ENTRANCE EXAMINATION FOR ADMISSION, MAY 2013.

Ph.D. (ELECTRONICS ENGINEERING)

COURSE CODE : 166

Register Number : [ ]

Signature of the Invigilator
(with date)

COURSE CODE : 166

Time : 2 Hours Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each of the question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you –1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

1. Two independent random variables X and Y are uniformly distributed in the interval $[-1,1]$. The probability that max $[X,Y]$ is less than 1/2 is

(A) 3/4 (B) 9/16

(C) 1/4 (D) 2/3

2. Given $f(z) = \frac{1}{z+1} - \frac{2}{z+3}$. If C is a counter clock wise path in the z-plane such that $|z+1| = 1$, the value of $\frac{1}{2\pi j}\oint f(z)dz$ is

(A) –2 (B) –1

(C) 1 (D) 2

3. Let be the solution of the initial value problem $\frac{dy}{dx} = \{y^2 + x\}, y(0) = 1$. Using Taylor series method of order 2 with the step size $h = 0.1$, the approximate value of $Y(0.1)$ is

(A) 1.315 (B) 1.415

(C) 1.515 (D) 1.215

4. The number of irreducible quadratic polynomials over the field of two elements F2 is

(A) 0 (B) 1

(C) 2 (D) 3

5. The initial value problem $x\frac{dy}{dx} = y + x^2, x\rangle 0; y(0) = 0$ has

(A) Infinitely many solutions (B) Exactly two solutions

(C) A unique solution (D) No solution

6. In modern MOSFET, the material used for the gate is

(A) Heavily doped polycrystalline silicon (B) High purity silica

(C) High quality silicon (D) Epitaxial grown silicon

7. The potential divider bias is more commonly used because it

(A) Uses minimum circuit components

(B) Stabilizes the collector current

(C) Does not reduce the input and output impedances drastically

(D) Uses only one battery

8. A two stage amplifier with negative feedback has an overshoot when the damping factor K is emitter follower circuit is widely used in electronic instruments because

(A) Less than unity (B) Greater than unity

(C) Negative (D) Zero

9. The propagation delay of ECL family is

(A) 10nsec (B) 4nsec

(C) 2nsec (D) 30nsec

10. The fan-out of TTL family is

(A) 20 (B) 50

(C) 10 (D) 40

11. The eigenvalue λ of the following Fredholm integral equation $y(x) = \lambda \int_0^1 x^2 t y(t) dt$ is

(A) –2 (B) 2

(C) 4 (D) –4

12. Let y be the solution of the initial value problem $\frac{d^2y}{dx^2} + y = 6\cos 2x$, $y(0) = 3$, $y\,y^1(0) = 1$. Let the Laplace transform of y be $F(s)$. Then, the value of $F(1)$ is

(A) 17/5 (B) 13/5

(C) 11/5 (D) 9/5

13. The stack pointer register in a microprocessor

(A) Keeps the address of the next instruction to be fetched

(B) Holds the address of the top of the stack

(C) Counts the number of programs being executing on the microprocessor

(D) Counts the number of instructions being executing on the microprocessor

14. The type of duplex method in CDMA2000 is

(A) FDD (B) TDD

(C) FDD/TDD (D) None of the above

15. Okumura model is applicable for frequencies in the range of

(A) 1500MHz to 2500MHz (B) 150MHz to 1920 MHz

(C) 150MHz to 1500MHz (D) None of the above

16. What makes optical fibers immune to EMI?

(A) They transmit signals in as light rather than electric current

(B) They are too small for magnetic fields to introduce current in them

(C) Magnetic fields cannot penetrate the glass of the fiber

(D) They are readily shielded by outer conductors in cable

17. Which of the following is not a reason to use fiber-optic cables for point to point data transmission?

(A) Need to assure data security

(B) Avoidance of ground loops

(C) Data-transfer rates too low to use metal cables

(D) Elimination of spark hazards

18. Which of the following describes a technique to achieve fault tolerance in optical networks with minimum costs?

(A) Bypassing active elements

(B) Avoid the usage of star couplers

(C) Duplication of system properties

(D) Topological reconfiguration

19. A normal GSM has 3 start bits, 3 stop bits, 26 training bits for allowing adaptive equalization, 8.25 guard bits and 2 bursts of 58 bits of encrypted data which is transmitted at 270.833 kbps in the channel. Calculate frame rate.

(A) 417.66 frames/sec

(B) 216.66 frames/sec

(C) 318.66 frames/sec

(D) 519.66 frames/sec

20. The speech coding used in D-AMPS is

(A) QCELP

(B) RPE-LTE

(C) VSELP

(D) None of the above

21. One method of solving 'blind speed' problems is to

(A) Use a variable PRT

(B) Use digital MTI

(C) Change Doppler frequency

(D) Use short wavelength

22. The noise figure of a radar receiver is 12 dB and its bandwidth is 2.5MHz. The value of P min for the radar will be

(A) 1.59×10^{-9} W

(B) 1.59×10^{-15} W

(C) 1.59×10^{-17} W

(D) 1.59×10^{-13} W

23. A communication channel has bandwidth of 5 KHz and if signal-to-noise ratio is 5,the corresponding channel capacity will be

(A) 18000 bits/sec (B) 4000 bits/sec

(C) 1500 bits/sec (D) 1000 bits/sec

24. The type of light source and fiber chosen for FDDI networks are:

(A) Single-mode fiber and 1550-nm lasers

(B) Single-mode fiber and 1300-nm lasers

(C) Multi-mode fiber and 1300-nm lasers

(D) Multi-mode fiber and 1300-nm LEDs

25. Speeds of laboratory fiber optic Local Area Networks are now in the range of

(A) 1 Mbits/s (B) 10 Mbits/s

(C) Gigabits per second (D) Hundreds of megabits per second

26. A device used to display one or more digital signals so that they can be compared to expected timing diagrams for the signals is:

(A) DMM (B) Spectrum Analyzer

(C) Logic Analyzer (D) Frequency Counter

27. The AND function can be used to ———— and the OR function can be used to ————

(A) Enable, Disable (B) Disable, Enable

(C) Enable or Disable, Enable or Disable (D) Detect, Invert

28. In a 16-bit Johnson counter sequence there are a total of how many states or bit patterns?

(A) 2 (B) 6

(C) 12 (D) 24

29. How is a J-K Flip-Flop made to toggle?

(A) J=0, K=0 (B) J=1, K=0

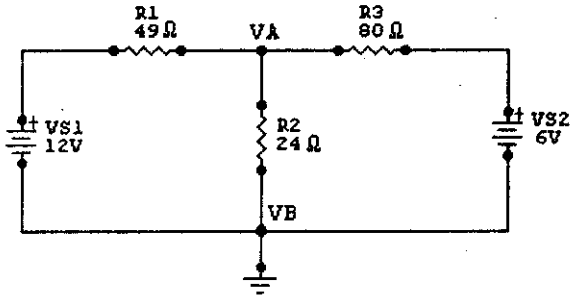
(C) J=0, K=1 (D) J=1, K=1

30. ALM is the acronym for

(A) Array Logic Matrix (B) Arithmetic Logic Module

(C) Asynchronous Local Modulator (D) Adaptive Logic Module

31. Find the node voltage V_A



(A) 6 volts (B) 12 volts

(C) 4.25 volts (D) 3.25 volts

32. A 15 Ω resistor, a 220 μH coil, and a 60 pF capacitor are in series across an ac source. What is the bandwidth of the circuit?

(A) 138 MHz (B) 10,866 Hz

(C) 1,907 Hz (D) 138 KHz

33. To tune a parallel resonant circuit to a higher frequency, the capacitance should be

(A) Increased (B) Decreased

(C) Left Alone (D) Replaced with inductance

34. In the ionosphere layer, the lowest frequency signal that penetrates the layer upon vertical incidence is given by

(A) $f_L = 81\ N_{Max}$ (B) $f_L = 81\ N^2{}_{Max}$

(C) $f_L = \sqrt{81 N_{Max}}$ (D) $f_L = 81\ \sqrt{N_{Max}}$

35. In superheterodyne receiver, the frequency of local oscillator

(A) Equal to that of incoming signal

(B) Slightly less than that of incoming signal

(C) Half that of incoming signals

(D) Higher than that of incoming signal

36. In which header file is the NULL macro defined?

(A) stdio.h (B) stddef.h

(C) stdio.h and stddef.h (D) math.h

37. A pointer is
(A) A keyword used to create variables
(B) A variable that stores the address of an instruction
(C) A variable that stores the address of other variable
(D) All the above

38. The library function used to find the last occurrence of a character in a string is
(A) strnstr( ) (B) laststr( )
(C) strrchr( ) (D) strstr( )

39. All MATLAB variables are ———— array
(A) One Dimensional (B) Two Dimensional
(C) Multidimensional (D) All the above

40. The MATLAB function used to generate " 0 0 0 0 0 " as output is
(A) z = zeros (5,1) (B) z = zeros (1,5)
(C) z = zeros (1 × 5) (D) z = zeros (5× 1)

41. Special transmission lines constructed with copper patterns on a printed-circuit board that can be used as tuned circuits, filters, or impedance-matching circuits are called
(A) Microchip (B) Stripline
(C) PCB lines (D) Special lines

42. Tinier Microstrip and striplines made by using monolithic, thin-film, and hybrid techniques when combined with diodes, transistors, and other components form what are called
(A) Microstrip integrated circuits (B) microwave integrated circuits
(C) Stripline integrated circuits (D) high-frequency integrated circuits

43. Find the transit time at the cavity gap for a two-cavity klystron operating at 5GHz with dc beam voltage of 10KV and cavity gap of 2mm. The magnitude of the gap voltage is 100 volts for a given input RF voltage.
(A) 33.7×10^{-12} sec (B) 3.37×10^{-9} sec
(C) 2.68×10^{-9} sec (D) 26.8×10^{-12} sec

44. Potential energy ———— if the test charge is moved from a lower potential point to a higher potential point
(A) Remains the same (B) Increases
(C) Decreases (D) Becomes zero

45. In the case of a linear material medium, ———— equation can be derived easily from Gauss law
(A) Poisson (B) Laplace
(C) Both (A) and (B) (D) None of the above

46. Z-transform of unit impulse function is

(A) z (B) z^2

(C) 0 (D) 1

47. Inverse Z-transform of $\frac{2z}{(z-1)}$ is

(A) 2 (B) 1/2

(C) –2 (D) –1/2

48. A regression model is used to express a variable Y as a function of another variable X. This implies that

(A) There is a causal relationship between Y and X

(B) A value of X may be used to estimate a value of Y

(C) Values of X exactly determine values of Y

(D) There is no causal relationship between Y and X

49. If $M = \{1, 3, 5, 7, 9\}$, $N = \{2, 5, 7\}$ and $O = \{5, 6\}$ then $M \cap N \ UO$

(A) {5} (B) {5, 6, 7}

(C) {1, 2, 5, 6, 7, 9} (D) {1, 2, 9}

50. In Cisco's Unified Wireless Solution, what is the split-MAC architecture?

(A) The split-MAC architecture uses MAC addresses to create a forward/filter table and break up collision domains.

(B) The split-MAC architecture allows the splitting of 802.11 protocol packets between the AP and the controller to allow processing by both devices

(C) The split-MAC architecture uses MAC addresses on the wireless network and IP addresses on the wired network

(D) The split-MAC architecture uses MAC addresses to create a forward/filter table and break up broadcast domains.

51. _____ is used to quantify how strongly transmitted ultrasound amplitude decreases as a function of frequency

(A) Attenuation co-efficient (B) Reflection co-efficient

(C) Pearson co-efficient (D) None of the above

52. Changing wave angle with frequency is a mechanism for _____

(A) Group velocity dispersion (B) Waveguide dispersion

(C) Both (A) and (B) (D) None of the above

53. Which of the following is not found on the linear scales printed at the bottom of Smith charts?

(A) SWR (B) Impedance

(C) dB loss (D) Reflection coefficient

54. What is the frequency range of the IEEE 802.11a standard?

(A) 2.4 Gbps (B) 5 Gbps

(C) 2.4 GHz (D) 5 GHz

55. Compression in PCM refers to relative compression of

(A) Lower signal frequencies (B) Higher signal frequencies

(C) Higher signal amplitudes (D) Lower signal amplitudes

56. An antenna in free space receives 2μW OF POWER WHEN THE INCIDENT ELECTRIC FIELD IS 20mV/m (rms). The effective aperture of the antenna is

(A) 1.885 m^2 (B) 3.77 m^2

(C) 0.005 m^2 (D) 0.06m^2

57. The line-of-sight communication requires the transmit and receive antennas to face each other. If the transmit antenna is vertically polarized for best reception the receive antenna should be

(A) At 45° degrees w.r.t horizontal polarisation

(B) At 45° degrees w.r.t vertical polarisation

(C) Horizontally polarized

(D) Vertically polarized

58. Consider a losseless antenna with a directive gain of +6dB. If 1 mW of power is fed to it , then the total power radiated by the antenna will be

(A) 10 mW (B) 8 mW

(C) 6 mW (D) 4 mW

59. A transmitting antenna having an effective height of 125 m take a current of 50 amp (rms) at a wavelength of 1250m. The antenna efficiency for a total antenna loss resistance of 5 ohms is

(A) 62% (B) 72%

(C) 82% (D) 92%

60. A transmission line is feeding 1W 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) 1W (B) 10W

(C) 0.01W (D) 0.1 W

61. Figure merit is always unity in

(A) SSB-SC (B) AM

(C) FM (D) All the three

62. The sampling rate is always between
(A) 0 and 1 W
(B) 1 W to 2 W
(C) 2W to 4W
(D) None

63. In a delta modulation scheme, the step height is 75 mV and step width is 1.5 ms. The maximum slope that the staircase can track is
(A) 50 V/s
(B) 55 V/s
(C) 60 V/s
(D) 65 V/s

64. Which of the following pulse communication system is inherently immune to noise?
(A) PPM
(B) PCM
(C) PWM
(D) PAM

65. Which of the following gives maximum probability of error?
(A) ASK
(B) FSK
(C) PSK
(D) DPSK

66. In a open loop control system
(A) Output is independent of control input
(B) Output is dependent of control input
(C) Only system parameters have effect on the control output
(D) None of the above

67. In closed loop control system with positive value of feedback gain the overall gain of the system will be
(A) Increase
(B) Decrease
(C) Idle
(D) None of the above

68. ———— has tendency to oscillate.
(A) Open loop system
(B) Closed loop system
(C) Both (A) and (B)
(D) Neither (A) nor (B)

69. The initial response when the output is not equal to input is called ————
(A) Transient Response
(B) Error Response
(C) Dynamic Response
(D) Static Response

70. ———— increases the steady state accuracy
(A) Integrator
(B) Differentiator
(C) Phase lead compensator
(D) Phase lag compensator

71. A system is said to be a casual system if the output depends on
(A) Past input only
(B) Present input and past output
(C) Present input and future output
(D) None of the above

72. The Discrete Time Fourier Transform for $\delta(n)$ is

(A) π (B) 1

(C) 0 (D) infinity

73. A causal system having the transfer function $H(s) = \frac{1}{s+2}$ is excited with $10u(t)$. The time at which the output reaches 99% of its steady state value is

(A) 2.9 sec (B) 2.7 sec

(C) 2.5 sec (D) 2.3 sec

74. In binary data transmission DPSK is preferred to PSK because

(A) A coherent carrier is not required to be generated at the receiver

(B) For a given energy per bit, the probability of error is less

(C) The 180° phase shifts of the carrier are unimportant

(D) More protection is provided against impulse noise

75. The total bandwidth required for a raised cosine spectrum is

(A) W/2 (B) 1W

(C) 2W (D) 4W

76. For a CSMA/CD network, twice the propagation time between the two most distant stations is called

(A) Slot time (B) Transfer time

(C) Round trip delay time (D) Both (A) and (C)

77. _____ is a technique which transforms an analogue telephone circuit into a digital signal, and involves three consecutive processes: sampling, quantization and encoding.

(A) Frequency Modulation (FM) (B) Pulse Code Modulation (PCM)

(C) Amplitude Modulation (AM) (D) Phase Modulation (PM)

78. The sequence of the binary digits representing the outcomes of parity checks in Hamming codes is known as

(A) Look-up entry (B) Hamming distance

(C) Radix (D) Syndrome

79. Find the transit time at the cavity gap for a two-cavity klystron operating at 5GHz with dc beam voltage of 10KV and cavity gap of 2 mm. The magnitude of the gap voltage is 100 volts for a given input RF voltage.

(A) 33.7×10^{-12} sec
(B) 3.37×10^{-9} sec
(C) 2.68×10^{-9} sec
(D) 26.8×10^{-12} sec

80. The maximum gain of 100 element uniform linear array is

(A) 1
(B) 10
(C) 100
(D) 1000

81. Rhombic antenna is

(A) Standing wave antenna
(B) Narrow band antenna
(C) $\lambda/2$ antenna
(D) Travelling wave antenna

82. The number of log periodic antenna elements depends on

(A) Gain only
(B) Wedge angle only
(C) Bandwidth only
(D) Bandwidth, scale and space factors

83. A Si microwave transistor has reactance 1 ohm, transit time cut-off frequency 4GHz, maximum E-field 1.6×10^5 V/m and saturation drift velocity 4×10^5cm/s. Determine the maximum allowable power

(A) 6.48 Watts
(B) 4.27 Watts
(C) 2.64 Watts
(D) 1.35 Watts

84. The usage of multiple cavities in klystron improves

(A) Impedance
(B) Gain
(C) Bandwidth
(D) None of the above

85. An air filled circular waveguide having an inner radius of 1 cm is excited in dominant mode at 10 GHz with $x'_{11} = 1.841$. Find the guide wavelength of dominant mode.

(A) 9.104 cm
(B) 8.223 cm
(C) 7.345 cm
(D) 6.303 cm

86. When a step-input is given to an op-amp integrator, the output will be

(A) A ramp
(B) A sinusoidal wave
(C) A rectangular wave
(D) A triangular wave with dc bias

87. In a full wave rectifier without filter, the ripple factor is

(A) 0.482
(B) 1.21
(C) 1.79
(D) 2.05

88. The minimum number of flip flops required to construct a mod-75 counter is

(A) 5 (B) 6

(C) 7 (D) 8

89. In a JFET, at pinch-off voltage applied on the gate

(A) The drain current becomes almost zero

(B) The drain current begins to decrease

(C) The drain current is almost at saturation value

(D) The drain-to-source voltage is close to zero volts

90. The frequency of oscillation of a tunnel-collector having $L = 30\ \mu H$ and $C = 300$ PF is nearby

(A) 267 KHz (B) 1677 KHz

(C) 1.68 KHz (D) 2.67 KHz

91. The type of modulation used in IEEE 802.15.4 having operating frequency of 2.4 GHz is

(A) DS-SS (B) BPSK

(C) QPSK (D) OQPSK

92. The encryption standard used in HIPERLAN/2 is

(A) DES (B) RSA

(C) ECC (D) RC4

93. The number bits used to denote the address of source and destination in IPv6

(A) 256 bits (B) 128 bits

(C) 64 bits (D) 32 bits

94. In a group of 10 servers, each is occupied for 30 minutes in an observation interval of two hours. Calculate the total traffic carried by the group.

(A) 4.5E (B) 3.5 E

(C) 2.5 E (D) 32 bits

95. For a probability distribution, if 'a' is the mean, 'b' is the mode and 'c' is the standard deviation then the coefficient of skewness is

(A) $\frac{(a-b)}{c}$ (B) $\frac{(b-a)}{c}$

(C) $\frac{(a-c)}{c}$ (D) $\frac{(b-c)}{a}$

96. Which one of the following is true regarding VLANs?

(A) Two VLANs are configured by default on all Cisco switches

(B) VLANs only work if you have a complete Cisco switched internetwork. No off-brand switches are allowed

(C) You should not have more than 10 switches in the same VTP domain

(D) VTP is used to send VLAN information to switches in a configured VTP domain

97. What is the main reason the OSI model was created?

(A) To create a layered model larger than the DoD model

(B) Application developers can change only one layer's protocols at a time

(C) Different networks could communicate

(D) Cisco could use the model

98. What protocols are used to configure trunking on a switch?

(1) VLAN Trunking Protocol

(2) VLAN

(3) 802.1Q

(4) ISL

(A) 1 and 2 (B) 3 and 4

(C) 1 only (D) 2 only

99. How many broadcast domains are created when you segment a network with a 12-port switch?

(A) 1 (B) 2

(C) 5 (D) 12

100. If standard deviation of data is 3, mean is 20 then coefficient of variation is

(A) 156 (B) 3/20

(C) 20/3 (D) None