(Post Name: Technical Assistant , Subject/Field: EC , Date of Exam: 26-04-2023 , Time of Exam: 4:00 PM)

1. The laplace transform of a system output is give as

$$V_o(s) = \frac{12}{s(s^2 + 3s + 2)}$$

The Inverse laplace of the systen is –

a) $[12 + 3e^{-2t} + 4\ e^{-t}]u(t)$ V
b) $[2 + 4e^{2t} + 8\ e^{t}]u(t)$ V
c) $[6 + 6e^{-2t} - 12\ e^{-t}]u(t)$ V
d) $[3 + 2e^{-2t} - 6\ e^{-t}]u(t)$ V

2 The Laplace transform function for the output voltage of a network is expressed in the following form –

$$V_o(s) = \frac{12(s + 2)}{s(s + 1)(s + 3)(s + 4)}$$

The final value of this voltage is as $t \to \infty$

a) 6 V
b) 2 V
c) 12 V
d) 4 V

3 How semiconductor relate with temperature

a) Proportional
b) Inversely proportional
c) Independent
d) None of these

4 Capacitors of 3μF, 6μF and 12μF are connected in series across a 350V supply. The charge in 3μF capacitor is -

a) 1.0 mC
b) 2.0 mC
c) 0.6 mC
d) None of these

5 An ac supply of 230V is applied to a half-wave rectifier circuit through a transformer of turn ratio 10:1. Find the output dc voltage and peak inverse voltage. Assume the diode is ideal.

a) 9.36V & 32.53V
b) 10.36V & 32.53 V
c) 10.36V & 30.53V
d) 9.36V & 30.53V

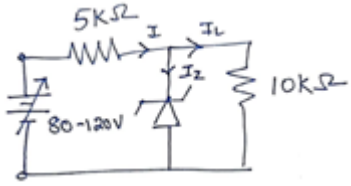
6 The size of inductance must be connected in parallel with a 250 pF capacitor to obtain a resonant frequency of 1.8 MHz –

a) 20.3 μH
b) 31.3 μH
c) 10.0 μH
d) None of these

7 The resistances for symmetrical T-network attenuator of characteristic resistance 50 Ω with 20dB are -

a) 39.1 Ω and 10.1 Ω
b) 49.1 Ω and 20.1 Ω
c) 29.1 Ω and 20.1 Ω
d) 49.1 Ω and 10.1 Ω

8. For the circuit shown in the Figure. The maximum and minimum Zener diode current is

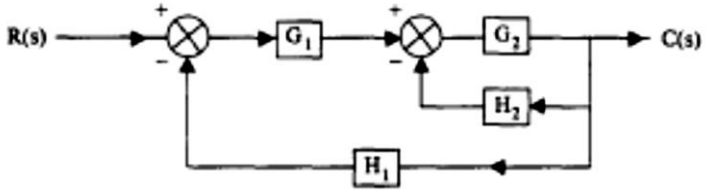


a) 9mA, 1mA
b) 10mA, 0.5mA
c) 8.5mA, 2mA
d) 8mA,5mA

9 In which configuration of Bipolar Junction Transistor (BJT)current gain is high –

a) Common base configuration
b) Common emitter configuration
c) Common collector configuration
d) None of these

10 The over all transfer function of the given block diagram of control system is –



a) $\frac{G_1G_2}{1+G_2H_2+G_1G_2H_1}$
b) $\frac{G_1G_2}{1+G_1H_1+G_1G_2H_1}$
c) $\frac{G_1G_2}{1+G_2H_2+G_1G_2H_2}$
d) None of these

11 An impulse is applied at the input of a continuous system and the output to be the time function e^{-2t}. The tranfer function of the system is –

a) 1/(s+2)
b) s/(s+2)
c) 2/(s+1)
d) 2/(s+2)

12 The voltage level at which a Schmitt trigger switches on is different from that at which it switches off. The phenomena are called:

a) negative feedback
b) current gain
c) hysteresis
d) positive feedback.

13 A VCO has a natural frequency of 1 MHz with a dc input of 0 V. The conversion gain of VCO is 50 kHz/V. The VCO's output frequency for voltage change of 1 V is -

a) 950 kHz
b) 1.05 MHz
c) a or b
d) none of these

14 To design single pulse generator, we can use:

a) Astable multivibrator
b) Bistable multivibrator
c) Monostable Multivibrator
d) None of these

15 The 4 bit Karnaugh map is shown as –

	AB			
	00	01	11	10
CD-00	0	1	1	1
01	0	1	0	0
11	0	1	0	0
10	0	1	1	1

The optimized sum of product equation is

a) BA' + D'A
b) B'A + DA'
c) BA + DA
d) None of these

16 The sensor that changes its resistance is -

a) A photodiode.
b) Capacitor microphone.
c) Hall effect device.
d) Strain gauge.

17. A 100Ω platinum RTD is being used in a system. The present resistance reading is 110Ω. The temperature is –

a) 20.6^{o}C
b) 10.0^{o}C
c) 50.6^{o}C
d) 25.6^{o}C

18. A 75 MHz carrier having an amplitude of 50 V is modulated by a 3 kHz audio signal having an amplitude of 20 V. The modulation factor of modulation is –

a) 0.2
b) 0.4
c) 25
d) None of these

19. The modulation index of an FM signal having a carrier swing of 100 kHz moddulated by signal of 8 kHz –

a) 12.5
b) 6.25
c) 25
d) None of these

20. A lossless line has a characteristic impedance of 50 Ω and is terminated in a load resitance of 75 Ω. The input impedance of the line is –

a) 33.33 Ω
b) 66.66
c) 0.66
d) None of these

21. The signal t u(t) is –

a) Energy signal
b) Power signal
c) Energy and power signal
d) None of these

22. If $x_1(t) = \cos(4t)$ and $x_2 = \cos(2\pi t)$ then $x(t) = x_1 + x_2$ is –

a) Periodic signal
b) Non periodic
c) Stationary signal
d) None of these

23 The system is linear –

a) It satisfy homogeneity
b) It satisfy superposition
c) both a & b
d) None of these

24. CMOS Logic is:

a) Sound controlled
b) Resistor controlled
c) Current controlled
d) Voltage controlled

25. A chip fanout of 6 means:

a) The chip's output can drive six inputs
b) The chip provides six outputs for a single input
c) There can be six chips connected to the various outputs
d) The chip provides six outputs, each one a variation on the Inputs

26. A small motor running at 200 rpm drives a paper roller in a business machine. The gear on the motor has 20 teeth and the gear on the roller has 50 teeth. The roller is running at –

a) 80 rpm
b) 500 rpm
c) 200 rpm
d) None of these

27. The characteristic equation of the given difference equation,is –

$$y(k+2)+\frac{5}{6}y(k+1)+\frac{1}{6}y(k)=u(k)$$

a) $6\,s^2 + 5\,s + 1 = 0$
b) $6\,z^2 + 5\,z + 1 = 0$
c) $z^2 + z + 1 = 0$
d) None of these

28. The slope of the Bode plot (asymptotic) within region $5 < \omega < 10$ for open loop transfer function G(s) = 100/ [s(s +10) (s+20)] is –

a) 10 dB/decade
b) 20 dB/decade
c) 40 dB/decade
d) None of these

29. A 4-digit DVM with 100% over range capability will be:

a) 4-digit DVM
b) 4½-digit DVM
c) 4¾-digit DVM
d) None of these

30. Two voltmeter having sensitivity of 75 ohm/V and 50 ohm/V are connected in series. Each voltmeter is set for range of 400 V. if 500 V is applied across the series combination, the reading of the meters will be:

a) 300 V and 200 V
b) 400 V and 100 V
c) 250 V and 250 V
d) 350 V and 150 V

31. If the retrace is visible on CRT, the problem may be due to:

a) Loss in the syn signal
b) Intensity being too high
c) Blanking control being faulty
d) Horizontal gain being too high

32. Three-state outputs are used:

a) for putting addresses on the address bus.
b) to send interrupts.
c) for reading data from the data bus.
d) to isolate internal circuits from the data bus.

33. A logic family most suited for battery-powered equipment is:

a) TTL.
b) ECL.
c) CMOS.
d) 74LS00.

34. When the integral action is included in a proportional controller, the propositional band –

a) Decreases
b) Remains unaffected
c) Increases
d) Depends upon the integral time constant

35. The angle between wave propagation directions of two monochromatic plan wave at λ = 500nm with period of 1mm is –

a) 0.03^{o}
b) 90^{o}
c) 45^{o}
d) None of these

36. The IP and NEMA rating are used for

a) Specifying the regulated power supply
b) Defining the protection level of the devices
c) Designing integrated circuits
d) Defining the protection level of the enclosures

37. An electric motor operates on 120 V and draws 5 A. If it is 90% efficient then the power lost in heat is –

a) 540 W
b) 30 W
c) 60 W
d) None of these

38. A three phase wye-connected system has individual phase voltage of 120 Vac. The three phase line voltage is –

a) 108 Vac
b) 104 Vac
c) 360 Vac
d) 208 Vac

39. The synchronous speed of a 50Hz, four-pole, single-phase motor is-

a) 1500 rpm
b) 1800 rpm
c) 80 rpm
d) None of these

40. The chart speed of a bio-signal recorder is set to 50 mm/s. If the frequency of the signal is 10 cycles/s. One cycle of the signal extends over –

a) 0.2 mm
b) 500 mm
c) 5 mm
d) 0.5 m

41. To produce a PWM output signal of 20 kHz and have 6 bits of accuracy, what input clock frequency should be used?

a) 20 kHz
b) 64 Hz
c) 1.28MHz
d) 5.1MHz

42 A microcontroller chip has:

a) memory.
b) unit for processing data.
c) clock.
d) All of the above

43. With the increase in probability, the amount of information conveyed

a) decreases
b) increases
c) independent of probability
d) none of these

44. The entropy of a system comprising of tossing of an unbiased coin is

a) 0.5
b) 0
c) $\log_{10}2$
d) 1

45. A 12 bit ADC advertises an accuracy of $\pm$ the least significant bit. The range of input is 0 to 10 V. The resolution of the ADC is –

a) 0.0024 V
b) 0.0012 V
c) 0.83 V
d) None of these

46. A periodic signal is decomposed into five sine waves with frequencies of 100, 300, 500, 700 and 900 Hz. The signal bandwidth is –

a) 1800 Hz
b) 1600 hz
c) 800 Hz
d) 900Hz

47. A communication channel has 1 MHz bandwidth. The SNR for this channel is 63. The appropriate bit rate of the channel is –

a) 2 Mbps
b) 6 Mbps
c) 12 Mbps
d) 1 Mbps

48. An 8-bit DAC has a reference input of 10 V. The binary input is 10011011. The analog output is–

a) 6.05 V
b) 3.025 V
c) 12.10 V
d) None of these

49 The window function used to observe transient in FFT analyzer , is:

a) Hanning
b) Hamming
c) Rectangular
d) Kaise

50. In doing analog-to-digital conversion the loss of information takes place in the process of

a) Sampling
b) Non-binary encoding
c) Quantization
d) Binary encoding

51 A communication Protocol is:

a) A set of communication system schematics
b) A set of rules that applied only to digital data communication hardware
c) The hard ware and software rules and procedures for making sure that transmission should be errorless
d) A set of rules applied only to digital data communication software.

52 In serial data transfer:

a) All bits arrive at a point at the same time

b) All the bits are collected, delayed, and then arrive at the same time

c) All bits are delayed, then arrive at a point at the same time

d) All bits arrive at a point one after another in sequence

53. CRC is acronym for

a) Circular Redundant Checksum

b) Cyclical Redundancy Check

c) Convex Recalculation Check

d) Computed Recursive Check

54. The critical angle of optical fibre with $n_1 = 1.45$ and $n_2 = 1.435$ is –

a) 81.9^o

b) 10.9^o

c) 45.9^o

d) 60.9^o

55. The acceptance angle of fibre with a core index of 1.49 and $\Delta = 1.5\%$ -

a) 15^o

b) 0^o

c) 45^o

d) 90^o

56. The power in the fibre at the connector input is 100 μW; the output power immediately after the connector is 83.2 μW. The insertion loss of the connector is-

a) 0.8 dB

b) 0 dB

c) 10 dB

d) None of these

57. A position sensor mounted in motor shaft uses a 250 slot disk. The current value of the counter is 00100110. The position of the shaft is –

a) 44.44^o

b) 54.44^o

c) 27.22^o

d) None of these

58. A low pass filter is used in superhetrodyne spectrum analyzer:

a) To filter DC from signal

b) To filter image frequency

c) To avoid hole in display

d) For impedance matching

59 A transmission line has following parameters –

R = 2Ω/m G = 0.5 mmho/m f = 1 GHz

L = 8nH/m C = 0.23 pF

The characteristic impedance of the line is –

a) 179.44 + j26.5 Ω

b) 10.44 + j24 Ω

c) 100 Ω

d) None of these

60 A typical transmission line has a characteristic impedance of 75 + j0.01 Ω and terminated in a load impedance of 70 + j50 Ω. The reflection coefficient of transmission line is –

a) 0.04 + j0.16

b) 0.08 + j 0.32

c) 0.12 + j 0.16

d) None of these

61 When the system is in the sleep mode:

a) everything in the system is inactive.

b) all circuits are active except the display.

c) the crystal oscillator and Timer are the only circuits active.

d) the microcontroller is fully active.

62 An R-2R 'ladder' is used in a:

a) DAC.

b) flash converter.

c) successive approximation converter.

d) operational amplifier.

63 Which of the following information of a signal cannot be capture by spectrum analyzer-

a) Amplitude

b) Time

c) Frequency

d) Power

64 The frequency can be measured by using-
a) Maxwell Bridge
b) Schering Bridge
c) Wein's Bridge
d) None of these

65. The nonlinearity of system is –
a) Dead zone
b) Saturation
c) Quantization
d) All of above

66 The disadvantages of serial data transmission over parallel data transmission is
a) Increased product chip count
b) Slower data transmission
c) Increased product power requirements
d) Increased data error rate

67 Four 1 kbps connections are multiplexed together. A unit is 1 bit. The transmission rate of the link is –
a) 1 kbps
b) 4 kbps
c) 2 kbps
d) 10 kbps

68 A code scheme has a Hamming distance of 4. The error correction cababilty of the code –
a) 4
b) 3
c) 2
d) 1

69 A code scheme has a Hamming distance of 4. The error detection cababilty of the code –
a) 4
b) 3
c) 2
d) 1

70 If the frequency spectrum of a signal has a bandwidth of 500 Hz with the highest frequency at 600 Hz, what should be the sampling rate according to the Nyquist theorem?

(a) 200 samples/sec.
(b) 500 samples/sec.
(c) 1000 samples/sec.
(d) 1200 samples/sec.

71 An air-filled rectangular waveguide of inside dimension 7 x 3.5 cm operates in the dominant TE_{10} mode. The cut-off frequency of waveguide is –

a) 2.14 GHz
b) 1.14 GHz
c) 4.04 GHz
d) None of these

72 Average filter in the spatial domain can also be considered as _____ pass filter in the frequency domain –

a) high pass filter
b) lowpass filter
c) band pass filter
d) none of these

73 The DC component of the Fourier transform of an image corresponds to _____ gray level value of the image in the spatial domain –

a) average
b) negative
c) reciprocal
d) none of these

74 The Bluetooth technology -

a) Is a short-range wireless communication protocol
b) Provides wireless RS232 interface
c) Operates in 2.4 GHz to 2.5 GHz frequency band
d) All of the above

75 Physical quantities in the human world are typically -

a) digital and analog.
b) analog and digital.
c) digital.
d) analog.

76 Helical antennas are often used for satellite tracking at VHF because of ____

a) troposcatter.
b) superrefraction
c) the Faraday effects.
d) ionospheric refraction.

77. A helical antenna is used for satellite tracking because of its-

a) broad bandwidth.
b) maneuverability.
c) circular polarization.
d) good front-to-back ratio.

78. For which minimum value of $n \in N$, $div\left(\frac{\vec{r}}{r^n}\right) = 0$, where $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$?

(a) 0
(b) 1
(c) 2
(d) 3

79. Trapezoidal rule for evaluation of $\int_a^b f(x)dx$ requires that the interval (*a*, *b*) is to be divided into _____

(a) 2*n* sub-intervals of equal width.
(b) 2*n* +1 sub-intervals of equal width.
(c) 3*n* sub-intervals of equal width.
(d) any number of sub-intervals of equal width.

80. In terms of Fourier transform, which of the following statement is false?

(a) Fourier transform is a linear operation.
(b) Finite Fourier cosine transform of f(x) = 1 in (0, π) is zero.
(c) $F_s[xf(x)] = -\frac{d}{ds}F_c(s)$
(d) $\int_0^\infty |f(x)|^2 dx = \int_0^\infty |F_c(s)|^2 dx$

81. Select the figure that will come next in the following series.

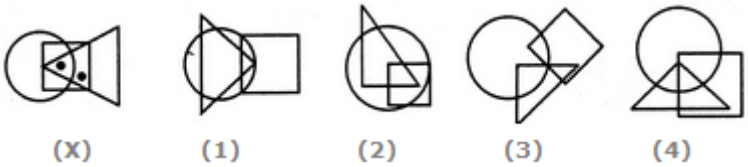
A. 

B. 

C. 

D. 

82 Select the figure which satisfies the same conditions of placement of the dots as in Figure-X



A. 1
B. 2
C. 3
D. 4

83. 2, 5, 9, 19, 37, ?
A. 73
B. 75
C. 76
D. 78

84. Find the wrong number in the given series.
13, 24, 29, 39, 44, 54, 61, 69
A. 13
B. 24
C. 44
D. 61

85. Mother was three times the age of her daughter five years ago. After five years, mother will be twice as old as her daughter. How old is the daughter today?
A. 20 Years
B. 15 Years
C. 10 Years
D. 5 Years

86. Rana starts from his house towards south and walks 60 m then turns towards east and walks 40 m and turns towards north and walks 30 m and stops. How far is he away from his house?

A. 30m
B. 35m
C. 40m
D. 50m

87. In a solid cube which is made up of 27 small cubes, two opposite sides are painted red, two painted yellow and the other two with white. How many cubes have two colors?

A. 8
B. 12
C. 16
D. 24

88 Answer the question on the basis of following information

Neelu, Pavitra, Sinthia, Pallavi and Madhvi are five friends. Each of them have 6 balls. Neelu gives three balls to Pallavi, who further gives two balls each to Pavitra and Madhvi. Sinthia gives 4 falls to Neelu who in turn gives 3 balls each to Pavitra and Madhvi. Pavitra gives 5 balls to Sinthia and Madhvi gives 4 balls to Pallavi.

How many balls Pavitra has with her?

A. 6
B. 7
C. 8
D. 9

89 Answer the question on the basis of the information given below:
In a code language
'few organic farming techniques' is written as 'li gs da cr'
'fertilizer products few available' is written as 'fo pz nb gs'
'organic waste into fertilizer' is written as 'nb cr pt mk'
'disposal of farming waste' is written as 'hu mk li yu'
What is the code for 'organic'?

A. is
B. cr
C. da
D. pt

90 In the following question, there are two statements followed by two conclusions numbered 1 and 2. You have to take the given two statements to be true even if they seem to be at variance from commonly known facts. Read the conclusion and then decide which of the given conclusions logically follows from the two given statements, disregarding commonly known facts.

Statements: Some dreams are nights. Some nights are days.
Conclusions:
1. All days are either nights or dreams.
2. Some days are nights.

A. Only Conclusion I follows
B. Only Conclusion II follows
C. Neither I nor II follows
D. Both I and II follows

91 ‘Ganesh’ is the father of ‘Laxman’ but ‘Laxman’ is not his son. ‘Avya’ is the daughter of ‘Laxman’.’ Sunita’ is the spouse of ‘Ganesh’. ‘Govind’ is the brother of ‘Laxman’. ‘Nirbhay’ is the son of ‘Govind’. ‘Meena’ is the spouse of ‘Govind’. ‘Ganpat’ is the father of ‘Meena’. Who is the grand-daughter of ‘Ganesh’?

A. Nirbhay
B. Avya
C. Meena
D. Sunita

92. In the following letter series how many times do PQR occur in such a way that Q is in the middle of P and R?
QMPNPQRROPQNOPPQRPMQROPQRPPRRPQRP

A. 4
B. 6
C. 3
D. 5

93 In the following question two statements are given followed by two conclusions. You have to take the given two statements to be true even if they seem to be at variance from commonly known facts. Read the conclusion and then decide which of the given conclusions logically follows the two given statements, disregarding commonly known facts.

Statement I: All dogs are cats
Statement II: All cats are rats

Conclusion I: Some dogs are rats
Conclusion II: Some dogs are cats

A. Only I follow
B. Only II follows
C. Both I and II follows
D. neither I nor II follows

94 In the following question two statements are given followed by two conclusions. You have to take the given two statements to be true even if they seem to be at variance from commonly known facts. Read the conclusion and then decide which of the given conclusions logically follows from the two given statements, disregarding commonly known facts.

Statement I: Some trees are plants
Statement II: Some plants are seeds

Conclusion I: Some trees are not seeds
Conclusion II: Some seeds are not plants

A. Only I follows
B. Only II follows
C. Both I and II follows
D. neither I nor II follows

95 The following question is based on the following information
(i) A < B means A is the daughter of B
(ii) A > B means A is the sister of B
(iii) A $ B means A is the father of B
(iv) A * B means A is the son of B

Which of the following shows the relation that K is the cousin of B?

A. A $ B < F > K $ G
B. A $ B < F > G $ K
C. A $ K < F > G $ B
D. Both b and c are true

96 In a certain code language,
‘few organic farming techniques’ is written as ‘13 17 19 11’,
‘fertilizer products few available’ is written as ‘15 18 12 17’,
‘organic waste into fertilizer’ is written as ‘12 11 14 16’ and
‘disposal of farming waste’ is written as ‘10 16 13 21’.
(All codes are two-digits codes only.)

What will be the code for 'few waste' in the given code language?

A. 16,17
B. 17,13
C. 14,19
D. 19,16

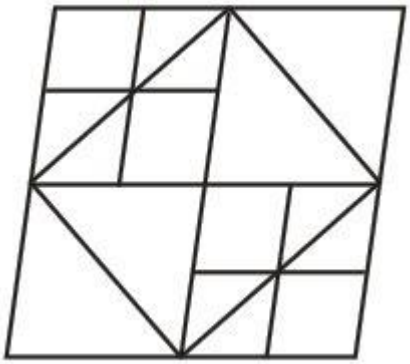
97 In the word 'DOORSTEP' if all the vowels are replaced with the letter immediate next to it in the english alphabet series and all the consonants are replaced with the letter immediate before it in the english alphabet series, then how many vowels are there in the new word so formed?

A. None
B. One
C. Two
D. Three

98 If the first half of the alphabet is written in the reverse order, which letter will be exactly midway between the 9th letter from the left and the 10th letter from the right end ?

A. B
B. A
C. N
D. D

99. How many triangles are there in the following fig.



A. 20
B. 22
C. 24
D. 26

100. Read the following information carefully to answer the following question.

On the occasion of an opening ceremony of a sports event, in a stadium, there are 600 players who are participating in four different events, that is, Athletics, Table Tennis, Kho-Kho and Lawn Tennis. The ratio of male to female players is 11:4. 30% of the female players are participating in Athletics. 10% of the female players are participating in Table Tennis. The remaining female players are participating in Kho-Kho and Lawn Tennis in the ratio of 1:3. The ratio of male players who are participating in Athletics and other events together is 3:5. 4% of those male players who are not participating in Athletics are participating in Lawn Tennis. Remaining male players are participating in Table Tennis and Kho-Kho in the ratio 5:3.

What is the total number of players (both males and females together) participating in Table Tennis and Athletics together?

A. 360
B. 358
C. 374
D. None of these