004/2021

<table>
<tr><td>Question Booklet
Alpha Code</td><td>**A**</td><td>Question Booklet
Serial Number</td><td></td></tr>
</table>

Total No. of Questions : 100   **Time : 75 Minutes**

Maximum : 100 Marks

INSTRUCTIONS TO CANDIDATES

1. The question paper will be given in the form of a Question Booklet. There will be four versions of question booklets with question booklet alpha code viz. A, B, C & D.

2. The Question Booklet Alpha Code will be printed on the top left margin of the facing sheet of the question booklet.

3. The Question Booklet Alpha Code allotted to you will be noted in your seating position in the Examination Hall.

4. If you get a question booklet where the alpha code does not match to the allotted alpha code in the seating position, please draw the attention of the Invigilator IMMEDIATELY.

5. The Question Booklet Serial Number is printed on the top right margin of the facing sheet. If your question booklet is un-numbered, please get it replaced by new question booklet with same alpha code.

6. The question booklet will be sealed at the middle of the right margin. Candidate should not open the question booklet, until the indication is given to start answering.

7. Immediately after the commencement of the examination, the candidate should check that the question booklet supplied to him contains all the 100 questions in serial order. The question booklet does not have unprinted or torn or missing pages and if so he/she should bring it to the notice of the Invigilator and get it replaced by a complete booklet with same alpha code. This is most important.

8. Blank sheets of paper is attached to the question booklet. These may be used for rough work.

9. **Please read carefully all the instructions on the reverse of the Answer Sheet before marking your answers.**

10. Each question is provided with four choices (A), (B), (C) and (D) having one correct answer. Choose the correct answer and darken the bubble corresponding to the question number using Blue or Black Ball-Point Pen in the OMR Answer Sheet.

11. **Each correct answer carries 1 mark and for each wrong answer 1/3 mark will be deducted. No negative mark for unattended questions.**

12. No candidate will be allowed to leave the examination hall till the end of the session and without handing over his/her Answer Sheet to the Invigilator. Candidates should ensure that the Invigilator has verified all the entries in the Register Number Coding Sheet and that the Invigilator has affixed his/her signature in the space provided.

13. Strict compliance of instructions is essential. Any malpractice or attempt to commit any kind of malpractice in the Examination will result in the disqualification of the candidate.

004/2021-A

Total Marks : 100 Marks

Time : 1 hour and 15 minutes

1. If $\lim\limits_{x \to 2} \dfrac{x^n - 2^n}{x^2 - 4} = 20$ and n is a positive integer then n is

   (A) 3   (B) 5   (C) 7   (D) 9

2. The slope of the normal to the curve $y = 2x^3$ at the point whose x coordinate is 2

   (A) −12   (B) $-\dfrac{1}{24}$ (C) 24   (D) $\dfrac{1}{12}$

3. The value of the integral $\int \left(\dfrac{x-1}{x^2}\right) e^x \, dx$ is

   (A) $(x-1)\, e^x + c$ (B) $\dfrac{e^x}{(x-1)} + c$ (C) $\dfrac{(x-1)}{x} e^x + c$ (D) $\dfrac{e^x}{x} + c$

4. $\int \dfrac{e^x(1+x)}{\sec(xe^x)} \, dx$ is

   (A) $\sin(xe^x) + c$ (B) $\sec(x + e^x) + c$ (C) $e^x \tan(xe^x) + c$ (D) $\tan(x + e^x) + c$

5. The integrating factor of the differential equation $\dfrac{dy}{dx} - \dfrac{y}{x} = \sin x$

   (A) $e^{\frac{1}{x}}$ (B) $\dfrac{1}{x \sin x}$ (C) $\dfrac{1}{x}$ (D) $e^{-\frac{1}{x}}$

6. A matrix X has a + b rows and b + 1 columns while the matrix Y has a − 2 rows and a + 2 columns. Both the matrix XY and YX exist. Then a and b are

   (A) $a=5, b=2$ (B) $a=3, b=7$ (C) $a=3, b=2$ (D) $a=7, b=5$

7. The value of the determinant $\begin{vmatrix} 1 & 2 & 3 \\ 3 & 2 & 5 \\ k & 2 & 4 \end{vmatrix}$ is 0, then k is

   (A) 1   (B) 3   (C) 2   (D) 4

8. If $C_0, C_1, C_2, \ldots, C_n$ denote the coefficients in the bionomial expansion of $(1 + x)^n$, then $C_0^2 + C_1^2 + \ldots + C_n^2$ is

   (A) $\dfrac{(2n)!}{(n!)^2}$ (B) $\dfrac{2^n(n+1)}{n!}$ (C) $n(n+1)2^{n-2}$ (D) 4^n

9. $2 \tan^{-1}(1) + \tan^{-1}(2) + \tan^{-1}(3)$ is

   (A) $\dfrac{\pi}{2}$ (B) $\dfrac{\pi}{4}$ (C) 0   (D) $-\dfrac{\pi}{2}$

10. The foot of the perpendicular from (2, 3) to the line $2x + y - 3 = 0$ is

    (A) $\left(\dfrac{11}{5}, \dfrac{1}{5}\right)$ (B) $\left(\dfrac{3}{5}, \dfrac{2}{5}\right)$ (C) $\left(\dfrac{-3}{5}, \dfrac{1}{5}\right)$ (D) $\left(\dfrac{2}{5}, \dfrac{11}{5}\right)$

11. Which among the following is the correct method for designing the combined footing for two column loads ?

    (A) Centre of gravity of soil reaction comes exactly at the middle of column loads.

    (B) Centre of gravity of column loads coincides with a point at half the length of the footing.

    (C) Centre of gravity of column loads coincides with the centre of gravity of soil reaction.

    (D) Centre of gravity of column loads coincides with the point of intersection of the diagonals of the plan of footing.

12. If using a Dumpy level and a levelling staff, a back sight is noted on a Bench mark of reduced level 100 as 0.60 and fore sight is noted on a point A as 0.80, what is the reduced level of point A ?

    (A) 100.80   (B) 99.80

    (C) 100.20   (D) 99.60

13. What is a fine aggregate ?

    (A) Aggregate passing through 80 mm IS sieve and retained on 4.75 mm IS sieve

    (B) Aggregate passing through 4.75 mm IS sieve and retained on 0.15 mm IS sieve

    (C) Aggregate passing through 75 micron IS sieve and retained on 0.155 mm IS sieve

    (D) Aggregate passing through 80 mm IS sieve and retained on 75 micron IS sieve

14. What is the yield strength of plain bars (mild steel conforming to IS 432) ?

    (A) 250 N/mm^2 (B) 400 N/mm^2

    (C) 415 N/mm^2 (D) 500 N/mm^2

15. In chain triangulation, what is the longest of main survey lines ?

    (A) Proof line   (B) Tie line

    (C) Check line   (D) Base line

16. Compared to a four stroke engine of same size and rpm, a two stroke engine practically produces

    (A) twice the power

    (B) same power

    (C) half the power

    (D) less than twice and greater than same power produced by the four stroke engine

17. A flywheel is used to

    (A) increase power produced by a system

    (B) decrease power fluctuations in the system

    (C) decrease power produced by a system

    (D) increase power fluctuations in the system

18. The functioning of a clutch can be improved by

    (A) providing liners with better coefficient of friction.

    (B) lubricating the contact surfaces.

    (C) Both (A) and (B)

    (D) None of the above

19. Function of surge tank in hydraulic power plant system is to

    (A) store surplus water which overflows from the dam.

    (B) accumulate the used water for irrigation.

    (C) reduce water hammer effect and breakage of penstock during sudden open / closure of valves.

    (D) provide proper lubrication to moving parts of turbine and generators.

20. The most hazardous among power plants of same rating is

    (A) Thermal power plant with diesel fuel.

    (B) Thermal power plant with coal fuel.

    (C) Thermal power plant using other bio fuels.

    (D) Nuclear power plant.

21. Two 230 V, 100 W bulbs are connected in series with 230 V supply. What will be the power consumption of each bulb ?
    - (A) 200 W
    - (B) 100 W
    - (C) 50 W
    - (D) 25 W

22. An electric iron is rated as 2000 W. If it is ON and OFF for equal durations while ironing, how long will it take to consume one unit of energy ?
    - (A) half an hour
    - (B) one hour
    - (C) 2 hours
    - (D) 4 hours

23. An inductor of 10 Ohms reactance and a capacitor of 10 Ohm reactance at 50 Hz are connected in series with a 10 Ohm resistor. If the combination is connected to a 300 V, 50 Hz supply, the current will be
    - (A) 30 A
    - (B) 10 A
    - (C) 20 A
    - (D) 15 A

24. Two resistors of 12 Ohm and 5 Ohm are connected in series and the combination is connected in parallel with a 10 Ohm resistor. What will be the power consumed by the 10 Ohm resistor, if the network is connected to a 100 V supply ?
    - (A) 2 kW
    - (B) 3.6 kW
    - (C) 1 kW
    - (D) 1.5 kW

25. Buchholz relay is used in the protection of
    - (A) motor
    - (B) transmission line
    - (C) generators
    - (D) transformer

26. If a single diode in a bridge rectifier opens, the dc value of output for an input of $V_m \sin wt$ is
    - (A) 0 V
    - (B) $\dfrac{V_m}{\pi}$
    - (C) $\dfrac{2\,V_m}{\pi}$
    - (D) V_m

27. A snubber circuit is used along with a relay for
    - (A) electrical isolation
    - (B) current boosting
    - (C) avoid arcing
    - (D) making contact

28. Which of the following devices is part of a microcontroller chip ?
    - (A) RAM
    - (B) ROM
    - (C) I/O ports
    - (D) All of these

29. GSM uses the following multiple access methods :
    - (A) TDMA
    - (B) FDMA
    - (C) Combination of FDMA & TDMA
    - (D) None of these

30. A standby UPS can be used for power requirements of
    - (A) 0.5 kVA
    - (B) 5 kVA
    - (C) 10 kVA
    - (D) greater than 10 kVA

31. In a zener diode with high breakdown voltage
    (A) Both P and N are heavily doped   (B) Either P or N is lightly doped
    (C) Both P and N are lightly doped   (D) None of the above

32. Most of the holes present in the base of a PNP transistor flow
    (A) into the emitter   (B) into the collector
    (C) into the supply   (D) out of base into the base least

33. A JFET configuration which connects a high resistance signal source to a low resistance load is
    (A) source follower   (B) common source
    (C) common drain   (D) common gate

34. When class B power amplifier is in a quiescent state, _____
    (A) half of the maximum current flows through the transistor.
    (B) maximum current flows through the transistor.
    (C) no current flows through the transistor.
    (D) quarter of the maximum current flows.

35. Inductor filter should be used when
    (A) load current is high   (B) load current is low
    (C) high load resistance R_L (D) none of the above

36. In a Wien-bridge oscillator, if the resistances in the positive feedback circuit are decreased, the frequency _____.
    (A) remains the same   (B) decreases
    (C) increases   (D) insufficient data

37. When frequency of oscillation of a crystal oscillator becomes parallel resonance frequency, reactance of crystal oscillator becomes _____.
    (A) Infinity   (B) Zero
    (C) Unpredictable   (D) Unity

38. The distortion in an amplifier is found to be 3%, when the feedback ratio of negative feedback amplifier is 0.04. When the feedback is removed, the distortion becomes 15%. Then the open loop gain (A) is _____.
    (A) 50   (B) 90
    (C) 150   (D) 100

39. Voltage gain of an amplifier without feedback is 60 dB. It decreases to 40 dB with feedback. Then the feedback factor is _____
    (A) 0.0095   (B) 0.00833
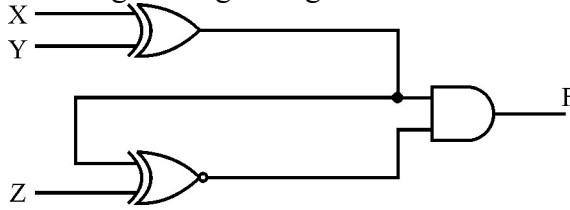   (C) 0.00675   (D) 0.00456

40. The switching of power with a PNP transistor is called _____.
   (A) forward sourcing
   (B) sinking current
   (C) sourcing current
   (D) reverse sinking

41. In the initial stages of a multistage amplifier, we use _____.
   (A) RC coupling
   (B) Transformer coupling
   (C) Direct coupling
   (D) None of the above

42. The total gain of a multistage amplifier is less than the product of the gains of individual stages due to _____.
   (A) power loss in the coupling device
   (B) loading effect of the next stage
   (C) the use of many transistors
   (D) the use of many capacitors

43. The oscillator that is mostly used for generating audio frequency signals is
   (A) Wein bridge
   (B) Tuned base
   (C) Tuned collector
   (D) RC phase shift

44. _____ multivibrator is a square wave oscillator.
   (A) Monostable
   (B) Astable
   (C) Bistable
   (D) None of the above

45. In a bistable multivibrator circuit, commutating capacitor is used to
   (A) increase the base storage charge
   (B) provide ac coupling
   (C) increase the speed of response
   (D) provide the speed of oscillations

46. A certain non-inverting amplifier has R_i of 2 kΩ and R_f of 100 kΩ. The closed loop voltage gain is _____.
   (A) 100
   (B) 50
   (C) 51
   (D) 49

47. In differential mode of op-amp, if output voltage is equal to the difference between outputs of individual transistors, its amplitude will be _____ the amplitude of signal voltage yielded at collector to ground.
   (A) twice
   (B) thrice
   (C) four times
   (D) one-fourth times

48. Common mode voltage gain of an op-amp is generally
   (A) >1
   (B) =1
   (C) <1
   (D) None of the mentioned

49. A 741 op-amp has a gain bandwidth product of 2 MHz. If a non-inverting amplifier using this op-amp has a voltage gain of 40 dB, then its –3dB bandwidth is _____.
   (A) 100 kHz
   (B) 20 kHz
   (C) 10 kHz
   (D) 50 kHz

50. What part of the characteristic curve of a diode is useful for log amplifiers ?
  - (A) The log region above 0.7 V
  - (B) The log region below 0.7 V
  - (C) The log region between 0 V and 0.7 V
  - (D) The log region below the zener voltage

51. The main purpose of an instrumentation amplifier is to amplify _____ signals that are riding on _____ common mode voltages.
  - (A) small, small
  - (B) small, large
  - (C) large, small
  - (D) large, large

52. The filter which provides a roll-off rate greater than – 20 /dB / decade / pole and are useful when a rapid roll-off required is _____.
  - (A) Butterworth
  - (B) Chebyshev
  - (C) Second order HPF
  - (D) None of the above

53. 555 timer basically consists of _____.
  - (A) one comparator
  - (B) two comparators
  - (C) three comparators
  - (D) four comparators

54. The output voltage of phase detector is _____.
  - (A) phase voltage
  - (B) free running voltage
  - (C) error voltage
  - (D) none of the mentioned

55. In a non-linear op-amp circuit, the
  - (A) op-amp never saturates
  - (B) feedback loop is never opened
  - (C) output shape is the same as the input shape
  - (D) op-amp may saturate

56. A Schmitt trigger has _____ feedback.
  - (A) positive
  - (B) negative
  - (C) compensating capacitors
  - (D) pull up resistors

57. In the locked state of PLL, the phase error between the input & output is _____.
  - (A) maximum
  - (B) moderate
  - (C) minimum
  - (D) All of the above

58. For an integrating circuit to be effective, the RC product should be _____ the time period of the input wave.
  - (A) 5 times greater than
  - (B) 5 times smaller than
  - (C) equal to
  - (D) atleast 10 times greater than

59. The decimal equivalent of $(11011.01)_2$ is
  (A) $(27.02)_{10}$
  (B) $(54.25)_{10}$
  (C) $(27.25)_{10}$
  (D) $(54.02)_{10}$

60. A device which converts BCD to seven segments is called _____.
  (A) Encoder
  (B) Decoder
  (C) Multiplexer
  (D) Demultiplexer

61. The simplification of the Boolean expression $\overline{(A\ B\ \overline{C})} + \overline{(A\ \overline{B}\ C)}$ is
  (A) 0
  (B) 1
  (C) A
  (D) BC

62. The SOP form of $(A + C)(A\overline{B} + AC)(\overline{A}\ \overline{C} + \overline{B})$ is
  (A) $A\overline{B} + A\overline{B}C$
  (B) $\overline{A}B + \overline{A}B\overline{C}$
  (C) $\overline{A\overline{B}} + \overline{\overline{A}B}C$
  (D) $(A + B)(A + \overline{B} + C)$

63. Data can be changed from special code to temporal code by using
  (A) Shift registers
  (B) Counters
  (C) Combinational circuits
  (D) A/D converters

64. The gates required to build a half adder are
  (A) EX-OR gate and NOR gate
  (B) EX-OR gate and OR gate
  (C) EX-OR gate and AND gate
  (D) EX-OR gate and NAND gate

65. _____ logic family has low power dissipation and _____ has excellent noise immunity.
  (A) ECL, TTL
  (B) RTL, HTL
  (C) RTL, DTL
  (D) TTL, RTL

66. Why is a pull-up resistor needed when connecting TTL logic to CMOS logic ?
  (A) To increase the output LOW voltage
  (B) To decrease the output LOW voltage
  (C) To increase the output HIGH voltage
  (D) To decrease the output HIGH voltage

67. A basic S-R flip-flop can be constructed by cross-coupling of which basic logic gates ?
  (A) AND or OR gates
  (B) XOR or XNOR gates
  (C) NOR or NAND gates
  (D) AND or NOR gates

68. The output F of the given digital logic circuit is

(A) $F = \overline{X}\,YZ + X\overline{Y}Z$
(B) $F = \overline{X}\,Y\,\overline{Z} + X\overline{Y}\,\overline{Z}$
(C) $F = \overline{XY}\,Z + XYZ$
(D) $F = \overline{XY}\,\overline{Z} + XYZ$

69. The flash type A/D converters are called as
(A) parallel non-inverting A/D converter
(B) parallel counter A/D converter
(C) parallel inverting A/D converter
(D) parallel comparator A/D converter

70. In a microprocessor, the address of the next instruction to be executed is stored in
(A) Address latch
(B) General purpose register
(C) Temporary data register
(D) Program counter

71. Which of the following instruction is not valid ?
(A) MOV AX, BX
(B) MOV DS, 5000 H
(C) MOV AX, 5000 H
(D) PUSH AX

72. Computer memory which is used to store programs and data currently being processed by CPU is
(A) mass memory
(B) RAM
(C) non-volatile memory
(D) PROM

73. A system is said to be shift invariant only if _____.
(A) a shift in the input signal also results in the corresponding shift in the output.
(B) a shift in the input signal does not exhibit the corresponding shift in the output.
(C) a shifting level does not vary in an input as well as output.
(D) a shifting at input does not affect the output.

74. Atmospheric noise become less severe at frequencies
(A) below 30 MHz
(B) above 30 MHz
(C) above 30 GHz
(D) below 30 GHz

75. A 2 GHz carrier is DSB SC modulated by a low pass message signal with maximum frequency of 1 MHz. The resultant signal is to be ideally sampled. The minimum frequency of the sampling impulse train should be
(A) 2 MHz
(B) 2.002 GHz
(C) 4.002 GHz
(D) 4 MHz

76. A 1 MHz sinusoidal carrier is amplitude modulated by a symmetrical square wave of period 100 μsec. Which of the following frequencies will not be present in the modulated signal ?

    (A) 990 kHz   (B) 1010 kHz

    (C) 1020 kHz   (D) 1030 kHz

77. A super-heterodyne radio receiver with an intermediate frequency of 455 kHz is tuned to a station operating at 2800 kHz. The associated image frequency is

    (A) 3710 kHz   (B) 3255 kHz

    (C) 2345 kHz   (D) 1890 kHz

78. In a BPSK signal detector, the local oscillator has a fixed phase error of 40°. This phase error deteriorates the SNR at the output by a factor of

    (A) $\cos 40^o$ (B) $\cos^2 40^o$

    (C) $\cos 80^o$ (D) $\cos^2 80^o$

79. Compression in PCM refers to relative compression of

    (A) lower signal frequencies   (B) lower signal amplitudes

    (C) higher signal amplitudes   (D) higher signal frequencies

80. The Fraunhofer field of an antenna varies with distance 'r' as

    (A) $1/r$ (B) $1/r^2$

    (C) $1/r^3$ (D) $1/\sqrt{r}$

81. A transmission line is feeding 2 Watt of power to a horn antenna having a gain of 10 dB. The antenna is matched to the transmission line. The total power radiated by the horn antenna into the free – space is

    (A) 10 Watts   (B) 1 Watt

    (C) 5 Watts   (D) 20 Watts

82. The design of optimum equi ripple linear phase FIR filter uses _____.

    (A) Butterworth approximation   (B) Chebyshev approximation

    (C) Hamming approximation   (D) None of the above

83. Which mode of propagation is adopted in HF antennas ?

    (A) Ionospheric   (B) Ground wave

    (C) Tropospheric   (D) Sky wave

84. The bandwidth of the channel used in the hopset is called _____.
   (A) Hopping bandwidth
   (B) Total hopping bandwidth
   (C) Instantaneous bandwidth
   (D) 3 dB bandwidth

85. _____ of TDMA system is a measure of the percentage of transmitted data that contains information as opposed to providing overhead for the access scheme.
   (A) Mean
   (B) Figure of merit
   (C) Signal to noise ratio
   (D) Efficiency

86. If the length of the intrinsic region in IMPATT diode is 4 μm and the carrier drfit velocity are 10^7 cm/s, then the nominal frequency of the diode is
   (A) 12.5 GHz
   (B) 25 GHz
   (C) 30.5 GHz
   (D) 24 GHz

87. A forward voltage can be applied to an SCR after its
   (A) anode voltage reduces to zero
   (B) gate recovery time
   (C) reverse recovery time
   (D) anode current reduces to zero

88. Peak inverse rating of a TRIAC is
   (A) same as that of a thyristor
   (B) greater than that of a thyristor
   (C) inferior and very much less than that of a thyristor
   (D) not very significant due to the nature of its application

89. The load voltage of a chopper can be controlled by varying the
   (A) duty cycle
   (B) firing angle
   (C) reactor position
   (D) extinction angle

90. A single phase full bridge inverter can operate in the load commutation mode in case load consist of
   (A) RLC overdamped
   (B) RLC underdamped
   (C) RLC critically damped
   (D) None of the above

91. _____ is used for growing n-p-n hetero-junction phototransistor.
   (A) Liquid-phase tranquilizers
   (B) Hetero poleax
   (C) Solid substrate
   (D) Liquid-phase epistaxis

92. The diode which emits a single wavelength coherent light is
   (A) LED
   (B) Tunnel Diode
   (C) Laser diode
   (D) Photo diode

93. Which material in CRT glows when high energetic electrons strike its surface ?

(A) Silicon   (B) Aquadag

(C) Germanium   (D) Phosphor

94. If a multimeter has a sensitivity of 500 Ω per volt and reads 50 V full scale, its internal resistance will be

(A) 20 kΩ (B) 25 kΩ

(C) 10 kΩ (D) 50 kΩ

95. LCDs operate from a frequency ranges from _____.

(A) 10 Hz to 60 Hz   (B) 50 Hz to 70 Hz

(C) 30 Hz to 60 Hz   (D) None of the above

96. The use of SMPS is normally limited to power levels around _____.

(A) 50 MW   (B) 100 W

(C) 50 W   (D) 100 MW

97. The rate effect in silicon controlled switch (SCS) is caused by

(A) Junction capacitance   (B) Depletion capacitance

(C) Diffusion capacitance   (D) Transition capacitance

98. Choose the correct statement :

(A) IGBTs have higher switching losses as compared to BJTs.

(B) IGBTs have secondary breakdown problems

(C) IGBTs have lower gate drive requirements

(D) IGBTs are current controlled devices

99. Photo voltaic devices in the form of thin films which absorb and convert the sun-light into electricity is

(A) Cadmium Telluroide   (B) Cadmium oxide

(C) Cadmium sulphide   (D) Cadmium sulphate

100. A light dependent resistor is basically a

(A) power resistor   (B) non-metallic resistor

(C) carbon resistor   (D) variable resistor

SPACE FOR ROUGH WORK

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