technique
    (c) Direct mapping set technique
    (d) Indirect mapping set technique

29. Which one of the following memories is primarily used to store machine microcode, desktop bootstrap loader, and video game cartridges ?
    (a) Mask-programmed ROM
    (b) Static-RAM
    (c) Dynamic-RAM
    (d) Non-Programmed ROM

30. In which one of the following situations is the CPU often idle ?
    (a) The speeds of the mechanical I/O devices are intrinsically slower than those of electronic devices.
    (b) The speeds of the electromechanical I/O devices are intrinsically faster than those of electronic devices.
    (c) The speeds of the electrical I/O devices are intrinsically slower than those of electronic devices.
    (d) The speeds of the electrical I/O devices are intrinsically faster than those of electronic devices.

31. Which one of the following systems provides a mechanism for translating program-generated addresses into correct main memory locations ?
    (a) Virtual memory system
    (b) Main memory system
    (c) Physical addresses system
    (d) Memory space system

32. Consider the following statements regarding memory :
    1. Integrated circuit RAM chips are available in both static and dynamic modes.
    2. The dynamic RAM stores the binary information in the form of electric charges that are applied to capacitors.
    3. The static RAM is easier to use and has shorter read and write cycles.
    4. RAM and ROM chips are available in a variety of sizes.
    Which of the above statements are correct ?
    (a) 1 and 2 only
    (b) 1, 3 and 4 only
    (c) 2, 3 and 4 only
    (d) 1, 2, 3 and 4

33. Which one of the following messaging systems attempts to avoid double copy operations by using virtual-memory management techniques ?
    (a) Mach message system
    (b) Duplex message system
    (c) Packet message system
    (d) Data message system

34. Which one of the following storage devices used is when the operating system abstracts from the physical properties of its storage devices to define a logical storage unit ?
    (a) Volatile storage devices
    (b) Non-volatile devices
    (c) Flash storages
    (d) Cache storage devices

35. Which one of the following is *not* correct when we define either a class that does not implement either a mathematical entity like a matrix or a complex number or a low-level type such as a linked list ?
    (a) Don't use global data (use members)
    (b) Don't use local functions
    (c) Don't use public data members
    (d) Don't use inline functions, except as a significant optimization

36. Which one of the following is also called as pseudo instructions that are not directly translated into machine language instructions ?
    (a) Macro expansions
    (b) Assembly directives
    (c) Micro expansions
    (d) Labels

37. The component of $\vec{P} = 2\hat{a}_x - \hat{a}_z$ along
    $$\vec{Q} = 2\hat{a}_x - \hat{a}_y + 2\hat{a}_z \text{ is}$$
    (a) $0 \cdot 745\,\hat{a}_x + 0 \cdot 298\,\hat{a}_y - 0 \cdot 596\,\hat{a}_z$
    (b) $4\hat{a}_x - 2\hat{a}_y + 4\hat{a}_z$
    (c) $0 \cdot 2222\,\hat{a}_x - 0 \cdot 1111\,\hat{a}_y\, 0 \cdot 2222\,\hat{a}_z$
    (d) $0 \cdot 4444\,\hat{a}_x - 0 \cdot 2222\,\hat{a}_y + 0 \cdot 4444\,\hat{a}_z$

38. Consider the following equations with time factor $e^{j\omega t}$:
    1. $\oint D_s \cdot dS = \int \rho_{vs}\, dv$
    2. $\oint E_s \cdot dl = -j\omega B_s$
    3. $\oint B_s \cdot dS = 0$
    4. $\oint H_s \cdot dS = \int (J_s + j\omega D_s) \cdot dl$

    Which of the above Time-Harmonic Maxwell's equations are correct ?
    (a) 1 and 2 only
    (b) 1 and 3 only
    (c) 1, 2 and 3 only
    (d) 3 and 4 only

39. If $\vec{A} = \rho \cos\phi\, \hat{a}_\rho + \sin\phi\, \hat{a}_\phi$, then the surface integration of curl of $\vec{A}$ (for $30° \le \phi \le 60°$ and $2 \le \rho \le 5$) is
    (a) $6 \cdot 750$
    (b) $4 \cdot 941$
    (c) $0 \cdot 732$
    (d) $1 \cdot 765$

40. Which one of the following is *not* the basic rule for boundary conditions at the surface between two different materials ?
    (a) The tangential components of electric field intensity are continuous across the boundary.
    (b) The normal components of electric flux density are discontinuous at the boundary by an amount equal to the surface-charge density on the boundary.
    (c) The tangential components of magnetic field intensity are discontinuous at the boundary by an amount equal to the surface-current density on the boundary.
    (d) The normal components of electric field intensity are continuous across the boundary.

41. A uniform plane wave propagating in a medium has
    $$\vec{E} = 2e^{-\alpha z} \sin(10^8 t - \beta z)\,\hat{a}_y \text{ V/m},$$
    if the medium is characterized by $\varepsilon_r = 1$, $\mu_r = 20$ and $\sigma = 3$ S/m. The values of α and β are respectively,
    (a) 30·70 Np/m, 30·70 rad/m
    (b) 61·40 Np/m, 61·40 rad/m
    (c) 122·80 Np/m, 122·80 rad/m
    (d) 15·35 Np/m, 15·35 rad/m

42. A distortionless transmission line has the following parameters :

characteristic impedance = 60 Ω, wave velocity = 0·6 c, where c is the speed of light in a vacuum, α = 20 mNp/m. The values of transmission line parameters R, L, G and C at 100 MHz are respectively,

(a) 1·2 Ω/m, 333 nH/m, 333 µS/m, 92·59 pF/m

(b) 1·2 Ω/m, 111 H/m, 333 µS/m, 92·59 F/m

(c) 2·4 Ω/m, 333 nH/m, 333 µS/m, 92·59 F/m

(d) 2·4 Ω/m, 111 H/m, 333 S/m, 92·59 pF/m

43. Consider the following statements regarding the Smith's chart :

1. Smith's chart is a graphical indication of the impedance of a transmission line and of the corresponding reflection coefficient as one moves along the line.

2. λ distance on the line corresponds to a 720° movement on the Smith's chart.

3. The admittance chart can be obtained by shifting each and every point on the impedance chart by 90°.

4. Counter-clockwise movement on the chart corresponds to moving towards the generator.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 1, 2 and 4 only

(d) 2, 3 and 4 only

44. Consider the following statements regarding the load matching and impedance measurements :

1. A mismatched load can be properly matched to a line by inserting prior to the load a transmission line λ/4 long.

2. For matching of 120 Ω load to a 75 Ω line, the quarter-wave transformer must have a characteristic impedance of 190 Ω.

3. The main disadvantage of single-stub matching is that it is a narrow-band or frequency-sensitive device.

Which of the above statements are **not** correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

45. Which of the following antennas are used directly as radiators aboard satellites to illuminate comparatively large areas of the Earth and they are widely used as primary feeds for reflector-type antennas both in transmitting and receiving modes ?

(a) Dipole antennas

(b) End fire-array antennas

(c) Microstrip antennas

(d) Horn antennas

46. At the higher frequencies, which one of the following becomes more confined to the region between the micro-strip and ground plane ?
    (a) Electric field
    (b) Magnetic field
    (c) Dispersion
    (d) Skin effect

47. A magnetic field strength of 5 μA/m is required at a point on $\theta = \pi/2$, which is 2 km from a half-wave dipole antenna in air. If the radiation resistance of the half-wave dipole antenna is 73 Ω, then the power radiated by this antenna (neglecting the ohmic loss) is
    (a) 72 mW
    (b) 144 mW
    (c) 158 mW
    (d) 316 mW

48. Consider the following statements regarding the waveguides :
    1. Cut-off frequency is the operating frequency below which attenuation occurs and above which propagation takes place.
    2. The dominant mode is the mode with the lowest cut-off wavelength.
    3. The dominant mode in the rectangular waveguide (for a > b) will be TE_{01}.
    Which of the above statements is/are not correct ?
    (a) 1 and 2 only
    (b) 1 and 3 only
    (c) 2 and 3 only
    (d) 3 only

49. Consider the following statements for Poly-Si deposition :
    1. Poly-Si layer is used for gate electrode of MOSFET because it has similar lattice constants with SiO_2.
    2. Poly-Si layer used for gate electrode of MOSFET for the better mechanical stability due to different thermal expansion coefficients.
    3. In VLSI circuits, interconnects can be completed in one or two metal levels.
    4. Poly-Si is used for short interconnects.
    Which of the above statements are correct ?
    (a) 1 and 2 only
    (b) 2 and 3 only
    (c) 1 and 4 only
    (d) 2, 3 and 4 only

50. Consider the following statements regarding the Read Only Memory (ROM) :
    1. The stored data is lost if the power is removed.
    2. It consists of an address decoder with n input lines and a programmable OR array with n output lines.
    3. The minterms are ORed through the programmable switches which can be made ON or OFF to select a particular minterm. The programmable switches can be implemented by either bipolar, CMOS, nMOS or pMOS technologies.
    4. Mask-programmed ROMs are used in the applications where the system requires data to be stored and to be changed during the operation.
    Which of the above statements are not correct ?
    (a) 1 and 2 only
    (b) 1, 3 and 4 only
    (c) 1, 2 and 4 only
    (d) 2, 3 and 4 only

51. If each core in a 16-core processor has a yield of 90% and nothing else on the chip fails, what is the yield of the chip ?
    (a) $(0 \cdot 9)^8$
    (b) $(0 \cdot 9)^{16}$
    (c) $(0 \cdot 1)^8$
    (d) $(0 \cdot 1)^{16}$

52. What is the simplified value of y(n), if
    $$y(n) = \sum_{n=-5}^{5} \sin (2n)\, \delta(n + 7) ?$$
    (a) sin 10
    (b) – sin 10
    (c) 1
    (d) 0

53. The energy of the signal $x(n) = (-0 \cdot 4)^n\, u(n)$ is
    (a) 1/16
    (b) 1/36
    (c) 5/3
    (d) 25/4

54. Consider the following statements for a system given by

$$y(n) = x(n) \sum_{k=-\infty}^{\infty} \delta(n - 3k).$$

1. The system is linear.
2. The system is non-linear.
3. The system is causal.
4. The system is non-causal.

Which of the above statements is/are correct ?

(a) 1 only
(b) 2 only
(c) 2 and 4 only
(d) 1 and 3 only

55. Which one of the following is the zero-input response of the system

$$y[n] - 3y[n - 1] - 4y[n - 2] = 0$$

described by the homogeneous second-order difference equation if $y[-2] = 0$ and $y[-1] = 5$?

(a) $y_{zi}(n) = (-1)^{n+1} + (-4)^{n+2}, n \geq 0$
(b) $y_{zi}(n) = (1)^{n+1} + (4)^{n+2}, n \geq 0$
(c) $y_{zi}(n) = (-1)^{n+1} + (4)^{n+2}, n \geq 0$
(d) $y_{zi}(n) = (1)^{n+1} + (-4)^{n+2}, n \geq 0$

56. Consider the following statements regarding Epitaxial Growth :

1. Thin layers are grown on a substrate wafer, this technique is known as epitaxial growth.
2. Physical vapour deposition is also called vapour phase epitaxy.
3. OMCVD is a technique to grow epitaxial layers from metalorganic compounds.
4. High throughout and slow deposition rate are the disadvantages of the CVD technique.

Which of the above statements are correct ?

(a) 2 and 3 only
(b) 1 and 3 only
(c) 1, 2 and 3 only
(d) 1, 3 and 4 only

57. FIR filter having anti-symmetrical impulse response with even filter order can be used to design

(a) low-pass, high-pass, band-pass and band-stop.
(b) low-pass and band-pass only.
(c) high-pass and band-stop only.
(d) differentiator and Hilbert transformer.

58. An IIR filter having numerator order M and denominator order N is to be realized using direct form II structure. How much total number of multiplications, additions and memory locations are required respectively ?

(a) M+N, M+N and M+N
(b) M+N, M+N and maximum of {M, N}
(c) M+N+1, M+N+1 and M+N
(d) M+N+1, M+N and maximum of {M, N}

59. In 8051, the accumulator register contains 80H and B register contains 8FH. The content of the accumulator and status of the carry flag after the addition operation are respectively,

(a) 0FH, 1
(b) 10FH, 0
(c) FFH, 1
(d) 10FH, 1

60. Which one of the following operations is *not* commutative ?

(a) Scaling and reversal of a signal x[n]
(b) Scaling and folding of a signal x[n]
(c) Folding and time reversal of a signal x[n]
(d) Folding and time delaying of a signal x[n]

61. Which one of the following traffics can adjust, over wide ranges, to changes in delay and throughput across an internet and still meet the needs of its applications ?

(a) Elastic traffic

(b) Inelastic traffic

(c) Internet traffic

(d) Service traffic

62. A data message of 10 ms duration having 4800 bits crosses 9 nodes (10 hops) to reach its destination. The data rate and total delay for circuit switched connection (assuming node delays as 1 ms) are respectively,

(a) 240 kbps, 20 ms

(b) 240 kbps, 21 ms

(c) 120 kbps, 21 ms

(d) 480 kbps, 20 ms

63. Consider the following statements regarding the OSI model :

1. Application layer provides the control structure for communication between applications; establishes, manages and terminates connections between cooperating applications.

2. Data link layer provides for the reliable transfer of information across the physical link.

3. Transport layer provides end-to-end error recovery and flow control of data.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 1, 2 and 3

(d) 2 and 3 only

64. Consider the following statements regarding the TCP/IP protocol :

1. TELNET is an application of TCP protocol.

2. SMTP provides a basic electronic mail facility and makes use of TCP to send message to an SMTP module on another host.

3. The Internet Protocol is used at internet layer to provide the routing function across multiple networks.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 1, 2 and 3

(d) 2 and 3 only

65. If a cellular system has p number of co-channel interfering cells, S is the desired signal power from serving base station and I_P is interference power from p^{th} interfering co-channel cell base station, then what is the signal to interference ratio for a mobile receiver in the functioning cell ?

(a) $\dfrac{S}{\Sigma_{i=1}^{p} I_P}$

(b) $\dfrac{2 \times S}{\Sigma_{i=1}^{p} I_P}$

(c) $\dfrac{\Sigma_{i=1}^{p} I_P}{S}$

(d) $\dfrac{S}{I_P}$

66. Which one of the following provides a reliable connection for the transfer of data between applications ?

(a) TCP

(b) UDP

(c) FTP

(d) SMTP

67. For a GEO satellite, what is the free space loss (L_{db}) at the equator in terms of carrier wavelength (λ)?

   (a) $20 \log (\lambda) + 21 \cdot 98$

   (b) $- 20 \log (\lambda) + 173 \cdot 07$

   (c) $20 \log (\lambda) - 173 \cdot 07$

   (d) $- 20 \log (\lambda) + 21 \cdot 98$

68. If R = Earth's radius, h = orbit height, β = coverage angle, and θ = minimum elevation angle, then which one of the following relations is correct?

   (a) $\dfrac{R}{R+h} = \dfrac{\cos (\beta + \theta)}{\cos (\theta)}$

   (b) $\dfrac{R}{h} = \dfrac{\cos (\beta)}{\cos (\theta)}$

   (c) $\dfrac{h}{R} = \dfrac{\cos (\beta + \theta)}{\cos (\beta)}$

   (d) $\dfrac{R+h}{h} = \cos (\beta + \theta) - \cos (\theta)$

69. Consider the following statements for public circuit-switching network :

   1. Private branch exchange (PBX) is an application of circuit switching.

   2. A switching centre that directly supports subscribers is known as digital PBX.

   3. The link between the subscriber and the network, is also referred to as the local loop.

   Which of the above statements are correct ?

   (a) 1 and 2 only

   (b) 1 and 3 only

   (c) 1, 2 and 3

   (d) 2 and 3 only

70. Consider the following statements regarding the cellular system/network :

   1. Cellular systems use open-loop power control and closed-loop power control.

   2. For FDMA system, the capacity of a cell is more as compared to the number of frequency channels allocated to it.

   3. A cell has L potential subscribers and is able to handle N simultaneous users. If L > N, then the system is referred to as nonblocking.

   Which of the above statements are *not* correct ?

   (a) 1 and 2 only

   (b) 1 and 3 only

   (c) 1, 2 and 3

   (d) 2 and 3 only

71. The fundamental parameter of a single-mode fiber is

   (a) the core diameter and cladding diameter.

   (b) the mode-field diameter.

   (c) the cladding diameter.

   (d) the buffer coating diameter.

72. Consider the following statements regarding the advantages of optical fiber communication :

   1. Enormous potential bandwidth.

   2. Electrical isolation.

   3. Immunity to interference and crosstalk.

   4. System reliability and ease of maintenance.

   Which of the above statements are correct ?

   (a) 1 and 4 only

   (b) 2, 3 and 4 only

   (c) 1, 2 and 3 only

   (d) 1, 2, 3 and 4

73. Express the Boolean function $F = A + \overline{B}C$ as a sum of minterms ?

(a) $ABC + \overline{A}\,\overline{B}C$

(b) $A\overline{B}C + \overline{A}\overline{B}C + AB\overline{C}$

(c) $ABC + AB\overline{C} + A\overline{B}C + A\overline{B}\,\overline{C} + \overline{A}\,\overline{B}C$

(d) $AB\overline{C} + A\overline{B}C + \overline{A}\,\overline{B}\,\overline{C}$

74. Consider the following statements regarding n-channel JFET :

1. The maximum drain current I_{DSS} occurs when gate-to-source voltage $V_{GS} = 0\ V$ and drain-to-source voltage $V_{DS} \geq |V_P|$. (V_P is pinch-off voltage).

2. For gate-to-source voltage V_{GS} less than the pinch-off level, the drain current is 0 A.

3. For all levels of V_{GS} between 0 V and the pinch-off level, the current I_D will range between I_{DSS} and 0 A, respectively.

Which of the above statements are correct ?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 1, 2 and 3
(d) 2 and 3 only

75. The circuit given below is a half wave rectifier. The internal resistance of a diode R_f is 20 Ω and load resistance R_L is 1 kΩ. The input AC source with rms voltage is 110 V. What is the DC voltage across the diode ?
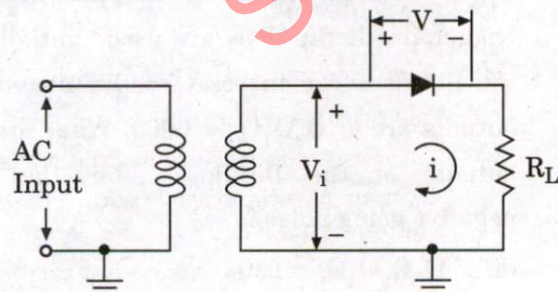
(a) $-28 \cdot 54\ V$
(b) $-38 \cdot 54\ V$
(c) $-48 \cdot 54\ V$
(d) $-58 \cdot 54\ V$

76. The circuit given below is the fixed biasing of the n-channel JFET. The pinch-off voltage and the maximum drain-to-source current is $-8\ V$ and 10 mA respectively. What are the values of V_{GSQ} and I_{DQ}, respectively ?
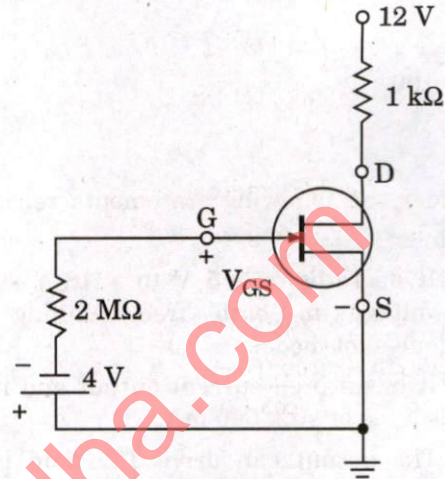
(a) $+4\ V$ and 25 mA
(b) $+4\ V$ and $2 \cdot 5$ mA
(c) $-4\ V$ and 25 mA
(d) $-4\ V$ and $2 \cdot 5$ mA

77. Consider the following statements regarding JFET :

1. The relationship between the drain current and gate-to-source voltage of a JFET is a nonlinear.

2. The minimum current for JFET occurs at pinch-off voltage defined by $V_{GS} = V_P$.

3. A current controlled device is one in which a current defines the operating conditions of the device.

Which of the above statements are correct ?
(a) 1 and 2 only
(b) 1 and 3 only
(c) 1, 2 and 3
(d) 2 and 3 only

78. What is the maximum closed-loop voltage gain that can be used when the input signal varies by 0·2 V in 10 μs with slew rate of op-amp SR = 2 V/μs ?

(a) 40

(b) 50

(c) 80

(d) 100

79. Consider the following statements regarding 555 timer :

1. It operates on − 5 V to + 18 V supply voltage in both free running and one-shot modes.

2. It has a high current output and it can source or sink 500 mA.

3. The output can drive TTL and has a temperature stability of 80 parts per million (ppm) per degree celsius change in temperature or equivalently 0·008%/°C.

Which of the above statements are *not* correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 1, 2 and 3

(d) 2 and 3 only

80. Consider the following statements for negative feedback :

1. It has more linear operation.

2. It has improved frequency response.

3. It has better stabilized voltage gain.

4. It has higher output impendence.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1, 2 and 3 only

(d) 2, 3 and 4 only

81. The simplified form of the function

$F(A, B, C, D) = \Sigma m(1,5,6,7,11,12,13,15)$ is

(a) $\bar{A}\,\bar{C}\,\bar{D} + \bar{A}\,\bar{B}\,C + AB\,\bar{C} + A\,\bar{C}\,D + BD$

(b) $\bar{A}\,\bar{C}\,D + \bar{A}\,BC + AB\,\bar{C} + ACD + BD$

(c) $\bar{A}\,\bar{C}\,D + \bar{A}\,BC + AB\,\bar{C} + ACD$

(d) $\bar{A}\,\bar{C}\,D + \bar{A}\,BC + \bar{A}\,B\,\bar{C} + ACD$

82. Consider the following statements regarding the Moore and Mealy models :

1. In the Mealy circuit, the final output depends only on the present state of memory elements.

2. In the Moore circuit, output can change in between the clock edges if the external inputs change.

3. The implementation of a logic function in Mealy circuit needs more number of states than Moore circuit.

Which of the above statements are *not* correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 1, 2 and 3

(d) 2 and 3 only

83. In a Johnson's counter, all the negative triggered J-K flip-flops are used. Initially all the flip-flops are in reset condition and the outputs are $Q_3Q_2Q_1Q_0 = 0000$. What are the outputs of the flip-flops after the fifth negative going pulse ?

(a) $Q_3Q_2Q_1Q_0 = 0101$

(b) $Q_3Q_2Q_1Q_0 = 1000$

(c) $Q_3Q_2Q_1Q_0 = 0010$

(d) $Q_3Q_2Q_1Q_0 = 1110$

84. Consider the following statements regarding PROM/EPROM :

1. The erasable programmable ROM using ultraviolet erasing is known as EPROM.

2. The ROM that makes use of the electrical voltage for erasing is known as electrically alterable ROM.

3. A PROM can be programmed many times after fabrication.
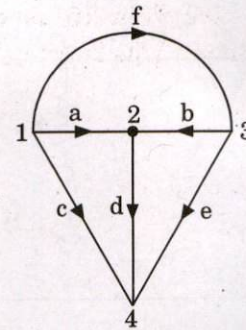
Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 1, 2 and 3

(d) 2 and 3 only

85. What are the values of R_a, R_b and R_c respectively, after transforming the Wye network shown in the figure to a delta network ?

(a) 140 Ω, 70 Ω and 45 Ω

(b) 70 Ω, 140 Ω and 35 Ω

(c) 140 Ω, 70 Ω and 35 Ω

(d) 40 Ω, 70 Ω and 25 Ω
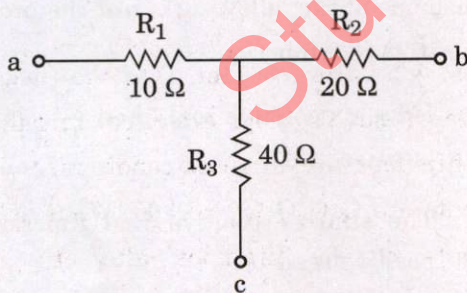
86. The number of links in the graph shown in the figure is

(a) 3

(b) 4

(c) 2

(d) 5

87. Which one of the following contains lesser number of nodes than the original graph ?

(a) Proper subgraph

(b) Improper subgraph

(c) Planar graph

(d) Non-planar graph

88. Consider the following statements regarding duality :

1. The dual networks are obtained for both AC and DC circuits and they are based on Kirchhoff's laws.

2. Dual circuits are not obtained in planar networks.

3. Two networks are said to be dual networks if mesh equations of one network have the same form as the nodal equations of the other.
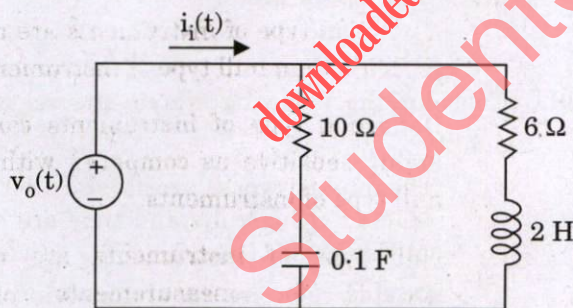
Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

89. The current gain $\dfrac{I_o(\omega)}{I_i(\omega)}$ for the given circuit is
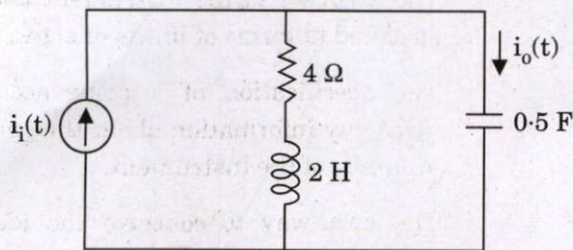
(a) $\dfrac{s(s+2)}{s^2+2s+1}$, where $s = j\omega$

(b) $\dfrac{s(s+1)}{s^2+s+1}$, where $s = j\omega$

(c) $\dfrac{s(s+2)}{s^2+2s+2}$, where $s = j\omega$

(d) $\dfrac{s(s+2)}{s^2+s+2}$, where $s = j\omega$

90. The poles and zeros of the given circuit are

(a) poles : -0.683 and -7.317
zeros : -1 and -3

(b) poles : -0.483 and -5.317
zeros : -3 and -4

(c) poles : -0.383 and -4.317
zeros : -2 and -3

(d) poles : -0.583 and -6.317
zeros : -1 and -4

91. Which one of the following has all the poles of the function lie on the $j\omega$ axis ?

(a) L-C function

(b) R-L function

(c) R-C function

(d) Y function

92. Which one of the following is an LC immittance function ?

(a) $Z(s) = \dfrac{Ks(s^2+4)}{(s^2+1)(s^2+3)}$

(b) $Z(s) = \dfrac{s^5+4s^3+5s}{3s^4+6s^2}$

(c) $Z(s) = \dfrac{K(s^2+1)(s^2+9)}{(s^2+2)(s^2+10)}$

(d) $Z(s) = \dfrac{2(s^2+1)(s^2+9)}{s(s^2+4)}$

93. Which one of the following is *not* the property of positive real function ?

(a) If $F(s)$ is positive real, then $\dfrac{1}{F(s)}$ is not a positive real.

(b) The sum of positive real functions is positive real.

(c) The poles and zeros of a positive real function cannot be in the right half of the S plane.

(d) Only simple poles with real positive residues can exist on the $j\omega$ axis.

94. Which one of the following is the transmission matrix equation for network N_a if two networks N_a and N_b are cascaded as shown in the figure ?
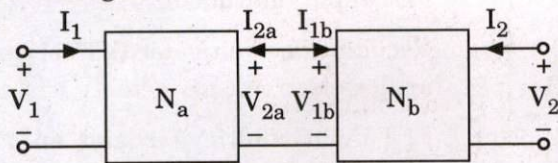

(a) $\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A_a & B_a \\ C_a & D_a \end{bmatrix} \begin{bmatrix} -V_{2a} \\ I_{2a} \end{bmatrix}$

(b) $\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A_a & B_a \\ C_a & D_a \end{bmatrix} \begin{bmatrix} V_{2a} \\ -I_{2a} \end{bmatrix}$

(c) $\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A_a & B_a \\ C_a & -D_a \end{bmatrix} \begin{bmatrix} -V_{2a} \\ I_{2a} \end{bmatrix}$

(d) $\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A_a & B_a \\ -C_a & D_a \end{bmatrix} \begin{bmatrix} V_{2a} \\ -I_{2a} \end{bmatrix}$

95. Which one of the following theorems becomes important if the circuit has sources operating at different frequencies ?

(a) Norton theorem

(b) Thevenin theorem

(c) Superposition theorem

(d) Maximum power transfer theorem

96. What is the value of Z_{th} at terminal a – b of the given Thevenin circuit ?
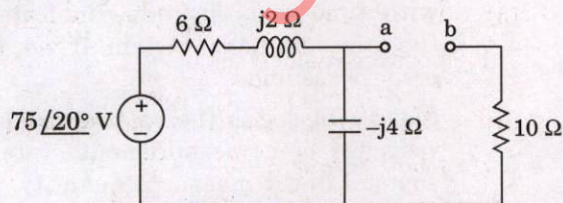
(a) $Z_{th} = (8\cdot4 - j1\cdot2)\ \Omega$

(b) $Z_{th} = (10\cdot3 - j2\cdot3)\ \Omega$

(c) $Z_{th} = (11\cdot3 - j2\cdot9)\ \Omega$

(d) $Z_{th} = (12\cdot4 - j3\cdot2)\ \Omega$

97. Consider the following statements for accuracy of the instrument :

1. The accuracy of the instrument may be specified in terms of limits of error.

2. The specification of a point accuracy gives any information about the general accuracy of the instrument.

3. The best way to conceive the idea of accuracy is to specify it in terms of the true value of the quantity being measured.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 1, 2 and 3

(d) 2 and 3 only

98. Consider the following statements for deflection and null type instruments :

1. Deflection type of instruments are more accurate than null type of instruments.

2. Deflection type of instruments can be highly sensitive as compared with the null type of instruments.

3. Null type of instruments are more suitable for measurements under dynamic conditions than deflection type of instruments.

Which of the above statements are *not* correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 1, 2 and 3

(d) 2 and 3 only

99. A digital timer with eight readout is stated to have accuracy of 0·005 percent of reading, ±1 in the final digit. Readout is in s, ms and μs. Assuming that the instrument meets its specifications, the maximum likely errors when the reading is 05000000 μs is

(a)   ±251 μs

(b)   ±260 μs

(c)   ±261 μs

(d)   ±250 μs

100. Which one of the following is essentially a permanent magnet moving coil instrument designed to be sensitive to extremely low current levels ?

(a)   Multimeter

(b)   Galvanometer

(c)   Electrodynamic Wattmeter

(d)   Electrodynamic Voltmeter

101. A strain gauge is bonded to a beam 0·1 m long and has a cross-sectional area 4 cm^2. Young's modulus for steel is 207 GN/m^2. The strain gauge has an unstrained resistance of 240 Ω and a gauge factor of 2·2. When a load is applied, the resistance of gauge changes by 0·013 Ω. The change in length of the steel beam is

(a) $1·23 \times 10^{-6}$ m

(b) $2·46 \times 10^{-6}$ m

(c) $4·92 \times 10^{-6}$ m

(d) $9·84 \times 10^{-6}$ m

102. A digital frequency meter has a time base derived from a 1 MHz clock generator frequency-divided by decade counters. What is the measured frequency when a 1·512 kHz sine wave is applied and the time base uses six decade counters ?

(a)   1·512 kHz

(b)   15·12 kHz

(c)   1·412 kHz

(d)   14·12 kHz

103. Which of the following instruments have large scales for easy reading ?

(a)   Vacuum-tube voltmeter (VTVM) and a FET-input multimeter

(b)   Vacuum-tube voltmeter (VTVM) and an analog electronic ammeter

(c)   FET-input multimeter and an analog electronic ammeter

(d)   FET-input multimeter and an analog electronic voltmeter

104. If a resistor is known to have a resistance of 500 Ω with a possible error of ±50 Ω, the ±50 Ω is

(a)   relative error.

(b)   absolute error.

(c)   gross error.

(d)   systematic error.

105. Consider the following statements for dynamic characteristics of a measurement system :

1.   Fidelity is defined as the degree to which a measurement system indicates changes in the measured quantity without any dynamic error.

2.   Dynamic error is the difference between the true value of the quantity changing with time and the value indicated by the measurement system if no static error is assumed.

3.   Measuring lag is the retardation in the response of a measurement system to changes in the measured quantity.

Which of the above statements are correct ?

(a)   1 and 2 only

(b)   1 and 3 only

(c)   1, 2 and 3

(d)   2 and 3 only

106. Current was measured during a test as of 30·4 A, flowing in a resistor of 0·105 Ω. It was discovered later that the ammeter reading was low by 1·2 percent and the marked resistance was high by 0·3 percent. What is the true power as a percentage of the power that was originally calculated ?

(a) 118·4%

(b) 109·7%

(c) 102·1%

(d) 104·8%

107. The LVDT is used in an accelerometer to measure seismic mass displacements. The LVDT and signal conditioning outputs are 0·31 mV/mm with a ±20 mm core displacement. The spring constant is 240 N/m and the core mass is 0·05 kg. The natural frequency and maximum measurable acceleration are respectively,

(a) 69·3 rad/s and 69·3 m/s^2

(b) 69·3 rad/s and 96 m/s^2

(c) 15·59 rad/s and 96 m/s^2

(d) 15·59 rad/s and 31·18 m/s^2

108. A quartz piezoelectric crystal having a thickness of 1·5 mm and voltage sensitivity of 0·05 V-m/N is subjected to a pressure of 2 MN/m^2. The permittivity of the quartz is $40·6 \times 10^{-12}$ F/m. The output voltage is

(a) 150 V

(b) 155 V

(c) 165 V

(d) 300 V

109. Which one of the following is a metallic crystal structure which has a cubic unit cell with atoms located at all eight corners and a single atom at the cube centre ?

(a) Face-centred cubic crystal structure

(b) Body-centred cubic crystal structure

(c) Cubic crystal structure

(d) Metal crystalline structure

110. What is the atomic packing factor for FCC crystal structure ?

(a) 0·96

(b) 0·48

(c) 0·74

(d) 0·37

111. Consider the following statements regarding crystal defects :

1. In metals, a self-interstitial introduces relatively large distortions in the surrounding lattice because the atom is substantially larger than the interstitial position in which it is situated.

2. All crystalline solids do not contain vacancies and, it is possible to create such a material that is free of these defects.

3. Impurity point defects are found in solid solutions, of which there are two types : substitutional and interstitial.

Which of the above statements is/are correct ?

(a) 1 and 3 only

(b) 2 and 3 only

(c) 3 only

(d) 2 only

112. Which one of the following represents the upper and lower upper bound of the elastic modulus respectively ? (E and V denote the elastic modulus and volume fraction respectively; the subscripts c, m and p represent composite, matrix and particulate phases respectively)

(a) $E_c(u) = \dfrac{E_m V_m}{E_p V_p}$ and

$$E_c(l) = \dfrac{E_m E_p}{V_m E_p + V_p E_m}$$

(b) $E_c(u) = \dfrac{E_m E_p}{V_m E_p + V_p E_m}$ and

$$E_c(l) = E_m V_m + E_p V_p$$

(c) $E_c(u) = E_m V_m + E_p V_p$ and

$$E_c(l) = \dfrac{E_m E_p}{V_m E_p + V_p E_m}$$

(d) $E_c(u) = E_m V_m + E_p V_p$ and

$$E_c(l) = \dfrac{V_m E_p + V_p E_m}{E_m E_p}$$

113. Which one of the following does *not* come under the category of ceramic material ?
(a) Al_2O_3
(b) SiO_2
(c) Si_2N_4
(d) SiC

114. Consider the following statements regarding corrosion of ceramic material :
1. Ceramic materials are much better suited to withstand most of these environments for reasonable time periods than are metals.
2. Corrosion of ceramic materials generally involves simple chemical dissolution, in contrast to the electrochemical processes found in metals.
3. Ceramic materials are not frequently used because of their non-resistance to corrosion.
Which of the above statements is/are correct ?
(a) 1 and 3 only
(b) 2 and 3 only
(c) 3 only
(d) 1 and 2 only

115. For a ferromagnetic material which one of the following relationships is correct between magnetic flux density and magnetization ?
(a) $B \cong 2\mu_0 M$
(b) $B \cong \mu_0 M$
(c) $B \cong \dfrac{\mu_0 M}{2}$
(d) $B \cong \dfrac{\mu_0}{M}$

116. Which of the following statements is *not* correct regarding ferrites ?
(a) Ferrites, with large magnetostrictive effects, are used in electromechanical transducers.
(b) Ferrites have very high resistivity.
(c) Hard magnetic ferrites are used for the manufacture of light weight permanent magnets.
(d) Soft magnetic materials can be used for making permanent magnets.

117. Which one of the following materials displays the behavior of antiferromagnetism ?
(a) Manganese oxide
(b) Iron
(c) Nickel
(d) Cobalt

118. Consider the following statements for superconductivity :
1. Superconducting magnets capable of generating high fields with low power consumption are currently being employed in scientific test and research equipment.
2. One of the potential applications of superconducting materials is electrical power transmission through superconducting materials — power losses would be extremely low, and the equipment would operate at low voltage levels.
3. Type II superconductors are preferred over type I for most practical applications by virtue of their higher critical temperatures and critical magnetic fields.
Which of the above statements is/are correct ?
(a) 1 only
(b) 2 and 3 only
(c) 3 only
(d) 1, 2 and 3

119. Which one of the following statements is *not* correct regarding the features of ceramics ?
(a) Ceramics are hard, strong and dense.
(b) Ceramics are stronger in compression than in tension.
(c) Ceramics have very poor dielectric properties.
(d) Ceramics are weak in impact strength.

120. What is the packing efficiency of diamond ?
(a) 0·17
(b) 0·34
(c) 0·24
(d) 0·48

121. A current of 5 A in primary coil of a circuit is reduced to zero at a uniform rate in 10^{-3} seconds. If coefficient of mutual inductance is 2 H, then the induced emf in the secondary coil is

    (a) 10^{-4} V

    (b) 10^4 V

    (c) 10^{-6} V

    (d) 10^6 V

122. A wire of resistor $10\ \Omega$ is drawn out so that its length is increased to twice its original length. Then, the new resistance is

    (a) $20\ \Omega$

    (b) $5\ \Omega$

    (c) $30\ \Omega$

    (d) $40\ \Omega$

123. What is the magnitude of emf induced in a 200 turn coil with cross-sectional area of $0.16\ m^2$, if the magnetic field through the coil changes from $0.10\ Wb/m^2$ to $0.50\ Wb/m^2$ at a uniform rate over a period of 0.02 seconds ?

    (a) -520 V

    (b) -640 V

    (c) -725 V

    (d) -815 V

124. In an AC circuit, the voltage source V is as follows : $V = 100 \sin (100t)$ volt. The rms value of voltage is

    (a) 35.35 V

    (b) 40.35 V

    (c) 80.7 V

    (d) 70.7 V

125. Which one of the following statements is *not* correct regarding the characteristics of ideal transformer ?

    (a) There is no leakage flux.

    (b) There are no losses in electric circuit or in magnetic circuit.

    (c) The resistance of both the windings is infinite.

    (d) The permeability of the core is infinite and zero reluctance.

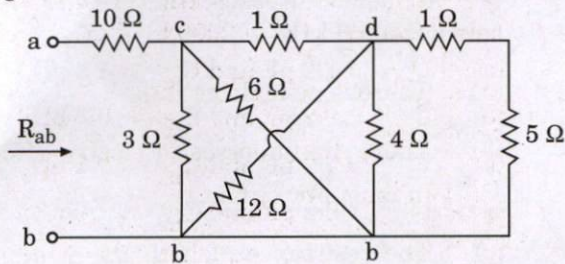126. Which one of the following is *not* the indication of a fully-charged cell ?

    (a) Intensity

    (b) Gassing

    (c) Voltage

    (d) Specific gravity of the electrolyte

127. For the given circuit, the currents i_1 and i_3 are
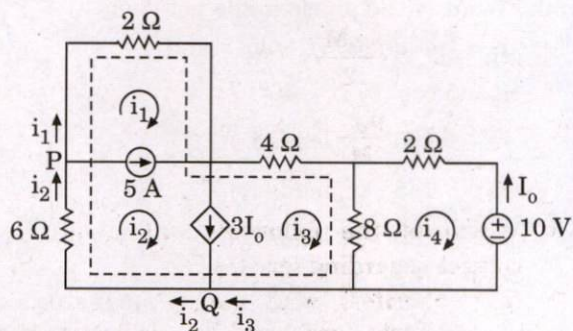
    (a) $i_1 = -2.5$ A and $i_3 = 3.93$ A

    (b) $i_1 = 7.5$ A and $i_3 = -2.5$ A

    (c) $i_1 = 3.93$ A and $i_3 = 2.14$ A

    (d) $i_1 = -7.5$ A and $i_3 = 3.93$ A

128. What is the equivalent resistance R_{ab} in the given circuit ?

(a) 34·08 Ω

(b) 11·20 Ω

(c) 42·16 Ω

(d) 17·82 Ω

129. Consider the following statements for inductors :

1. An inductor acts like a short circuit to DC.

2. The current through an inductor cannot change instantaneously.

3. The current through an inductor can change instantaneously.

4. An inductor acts like an open circuit to DC.

Which of the above statements is/are correct ?

(a) 1 only

(b) 1 and 2 only

(c) 2 only

(d) 3 and 4 only

130. What is the phase angle between

$i_1 = -4 \sin(377t + 25°)$ and

$i_2 = 5 \cos(377t - 40°)$?

(a) 155°, (i_1 leads i_2)

(b) 145°, (i_2 leads i_1)

(c) 135°, (i_1 leads i_2)

(d) 125°, (i_2 leads i_1)

131. Which one of the following laws states that the line integral of the tangential component of H around a closed path is the same as the net current I_{enc} enclosed by the path ?

(a) Biot-Savart's law

(b) Lenz's law

(c) Gauss's law

(d) Ampere's circuit law

132. Consider the following statements regarding an ideal transformer :

1. Coils have very large reactances.

2. Coupling coefficient is equal to unity.

3. Primary and secondary coils are not lossless.

Which of the above statements is/are correct ?

(a) 2 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 only

133. The total efficiency of an injection laser with a GaAs active region is 18%. The voltage applied to the device is 2·5 V and the bandgap energy for GaAs is 1·43 eV. The external power efficiency of the device is

(a) 5%

(b) 10%

(c) 15%

(d) 20%

134. The slope of the output characteristics of a transistor in CE configuration is higher than that in CB configuration due to which one of the following effects ?

(a) Zener effect

(b) Early effect

(c) Avalanche effect

(d) Transistor effect

135. Which one of the following statements is correct regarding the comparison between Avalanche and Zener effect ?

(a) Zener effect is caused by impact ionization.

(b) Zener diodes have higher resistance.

(c) Avalanche effect occurs at voltages usually above 7 V.

(d) Avalanche diodes have lower resistance.

136. A sinusoidal input is given to the network shown below. The output waveform is

(a)

(b)

(c)

(d)
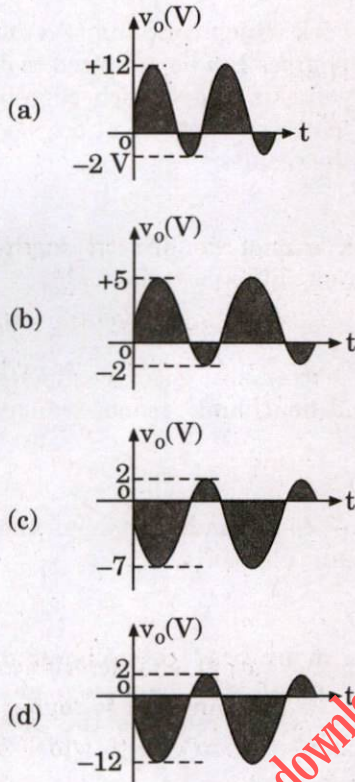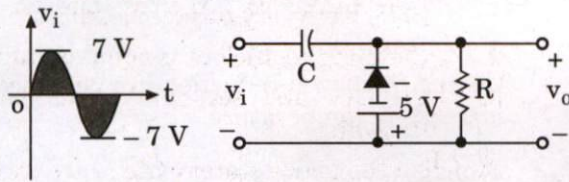
137. For enhancement-type n-channel MOSFET with drain current $I_D = 10$ mA, $V_{GS} = 8$ V and $V_T = 2$ V, the device constant k is

(a) 0.139 mA/V^2

(b) 0.278 mA/V^2

(c) 0.387 mA/V^2

(d) 0.556 mA/V^2

138. Which one of the following statements is correct regarding shunt-series feedback amplifier topology ?

(a) The currents are compared and the output voltages are sampled.

(b) The currents are compared and the output currents are sampled.

(c) The voltages are compared and the output currents are sampled.

(d) The voltages are compared and the output voltages are sampled.

139. A Hartley oscillator uses $L_1 = 2$ mH and $L_2 = 1.5$ mH. The range of capacitance so that the frequency of oscillation can be varied between 1000 kHZ to 2000 kHZ are

(a) $C_{max} = 7.2$ pF and $C_{min} = 1.8$ pF

(b) $C_{max} = 9.2$ pF and $C_{min} = 0.8$ pF

(c) $C_{max} = 7.2$ pF and $C_{min} = 0.8$ pF

(d) $C_{max} = 9.2$ pF and $C_{min} = 1.8$ pF

140. Which one of the following statements is correct regarding integrated circuit fabrication ?

(a) IC offers increased reliability, improved performance, high speed and lower power consumption.

(b) IC is a miniature, low cost electronic circuit fabricated on a multi crystal chip of silicon.

(c) IC is a miniature, high cost electronic circuit fabricated on a multi crystal chip of silicon.

(d) IC offers decreased reliability, improved performance, low speed and higher power consumption.

141. What is the value of capacitor of the Wien bridge oscillator operating at resonant frequency of 10 kHz with resistance of 100 kΩ ?

(a) 149 pF

(b) 159 pF

(c) 169 pF

(d) 189 pF

142. A monolithic metal oxide semiconductor (MOS) non-polarized capacitor which is a parallel plate capacitor with SiO_2 as dielectric. A surface thin film of metal (aluminium) is the top plate. The bottom plate consists of the heavily doped n^+ region that is formed during emitter diffusion. What is the typical value of capacitance for an oxide thickness of 500 Å of this MOS capacitor ?

(a) 0.1 pF/mil^2

(b) 0.2 pF/mil^2

(c) 0.3 pF/mil^2

(d) 0.4 pF/mil^2

143. For the given figure, the output voltage is
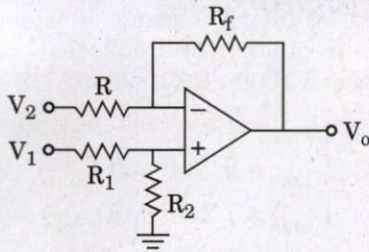
(a) $V_0 = -\dfrac{R_f}{R} V_2 + \left(\dfrac{R + R_f}{R_1 + R_2} V_1\right)$

(b) $V_0 = -\dfrac{R}{R_f} V_2$
$\qquad + \left(\dfrac{R + R_f}{R_f}\right)\left(\dfrac{R + R_f}{R_1 + R_2} V_1\right)$

(c) $V_0 = -\dfrac{R_f}{R} V_2$
$\qquad + \left(\dfrac{R + R_f}{R}\right)\left(\dfrac{R_1 + R_2}{R + R_f} V_1\right)$

(d) $V_0 = -\dfrac{R_f}{R} V_2$
$\qquad + \left(\dfrac{R + R_f}{R}\right)\left(\dfrac{R_2}{R_1 + R_2} V_1\right)$

144. In a BJT switching circuit, supply voltage is V_{CC} = 9 V, biasing resistors are R_B = 15 kΩ, R_C = 6·8 kΩ and the transistor has an h_{FE} value of 25. What is the minimum input voltage required to switch the transistor into saturation when V_{CE} = 0·2 V ?
(a) 1·48 V
(b) 0·78 V
(c) 5 V
(d) 2·5 V

Directions : *Each of the next six (06) items consist of two statements, one labelled as 'Statement (I)' and the other labelled as 'Statement (II)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :*
Codes :
(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I).
(b) Both Statement (I) and Statement (II) are individually true, but Statement (II) is ***not*** the correct explanation of Statement (I).
(c) Statement (I) is true, but Statement (II) is false.
(d) Statement (I) is false, but Statement (II) is true.

145. *Statement (I) :*
Ge and Si are said to have negative temperature coefficient of resistivity.
Statement (II) :
Ge and Si show a reduction in resistance with increase in temperature.

146. *Statement (I) :*
A linear network which contains two or more independent sources can be analyzed to obtain the various voltages and branch currents by allowing the sources to act one at a time, then superposing the results.
Statement (II) :
Superposition cannot be directly applied to the computation of the power.

147. *Statement (I) :*
Metals are extremely good conductors of electricity and heat, and are not transparent to visible light.
Statement (II) :
Ceramics are compounds between metallic and non-metallic elements.

148. *Statement (I) :*
M-ary PSK can be used to transmit digital data over a non-linear bandpass channel, whereas M-ary QAM requires the use of a linear channel.
Statement (II) :
M-ary PSK and M-ary QAM are examples of non-linear modulation.

149. *Statement (I) :*
Linear system may have multiple equilibrium states.
Statement (II) :
If a system is BIBO stable, it must also be zero-input or asymptotically stable.

150. *Statement (I) :*
The total flux out of a closed surface is equal to the net charge enclosed within the surface.
Statement (II) :
An electric field is completely specified by its intensity vector.

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