This Question Booklet contains 16 printed pages

PGEC

Total Marks : 100
Time : 100 Minutes

Question Booklet Code : **A**

A
Seal Sticker

Candidate's Seat No. :

Candidate's Signature _____ **Block Supervisor's Signature** _____

DO NOT OPEN QUESTION BOOKLET UNTIL INSTRUCTED.

INSTRUCTIONS FOR CANDIDATE:

1. Check Number printed on your OMR SHEET and Question Paper with your SEAT No. before answering the questions. Consult block supervisors in case the above mentioned numbers do not match with your seat number.
2. There are total 100 questions. For answer of each question A, B, C, D, E options are given in OMR SHEET. In OMR SHEET, there is "E" option. "E" option is for "Not Attempted". If candidate do not wish to answer the question he/she should select "E" option (Not Attempted). All questions are compulsory.

   For Example:

   Which state of India has the longest sea shore ?

   A ○ B ○ C ● D ○ E ○

   (A) Maharashtra (B) Tamilnadu

   (C) Gujarat (D) Andhra Pradesh

   In this example, the right answer is (C). Therefore, the Circle of (C) has been darkened (encoded). Candidate should not give the answer "Gujarat" in writing.

   The options once darkened/answered by candidate cannot be changed.
3. Candidates are not permitted to leave examination hall during examination.
4. Candidates must strictly enter SEAT NO. in the designated space provided in OMR SHEET as well as Question Paper neatly as soon as they receive the OMR SHEET & Question Paper.
5. Candidates must not write name or put any identification sign/symbol on OMR SHEET. In such case strict disciplinary action will be taken against candidate & will be considered disqualified/ineligible. Only Seat No. must be entered at designated space provided in OMR SHEET.
6. Both, Candidate's & Supervisor's signature must be done on Certificate of OMR SHEET. Unsigned OMR SHEET would not be considered for evaluation.
7. Candidates are not permitted to use or carry with them any kind of literature, guide, hand written notes, or printed books, mobile phone, pagers, smart watches, camera or any electronic gadgets to examination hall.
8. Use of only Non-scientific / Non-programmable calculator shall allow during examination.
9. Candidates are not permitted to talk/discuss in the Examination Hall. Any candidate found violating supervisor's instructions will be disqualified.
10. Candidates must fully darken circle A, B, C, D and E accordingly with Blue / Black ball pen. If answers are marked with any other coloured ball pen, pencil, white ink (whitner), any corrections are done by candidate by means of blade or rubber or whitner will not be considered for evaluation.
11. Candidates may carry QP with them after Examination.
12. **For correct answer 1 (One) marks will be given.**

    If candidate gives more than one option as answer for one question in answer sheet (OMR SHEET), or gives wrong answer then the candidate will be allotted Zero (0) marks.

    If candidate does not want to answer a particular question and marks (E) or leave the option without encoding on OMR sheet, then no minus marks will be given.

Submit the OMR SHEET to the block supervisor after completion of examination without fail before leaving examination hall, failure to do so will result in disqualification of the candidature for the examination and disciplinary action will be taken against such candidate.

SPACE FOR ROUGH WORK / રફ કામ માટેની જગ્યા

1. At 300 Kelvin the value of electron concentration is approximately 1.18×10^{10} per cm^3. This means that roughly _____ electron-hole pairs are to be found in a cube of 10 μm on a side.

(A) 1.18 (B) 11.8

(C) 0.118 (D) 0.0118

2. Silicon contains 5×10^{28} atoms per cubic metre. If it is doped with Arsenic whose concentration is two parts per million atoms of Silicon, then the electron density at room temperature will be approximately _____.

(A) 10^{21} m^{-3} (B) 10^{22} m^{-3}

(C) 10^{23} m^{-3} (D) 10^{20} m^{-3}

3. The threshold voltage of an n-channel enhancement mode MOSFET is 0.5 V. When the device is biased at VGS equal to 3 V. Pinch-off would occur at a drain voltage of _____.

(A) 2.5 V (B) 3.5 V

(C) 1.5 V (D) 3 V

4. The mobility of electrons in a material is expressed with an unit of _____.

(A) V/sec (B) $m^2/(V.sec)$

(C) $m^2/(sec)$ (D) $m^3/(V.sec)$

5. Transition capacitance of a p-n junction diode _____ with the _____ in reverse bias voltage.

(A) Increases, increases (B) Decreases, decreases

(C) Remains unchanged, decreases (D) decreases, increases

6. For normal operation of MOSFET, source-substrate and drain-substrate junctions should be _____ and _____, respectively.

(A) Forward, Forward (B) Forward, Reverse

(C) Reverse, Forward (D) Reverse, Reverse

7. IDS - VDS characteristic of p-channel enhancement MOSFET falls into _____ quadrant.

(A) 1^{st} (B) 2^{nd}

(C) 3^{rd} (D) 4^{th}

8. How many minimum number of NAND gates are required to implement a 2-input Ex-OR gate without using any other logic gate?

(A) 4 (B) 3

(C) 5 (D) 6

9. An n-variable Ex-OR expression is equal to the Boolean function with _____ minterms whose equivalent binary numbers have an _____ number of 1's.

(A) $2^n/2$, even (B) $2^n/2$, odd

(C) $2^n/4$, even (D) $2^n/4$, odd

10. An n-variable Ex-OR and equivalence expressions are _____ when number of variables (n) is _____.

(A) same, odd (B) complement of each other, odd

(C) same, even (D) complement of each other, odd or even

11. A 1-bit full adder circuit can be implemented with _____ and OR gates each with _____ inputs.

(A) One 3×8 decoder, two, two (B) One 2×4 decoder, two, two

(C) One 3×8 decoder, two, three (D) One 3×8 decoder, two, four

12. What is the minimum number of 2-input NOR gates required to implement 4-variable function expressed in sum-of-minterms form as $f = \Sigma(0,2,5,7,8,10,13,15)$? Assume that all the inputs and their complements are available _____

(A) 3 (B) 4

(C) 5 (D) 2

13. Minimum number of flip-flops required to construct a binary modulo N counter is _____.

(A) N (B) 2N

(C) $\log_2(N)$ (D) $2*\log_2(N)$

14. A 2-input CMOS NAND gate is fabricated in single well CMOS technology. The minimum and maximum supply voltages in the circuit are –VDD and VDD, respectively. The substrate terminal of NMOS are grounded and that of PMOS are connected to VDD. What is wrong with connections of terminals in this circuit which will result into improper functioning of the circuit? (Assume VDD greater than diode cut-in voltage)

(A) Connections of substrate terminal of NMOS to ground

(B) Connections of substrate terminal of PMOS to VDD

(C) Connections of substrate terminal of NMOS to ground and that of PMOS to VDD

(D) Nothing wrong with connections

15. Which of the following statement is true for the transfer function of band-pass filter?

(A) Poles lead zeroes, and the transfer function has two poles and two zeroes.

(B) Poles lag zero, and the transfer function has two poles and one zero.

(C) Poles lead zeroes, and the transfer function has one pole and two zeroes

(D) Poles lag zeroes, and the transfer function has two poles and two zeroes.

16. The bypass capacitor placed in parallel with emitter resistor of common-emitter amplifier can _____.

(A) Avoid reduction in gain at all frequencies

(B) Avoid reduction in gain at all frequencies except at very high frequencies

(C) Avoid reduction in gain at all frequencies except at very low frequencies

(D) Doesn't affect frequency response

17. Race around problem in positive level triggered JK flip flop takes place when inputs J and K are _____ and _____, respectively, and this problem can be avoided if the clock ON time is _____ than the propagation delay of JK flip flop. Flip-flop is sensitive to input signals when clock is ON.

(A) 1, 1, greater (B) 0, 1, lesser

(C) 1, 0, greater (D) 1,1, lesser

18. In a microprocessor with 16 address lines, a peripheral is interfaced by using lower four address lines. Peripheral is selected when lower four address lines are at '0'. The address(es) assigned to the peripheral is/are _____, and this technique of address decoding is called as _____.

(A) 00, Absolute decoding (B) 0000 to FFF0, Absolute decoding

(C) 0000 to FFF0, Partial decoding (D) F0, Partial decoding

19. Incorporation of voltage shunt negative feedback in the amplifier circuit results into _____ and _____ in output and input impedances, respectively.

(A) Decrease, increase (B) Decrease, decrease

(C) Increase, decrease (D) Increase, increase

20. The unit of phase noise is _____, and it is the noise power relative to the carrier signal in a bandwidth of _____ at certain offset from the carrier.

(A) dBm/Hz, 1 Hz
(B) dBc/kHz, 1 kHz
(C) dBm/kHz, 1 kHz
(D) dBc/Hz, 1 Hz

21. At the input terminals, lossless short-circuited stub behaves as open circuited for a length _____, as inductor for a length _____, and as capacitor for a length _____.

(A) $\lambda/4$, greater than $\lambda/4$, lesser than $\lambda/4$
(B) $\lambda/2$, greater than $\lambda/2$, lesser than $\lambda/2$
(C) $\lambda/4$, lesser than $\lambda/4$, greater than $\lambda/4$
(D) $\lambda/2$, lesser than $\lambda/2$, greater than $\lambda/2$

22. Settling time of 2nd order control system is _____

(A) Proportional to the product of "damping ratio" and "natural frequency"
(B) Inversely proportional to the product of "damping ratio" and "natural frequency"
(C) Ratio of "damping ratio" to "natural frequency"
(D) Ratio of "natural frequency" and "damping ratio"

23. Which of the following chip is "Programmable Priority Interrupt Controller"?

(A) 8259
(B) 8279
(C) 8255
(D) 8253

24. What is the gain of half wave length dipole antenna in terms of dBi? Neglect electrical inefficiency.

(A) 1.76
(B) 1.51
(C) 5.25
(D) 2.15

25. Suppose the voltage source can supply 0 to 10 V, and has internal resistance of 75 Ω. What is approximate value of the maximum current, it can provide?

(A) 133 mA
(B) ∞ A
(C) 10A
(D) 1.33 mA

26. In ideal op-amp, the slew rate _____ and CMRR are _____, respectively.

(A) Infinite, Zero
(B) Infinite, Infinite
(C) Zero, Infinite
(D) Zero, Zero

27. The full-scale output of a DAC is 10 mA. If resolution is to be less than 40 μA, then minimum number of required bits are _____

(A) 11
(B) 10
(C) 8
(D) 9

28. An analog signal is quantized and transmitted using a PCM system. The tolerable error in sampled amplitude is 0.5% of peak-to-peak full scale value. The minimum binary digits required to encode a sample is _____.

(A) 7
(B) 6
(C) 5
(D) 8

29. For a given BJT device, hoe and hie parameters can be calculated from _____.

(A) IB - VBE and IC - VCE, respectively
(B) IC - VCE
(C) IC - VCE and IB - VBE, respectively
(D) IB - VBE

30. In three input CMOS NOR gate, _____ suffer from substrate bias effect. Assume that substrate terminals of NMOS transistors are grounded (minimum supply voltage in the circuit) and that PMOS are connected to VDD (maximum supply voltage in the circuit).

(A) 2 NMOS transistors
(B) 2 PMOS transistors
(C) 3 NMOS transistors
(D) 3 PMOS transistors

31. Which of the following statement is true?

(A) Tunnel diode exhibits negative resistance in its I-V characteristic whereas Gunn and Schottky diodes do not exhibits negative resistance in its I-V characteristic

(B) Tunnel diode and Gunn diode exhibit negative resistance in its I-V characteristic whereas Schottky diodes does not exhibit negative resistance in its I-V characteristic

(C) Gunn diode exhibits negative resistance in its I-V characteristic whereas Tunnel and Schottky diodes do not exhibit negative resistance in its I-V characteristic

(D) Gunn, Tunnel and Schottky diodes exhibit negative resistance in its I-V characteristic

32. In a second order system, if the damping ratio is greater than '1', then what would be the nature of roots?

(A) Imaginary
(B) Real and equal
(C) Real but not equal
(D) Complex conjugate

33. For M equally likely messages, the average amount of information H is _____.

(A) $H = \log_{10}(M)$
(B) $H = \log_2(M)$
(C) $H = 2*\log_{10}(M)$
(D) $H = (1/2)*\log_{10}(M)$

34. 3 dBi gain of antenna means _____ the power relative to an isotropic antenna in the peak direction.

(A) Twice
(B) Thrice
(C) One half
(D) One third

35. Identify the region (linear/saturation) of operation for p-channel and n-channel MOSFET device for following cases: (i) p-channel MOSFET with VT = -1.5 V and terminal voltages having values as VG = 0 V, VB = 5 V, VD = 3 V, and VS = 5 V and (ii) n-channel MOSFET with VT = 1.5 V and terminal voltages having values as VG = 5 V, VB = 0 V, VD = 3 V, and VS = 0 V.

(A) linear, linear
(B) saturation, saturation
(C) saturation, linear
(D) linear, saturation

36. Twelve (12) signals each band limited to 5 kHz are to be transmitted over a single channel by frequency division multiplexing. If AM - SSB modulation scheme with a guard band of 1 kHz is used, then the bandwidth of the multiplexed signal will be _____.

(A) 81 kHz
(B) 51 kHz
(C) 61 kHz
(D) 71 kHz

37. A television signal is sampled at a rate of 20% above the Nyquist rate. The signal has a bandwidth of 6 MHz. The samples are quantized into 1024 levels. The minimum bandwidth required to transmit this signal would be _____.

(A) 72 M bits/sec
(B) 144 M bits/sec
(C) 72 K bits/sec
(D) 144 K bits/sec

38. A series tuned antenna circuit consists of a variable capacitor (50 pF to 360 pF) and a 240 μH antenna coil has DC resistance of 12 Ω. The approximate frequency range (f) of radio signal to which the radio is tunable is _____.

(A) 2.48 MHz < f < 8.4 MHz
(B) 3.4 MHz < f < 9.1 MHz
(C) 541 kHz < f < 1.45 MHz
(D) 436 kHz < f < 938 kHz

39. A sinusoid message signal m(t) is transmitted by binary PCM without compression. If the signal to quantization noise error ratio is required to be at least 48 dB, the minimum number of bits per sample will be _____.

(A) 8
(B) 10
(C) 12
(D) 14

40. N-channel MOSFET device is a good conductor of digital level _____ and P-channel MOSFET device is a good conductor of digital level _____.

(A) 0, 1
(B) 1, 0
(C) 1, 1
(D) 0 and 1 both, 0 and 1 both

41. The entropy of a message source generating four messages with probabilities 0.5, 0.25, 0.125 and 0.125 is _____.

(A) 1 bit/message
(B) 1.75 bits/message
(C) 3.32 bits/message
(D) 5.93 bits/message

42. The gain margin of unity feedback system G(s) = 2/[(s + 1)(s + 2)] is _____ dB.

(A) 1.76
(B) 3.5
(C) -1.76
(D) -3.5

43. Consider two signals: x[n] = {1, 2, –1} and h[n] = x[n]. The convolution y[n] = x[n] * h[n] is _____. The index of 1st sample in sequence x[n] is 0.

(A) {1, 4, 2, –4, 0}
(B) {1, 2, –1}
(C) {1, 4, 2, –4, 1}
(D) {1, 4, 1}

44. The closed loop system with transfer function T(s) = 10/(s^5 + 2s^4 + 3s^3 + 6s^2 + 5s^1 + 3) is _____ and has _____ poles in right half of s-plane.

(A) Stable, 0
(B) Unstable, 1
(C) Unstable, 3
(D) Unstable, 2

45. The open loop transfer function of a system is

G(s)H(s) = K/[s(1+2s)(1+3s)]

The phase crossover frequency is _____.

(A) 6 rad/sec
(B) 2.46 rad/sec
(C) 0.41 rad/sec
(D) 3.23 rad/sec

46. A 5V voltage source with internal resistance RS is connected to load resistance of 2 kΩ for a time period of 5 ms. Assume that RS is equal to 3 kΩ in initial 1 ms and after that it takes a value of 8 kΩ. What is the average of current flowing through the load resistance?

(A) 0.6 mA
(B) 1.5 mA
(C) 0.75 mA
(D) 2.5 mA

47. In a series RC circuit with C equal to 1 μF, the output is taken across C. The phase shift between output and input at 20 rad/s is –45°. What is the value of R?

(A) 200 kΩ (B) 150 kΩ

(C) 100 kΩ (D) 50 kΩ

48. In T flip-flop, the normal and complement outputs of T flip-flop is performed XOR operation and then, connected to the T input of flip-flop. If clock frequency to the circuit is fClk, what is the frequency of the output signal of the circuit?

(A) fClk (B) fClk/2

(C) fClk/4 (D) 2fClk

49. A 4-bit ripple counter and 4-bit synchronous counter made by flip-flops having a propagation delay of 10 ns each. What is the worst case delay in ripple counter and synchronous counter?

(A) 10 ns, 10 ns (B) 40 ns, 40 ns

(C) 10 ns, 40 ns (D) 40 ns, 10 ns

50. In CMOS inverter circuit, as the input signal is swept from 0 V to VDD voltage level, NMOS device moves from _____ to _____ to _____ region, and PMOS device moves from _____ to _____ to _____ region.

(A) Cutoff, linear, saturation; cutoff, linear, saturation

(B) Cutoff, saturation, linear, linear, saturation, cutoff

(C) Cutoff, linear, saturation, saturation, linear, cutoff

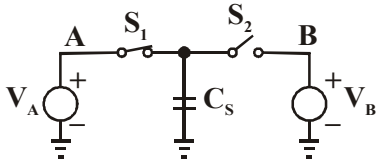
(D) Cutoff, linear, saturation, cutoff, saturation, linear

51. What is the PIV across each diode of a bridge rectifier with a secondary voltage of 20 V rms?

(A) 14.1 V (B) 20 V

(C) 28.3 V (D) 34 V

52. What is average current flowing in the circuit given below from node A to node B in one clock cycle? Assume switches S1 and S2 are ideal. S1 and S2 are operated by complementary and non-overlapping clock signals. The frequency of clock signals applied to S1 and S2 are fs. Non-overlapping and complementary means when S1 is ON then S2 is OFF, and vice versa. Assume that VA and VB don't change when concerned switch is ON.



(A) $C_S f_s(V_A - V_B)$ (B) $(V_A - V_B)/(C_S f_s)$

(C) $(V_A - V_B)C_S/f_s$ (D) $(V_A - V_B)\, f_s/C_S$

53. Which of the following functions can be used to generate odd parity for 3-input (x,y, z) bits?

(A) x (Ex-OR) y (Ex-NOR) z

(B) x (Ex-NOR) y (Ex-OR) z

(C) x (Ex-OR) y (Ex-OR) z

(D) Either of the following functions:

(1) x (Ex-OR) y (Ex-NOR) z

(2) x (Ex-NOR) y (Ex-OR) z

54. Infinite sheet of charge having charge density ρS C/m^2 lying at x = 0 and $-\rho S$ C/m^2 lying at x = a. What is the electric field (E) in the region 0 < x < a?

(A) 0

(B) $(\rho S / \in_0)a_x$

(C) $(\rho S / (2\in_0))a_x$

(D) $(2\rho S / \in_0)a_z$

55. The direction of electric field is _____ to equipotential surface and towards more _____ equipotential surfaces.

(A) tangential, positive

(B) normal, negative

(C) tangential, negative

(D) normal, positive

56. Which of the following represents point form of Ampere's circuital law?

(A) $\nabla X H = J$

(B) $\nabla X J = H$

(C) $\oint H.dL = I$

(D) $\nabla X E = 0$

57. In c language program, if following statements are part of the program, what would be the value variables m and y at the end of execution of both statements?

```
m=5;
y=m++;
```

(A) y = 6, m = 6

(B) y = 5, m = 6

(C) y = 5, m = 5

(D) y = 6, m = 5

58. Two carriers 40 MHz and 80 MHz, respectively, are frequency modulated by a signal of frequency 4 kHz such that the bandwidths of the FM signal in the two cases are the same. The peak deviations in both the cases are in the ratio of _____.

(A) 1:4

(B) 1:2

(C) 2:1

(D) 1:1

59. In c language, use and execution of "continue" statement in while and do loops, transfers control _____.

(A) To test condition of while and do loops and then to continue iterative process

(B) Next statement after continue statement will be executed

(C) Continue statement can't be used in while and do loops

(D) Out of while and do loops

60. In switch statement of c language, default case label is _____ and we can have _____ default labels.

(A) Optional, multiple

(B) Optional, at most one

(C) Mandatory, multiple

(D) Mandatory, at most one

61. How many integer data can be stored in a variable declared as under in c language?

```
int survey[3][5][12];
```

(A) 180

(B) 312

(C) 88

(D) 120

62. In c language, the permitted subscript (index) value in height array variable defined as per the following statement is _____

```
float height[50];
```

(A) 1 to 49

(B) 1 to 50

(C) 50

(D) 0 to 49

63. Which of the following modulation scheme has low noise immunity?

(A) PSK (B) ASK

(C) FSK (D) PSK and FSK, both.

64. For a message signal $m(t) = \cos(2\pi f_m t)$ and carrier frequency f_c, which of the following represents a single side-band signal?

(A) $\cos(2\pi f_m t)\cos(2\pi f_c t)$ (B) $\cos(2\pi f_c t)$

(C) $\cos(2\pi(f_m + f_c)t)$ (D) $[1+\cos(2\pi f_m t)]\cos(2\pi f_c t)$

65. The modulating frequency in FM is increased from 10 kHz to 20 kHz. The bandwidth is _____.

(A) Doubled (B) Halved

(C) Increased by 20 kHz (D) Increased by 10 kHz

66. In an 8085 microprocessor, the instruction CMP B has been executed while the content of accumulator is less than that of the register B. As a result, carry flag and zero flag will be, respectively, _____ and _____.

(A) Set, reset (B) Reset, set

(C) Set, set (D) Reset, reset

67. In 8085 microprocessor, the clock frequency is 5 MHz. The time required to execute an instruction with 20 T-state is _____.

(A) 0.2 μs (B) 4 μs

(C) 2 μs (D) 0.4 μs

68. Consider the execution of following program in 8085 microprocessor.

```
XRA A
LXIB, 0007H
LOOP: DCX B
JNZ LOOP
```

How many times the loop will be executed in above program?

(A) 1 time (B) 7 times

(C) 8 times (D) Infinite times

69. The impulse response of a continuous-time LTI system is $h(t) = e^{-6t}u(3-t)$. The system is _____.

(A) causal and stable (B) causal but not stable

(C) Not causal but stable (D) Neither causal nor stable

70. The impulse response of an LTI system is $h(t) = u(t) - u(t-4)$. The step response is _____.

(A) $tu(t) + (4-t)u(t-4)$ (B) $tu(t) + (1-t)u(t-4)$

(C) $1 + t$ (D) $(1 + t)u(t)$

71. A 4-bit D/A converter produces an output voltage of 4.5 V for an input code of 1001. What will be the value of the output voltage for an input code of 0011?

(A) 1 V (B) 1.5 V

(C) 3 V (D) 0.5 V

72. Find parameter h_{21} for a two-port T network. Assume that each branch in T network has resistor with a value R.

(A) –3/2 (B) 1/2

(C) –1/2 (D) 3/2

73. Consider a 150 m long air-filled hollow rectangular waveguide with cutoff frequency 6.5 GHz. If a short pulse of 7.2 GHz is introduced into the input end of the guide, the time taken by the pulse to return to the input end is _____. Take c (velocity) as 3 X 10^8 m/sec.

(A) 920 ns (B) 460 ns

(C) 230 ns (D) 430 ns

74. A 0 - 250V voltmeter has a guaranteed accuracy of 2% of full scale reading. What is the maximum percentage of error if it measures 150V?

(A) 2.33% (B) 3.33%

(C) 5.33% (D) 1.33%

75. The smallest change in measured variable to which instrument will respond is _____.

(A) Resolution (B) Accuracy

(C) Precision (D) Resolution and Precision

76. The Z transform of u[n] is

(A) $1/(1-z^{-1})$, $|z| > 1$ (B) $1/(1-z^{-1})$, $|z| < 1$

(C) $z/(1-z^{-1})$, $|z| < 1$ (D) $z/(1-z^{-1})$, $|z| > 1$

77. A 5 V voltage source is connected to non-inverting terminal of op-amp, 0.1 mA is injected into inverting terminal, and 20 kΩ resistor is connected between inverting terminal and output terminal of op-amp. Calculate output voltage. Assume ideal op-amp.

(A) 4 V (B) 3 V

(C) 5 V (D) 2 V

78. In a BJT circuit, I_C = 100 mA and I_E = 100.5 mA. The value of β is _____.

(A) 0.995 (B) 201

(C) 199 (D) 200

79. The both dc load line and ac load line in common-emitter amplifier have the same _____.

(A) X-axis intercept (B) Y-axis intercept

(C) Slope (D) Q-point

80. In order to start up and ensure oscillations, it is required oscillator circuit to have _____ phase shift and loop-gain _____ around the feedback loop.

(A) Zero degree, greater than or equal to 1

(B) 180 degree, less than 1

(C) 180 degree, greater than or equal to 1

(D) Zero degree, less than 1

81. If $u = e^x + y$ and $v = e^x + 7y$, then the Jacobian $\frac{\partial(x,y)}{\partial(u,v)}$ equals _____.

(A) $7e^x$ (B) $6e^x$

(C) $7e^{-x}$ (D) $\frac{e^{-x}}{6}$

82. Let $f:[0,1]\to\mathbb{R}$ be continuous function which is differentiable on (0, 1) and such that $f(0) = 1$ and $f(1) = 0$. Then which of the following statements is true in general ?

(A) There exists $c \in (0, 1)$ such that $f(c) = cf'(c)$

(B) There exists $c \in (0, 1)$ such that $f(c) = -cf'(c)$

(C) There exists $c \in (0, 1)$ such that $f'(c) = cf(c)$

(D) There exists $c \in (0, 1)$ such that $f'(c) = -cf(c)$

83. If $f(x, y) = x^2y - xy^2 + 4xy - 4x^2 - 4y^2$ then (0, 0) is

(A) A point of minima

(B) A point of maxima

(C) A saddle point

(D) None of these

84. The improper integral $\int_0^{\pi/2} \frac{\sin x}{\sqrt{1-\cos x}}dx$ is

(A) divergent

(B) convergent and its value is 0

(C) convergent and its value is 1

(D) convergent and its value is 2

85. Let C denote the closed curve in the first quadrant formed by the parabolas $y^2 = 4x$ and $x^2 = 4y$. If the area bounded by C is $\frac{16}{3}$, then the value of the line integral $\oint_C (xdy - ydx)$ is

(A) $\frac{8}{3}$

(B) $\frac{16}{3}$

(C) $\frac{32}{3}$

(D) $\frac{4}{3}$

86. The general solution of the equation $y'' + 2y' - y = 0$ is

(A) $y = e^{-x}(c_1 e^{\sqrt{2x}} + c_2 e^{-\sqrt{2}x})$

(B) $y = e^{\sqrt{2}x}(c_1 e^{x} + c_2 e^{-x})$

(C) $y = e^{x}(c_1 e^{\sqrt{2}x} + c_2 e^{-\sqrt{2}x})$

(D) $y = e^{-\sqrt{2}x}(c_1 e^{x} + c_2 e^{-x})$

87. If the general solulion of the equationdy $\frac{dy}{dx} + y\sin x = e^{\cos x}$ is $(f(x)+c)e^{\cos x}$, then $f(x)$ equals _____

(A) $\sin x$

(B) $\cos x$

(C) x

(D) 0

88. The inverse Laplace transform of the function F(s) = $\frac{1}{S^2(S^2+1)}$ is

(A) t cost

(B) t sint

(C) t – cost

(D) t – sint

89. If the Laplace transform of the function f(t) = $\frac{\cos 2t \sin t}{e^t}$ is denoted by F(s), then the value of F(0) is

(A) $\frac{-1}{5}$

(B) $\frac{1}{5}$

(C) $\frac{-1}{10}$

(D) $\frac{1}{10}$

90. Which of the following is a solution of Laplace equation in two dimensions ?

(A) $e^{-y}\cos x$ (B) $x^2 + y^2$

(C) $e^{-y} + \cos x$ (D) $x^3 + 3x^2 - 3y^2 + 1$

91. If the eigen values of the matrix $\begin{bmatrix} a & 1 \\ 1 & 2b \end{bmatrix}$, (where a, b > 0), are 2 and 3 then the point (a, b) lies on which of the following straight lines ?

(A) $x + y = 5$ (B) $x + 2y = 6$

(C) $x + y = 1$ (D) $x + 2y = 5$

92. Let A be a square matrix of order 3 and suppose det $A \neq 0$. Then the non-homogeneous system of linear equations Ax = b has

(A) no solulion (B) unique solution

(C) three solutions (D) infinite solutions

93. Let C = { Z : $|z| = \frac{3}{2}$}. Then the value of the contour integral $\int_C \frac{\cos(2\pi z)}{z^2 - 3z + 2} dz$ is

(A) $-2\pi i$ (B) $2\pi i$

(C) 1 (D) –1

94. The coefficient of Z^2 in the Taylor series expension of $f(z) = \sin^2 z$ about z = 0 is

(A) 0 (B) 1

(C) 2 (D) $\frac{1}{2}$

95. Consider functions f(z) = $\overline{Z}$ and g(z) = $e^{\overline{z}}$ defined over complex numbers, Then

(A) f and g both are analytic in C (B) f is analytic but g is not analytic in C

(C) g is analytic but f is not analytic in C (D) Neither f nor g is analytic in C

96. Bag A contains 2 white and 3 red balls and Bag B contains 4 white and 5 red balls. One ball is drawn at random from one of the bags and it is found to be white. What is the probability that the white ball is drawn from Bag B ?

(A) $\frac{9}{19}$ (B) $\frac{18}{19}$

(C) $\frac{5}{19}$ (D) $\frac{10}{19}$

97. The probability of obtaining at least two 'Five' in rolling a fair die 3 times is

(A) $\frac{2}{9}$ (B) $\frac{1}{9}$

(C) $\frac{2}{27}$ (D) $\frac{1}{27}$

98. If the mean of the 15 observations is $x_1, x_2, ..., x_{14}, x_{15}$ is 15 then the mean of the 15 observations $y_1, y_2, ..., y_{14}, y_{15}$ (where $y_i = x_i + i$ for $i = 1, 2, ...15$) is

(A) 23 (B) 22

(C) 11 (D) 9

99. Which of the following iteration formula is suitable for computing the cube-root of the number 11?

(A) $x_{n+1} = \frac{x^3_n + 11}{2x^2_n}$ (B) $x_{n+1} = \frac{3x^3_n + 11}{2x^2_n}$

(C) $x_{n+1} = \frac{2x^3_n + 11}{3x^2_n}$ (D) $x_{n+1} = \frac{x^3_n + 11}{3x^2_n}$

100. Which of the following is a single step method for numeric solution of ordinary differential equations?

(A) Gauss - Jordan method (B) Secant method

(C) Runge - Kutta method (D) Bisection method

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