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PHD-EE-2013

SUBJECT : Electronics & Communication Engineering

B

Sr. No. 10038

Time : 1¼ **Hours** Max. Marks : **100** Total Questions : **100**

Candidate's Name _____ Date of Birth _____

Father's Name _____ Mother's Name _____

Roll No. (in figures) _____ (in words) _____

Date of Examination _____

_____ _____

(Signature of the Candidate) (Signature of the Invigilator)

SEAL

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. ***All questions are compulsory and carry equal marks.***
2. All the candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means/misbehaviour will be registered against him/her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing **within two hours** after the test is over. No such complaint(s) will be entertained thereafter.
4. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers **Should Not** be ticked in the question booklet.
5. ***Use black or blue ball point pen only in the OMR Answer-Sheet.***
6. For each correct answer, the candidate will get full credit. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer. There will be No Negative marking.
7. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

1. The open loop DC gain of a unity negative feedback system with closed loop transfer function $\frac{s+4}{s^2+75+13}$ is :

(1) $\frac{4}{13}$ (2) $\frac{4}{9}$ (3) 4 (4) 13

2. The transfer function of a tachometer is of the form :

(1) ks (2) $\frac{k}{s}$ (3) $\frac{k}{s+1}$ (4) $\frac{k}{s(s+1)}$

3. A system represented by $\frac{dy}{dt}+2y=4t\,u(t)$. The ramp component in the forced response will be :

(1) t u(t) (2) 2t u(t) (3) 3t u(t) (4) ut u(t)

4. If the feedback control system is of type 2, then the steady state error for a ramp input is :

(1) Infinite (2) Constant (3) Zero (4) Indeterminate

5. The closed loop transfer function of a control system is given by $\frac{C(s)}{R(s)}=\frac{2(S-1)}{(S+2)(S+1)}$ for a unit step input the output is

(1) $-3e^{-2t}+4e^{-t}-1$ (2) $-3e^{-2t}-4e^{-t}+1$

(3) Zero (4) Infinity

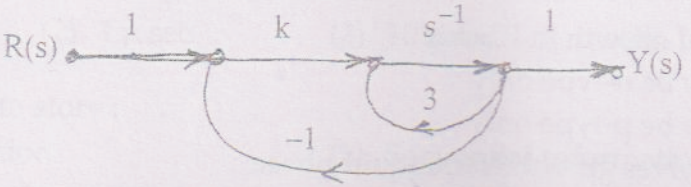
6. For characteristic equation of a closed loop system $S^4+6S^3+11S^2+6S+k=0$ Stable closed-loop behaviour can be ensured when gain k is such that

(1) $0<k<10$ (2) $k>10$ (3) $-\infty \le k > \infty$ (4) $0<k\le 20$

7. The phase margin of a system with the open loop transfer function $G(s)\,H(s)=\frac{(1-s)}{(1+s)(2+s)}$ is :

(1) 0° (2) 63.4° (3) 90° (4) ∞

8. The system shown in fig. remains stable when :

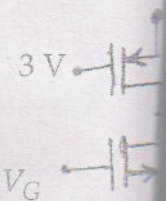


(1) $k<-1$ (2) $-1<k<1$ (3) $1<k<3$ (4) $k>3$

9. In the Bode plot of a unity feedback control system, the value of phase of $G(jw)$ gain cross over frequency is $-125°$. The phase margin of the system is :
(1) $-125°$ (2) $-55°$ (3) $55°$ (4) $125°$

10. In a synchronous error detector, the output voltage is proportional to $[w(t)]^n$, $w(t)$ is the rotor velocity and n equals :
(1) -2 (2) -1 (3) 1 (4) 2

11. Consider the CMOS circuit shown where the gate voltage V_G of the n-MOSFET is increased from 0 to high, while the V_G of p-MOSFET is kept constant at 3V. Assume V^{th} for both is 1V & $\mu C_{ox} \cdot \left(\frac{W}{L}\right) = |mA|V^2$ for a small increase in V_G beyond 1 V, which of the following gives the ***correct*** description of the region of operation of each MOSFET ?



(1) Both the MOSFETS are in saturation region
(2) Both the MOSFETS are in triode region
(3) n-MOSFET in triode region & p-MOSFET in saturation region
(4) n-MOSFET in saturation & p- MOSFET in triode region

12. Estimate the output voltage V_0 for $V_G = 1.5\,V$ in above case :
(1) $\left(4-\frac{1}{\sqrt{2}}\right)V$ (2) $\left(4+\frac{1}{\sqrt{2}}\right)V$ (3) $\frac{\sqrt{3}}{2}V$ (4) $\left(4+\frac{\sqrt{3}}{2}\right)V$

13. The p-type substrate in a conventional p-n junction isolated integrated circuit be connected to :
(1) no where i.e. left floating
(2) a dc ground potential
(3) most positive potential available in the circuit
(4) most negative potential available in the circuit

14. The typical number of diffusions used in making epitaxial-diffused silicon int circuit is :
(1) 1 (2) 2 (3) 3 (4) 4

15. Epitaxial growth in IC chip :
(1) may be n-type only
(2) may be p-type only
(3) involves growth from liquid phase
(4) involves growth from gas phase

16. The main purpose of metalization process is :
(1) to act as heat sink
(2) to protect transistor from possible thermal runaway
(3) to interconnect various circuit elements
(4) to protect the chip from oxidation

17. The thin film :
(1) component are made by screen and fire process
(2) resistor have greater protection, precision and more stable
(3) resistor are cheaper than the simple resistors
(4) all of these

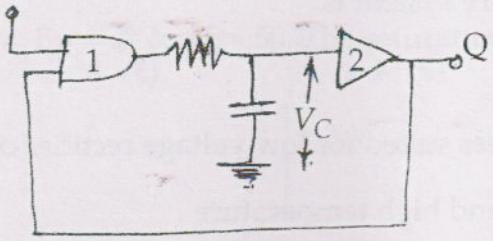
18. Channel resistance R_{on} is scaled by a factor :
(1) $\frac{1}{\alpha}$ (2) $\frac{\beta}{\alpha}$ (3) 1 (4) $\frac{\alpha^2}{\beta}$

19. Propagation delay and fan out for a standard IC(TTL NAND gate) are :
(1) 8 n sec & 12 (2) 6 n sec & 15 (3) 8 n sec & 10 (4) 6 n sec & 10

20. An ideal n-MOSFET has following parameters W = 30 μm $\mu_n = 450\ cm^2/v-s$, L = $2\mu_m$ $t_{ox} = 350^{\circ}A$ $V_{TN} = 0.8v$. If transistor is operating in saturation at $V_{GS} = 4v$ then value of g_m is :
(1) 486 μs (2) 0.213 ms (3) 2.13 ms (4) 48.6 ms

21. The characteristics equation of T-flip flop is given by :
(1) $Q = \overline{T}Q + T\overline{Q}$ (2) $Q = T\overline{Q} + Q\overline{T}$ (3) $Q = TQ$ (4) $Q = T\overline{Q}$

22. The multivibrator shown in the figure has R = 300 Ω and C_1 = 500 pf. Then the pulse width is :



(1) 1 n sec (2) 1 μ sec (3) 10 n sec (4) 1 m sec

23. PROMs are used to store :
(1) Bulk information
(2) Sequential information
(3) Information to be accessed rarely
(4) Relatively permanent information

24. A single instruction to clear the lower four bits of accumulator in 8085 asse language is :

(1) XRI OFH (2) ANI FOH (3) XRI FOH (4) ANI OFH

25. 2's complement representation of a 16 bit number (one sign bit and 15 magnitude is FFF1. Its magnitude in decimal representation is :

(1) 0 (2) 1 (3) 32,767 (4) 65,767

26. If the accumulator of 8085 contains 37 H and the previous operation has set the c flag, the instruction ACI. 56 H will result in :

(1) 8 DH (2) 8 EH (3) 17 H (4) 18 H

27. In standard TTL, 'Totem Pole' stage refers to :

(1) Multi-emitter input stage (2) Phase splitter

(3) Output buffer (4) Open collector output stage

28. An 8085 up based system drives a multiplexed 5-digits, 7-segments display. digits are refreshed at a rate of 500 Hz. The ON time for each digit is :

(1) 4 ms (2) 0.4 ms (3) 10 ms (4) 25 ms

29. Serial input data of 8085 can be loaded into bit 7 of the accumulator by :

(1) Executing RIM instruction (2) Execution of RST-1

(3) Using TRAP (4) None of these

30. A memory system of size 16 k bytes is required to be designed using memory which have 121 address lines and 4 data lines each. Number of such chips requir design the memory system is :

(1) 2 (2) 4 (3) 8 (4) 16

31. Silicon diode is less suited for low voltage rectifier operation, because :

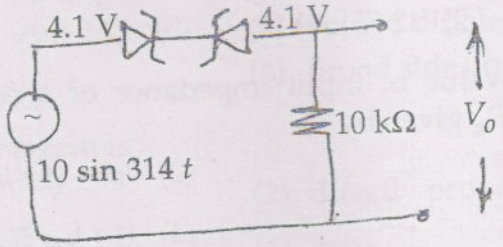
(1) it can withstand high temperature

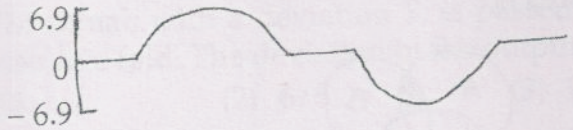
(2) its reverse saturation current is low

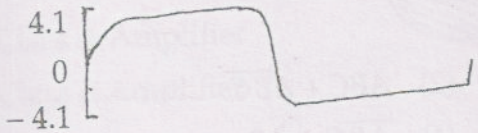
(3) its cut-in voltage is high

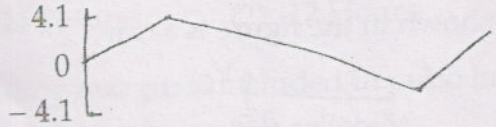
(4) its break down voltage is high

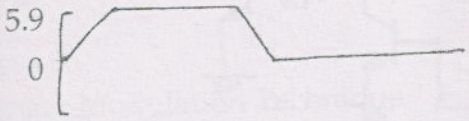
32. The waveshape of V_o in the fig. below will be :



(1) 

(2) 

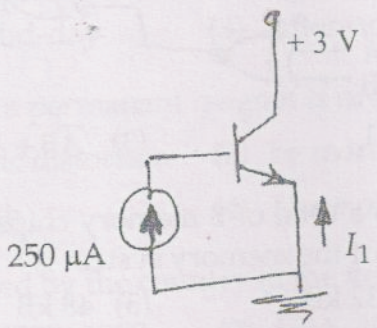
(3) 

(4) 

33. The static characteristics of an adequately forward biased p-n junction is a straight line, if the plot is of :

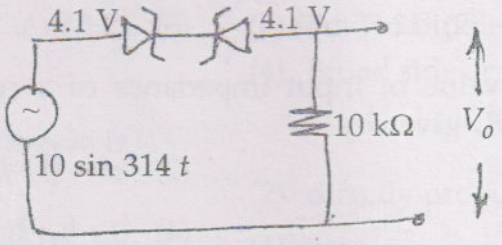
(1) log I v/s log V (2) log I v/s V (3) I v/s log V (4) I v/s V

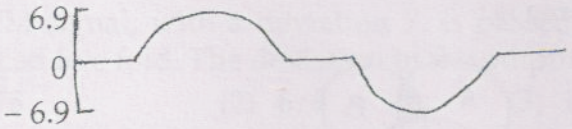
34. For the circuit shown below $\beta_R = .5$ & $\beta_F = 50$. The saturation current is 10^{-16} A. The base emitter voltage is :

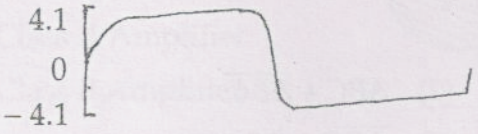


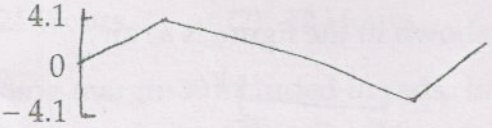
(1) 0.53 V (2) 0.7 V (3) 0.84 V (4) 0.98 V

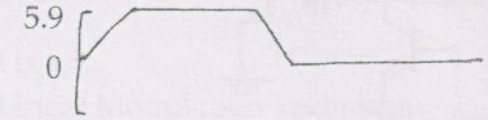
32. The waveshape of V_o in the fig. below will be :



(1) 

(2) 

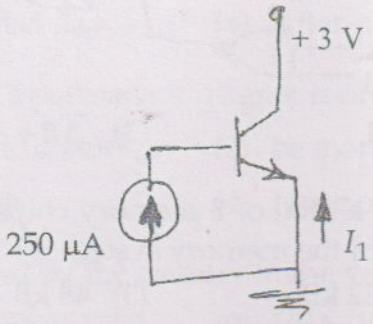
(3) 

(4) 

33. The static characteristics of an adequately forward biased p-n junction is a straight line, if the plot is of :

(1) $\log I$ v/s $\log V$ (2) $\log I$ v/s V (3) I v/s $\log V$ (4) I v/s V

34. For the circuit shown below $\beta_R = .5$ & $\beta_F = 50$. The saturation current is 10^{-16} A. The base emitter voltage is :



(1) 0.53 V (2) 0.7 V (3) 0.84 V (4) 0.98 V

35. In the above problem current I_1 is :

(1) -12.75 mA (2) 12.75 mA (3) 12.5 mA (4) -12.5 mA

36. The approximate value of input impedance of a common emitter amplifier with emitter resistance R_e given by :

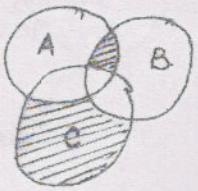
(1) $hie + A_I R_e$

(2) $hie + (1 + h_{fe})R_e$

(3) hie

(4) $(1 + h_{fe})R_e$

37. Boolean expression for shaded area is :



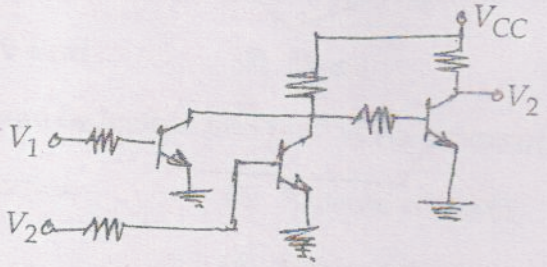
(1) $AB + \overline{BC}$

(2) $ABC + A\overline{BC}$

(3) $AB\overline{C} + \overline{AB}C + \overline{AB}$

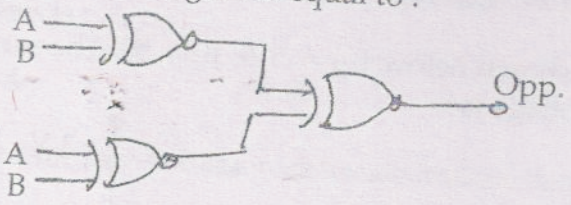
(4) $\overline{AB}C + AB$

38. The circuit of a gate in the RTL family shown in the figure is a/an :



(1) AND gate (2) OR gate (3) NAND gate (4) NOR gate

39. The output of the circuit shown in figure is equal to :



(1) 0 (2) 1 (3) $\overline{A}B + A\overline{B}$ (4) $(\overline{A \times B}) \times (\overline{A \times B})$

40. The memory system has a total of 8 memory chips, each with 12 address lines and data lines. The total size of the memory system is :

(1) 6 kB (2) 32 kB (3) 48 kB (4) 64 kB

41. One of the following consisting of non-resonant antenna :
(1) Rohmbic
(2) Folded dipole
(3) End fire array
(4) Broad side array

42. In feedback amplifier the gain is :
(1) independent of β
(2) directly proportional to β
(3) inversely proportional to β
(4) zero

43. An FM signal, with a deviation S, is passed through a miner and has its frequency reduced five fold. The deviation in the output of the mixer is :
(1) 5δ (2) 6/5 (3) in terminate (4) δ

44. Harmonic generators use :
(1) Class *A* Amplifier
(2) Class *AB* Amplifier
(3) Class *B* Amplifier
(4) Class C Amplifier

45. Synchronous satellites orbit the earth once in :
(1) 24 Hours (2) 12 Hours (3) 6 Hours (4) 1 Hour

46. A fading margin is included in radio link design to :
(1) improve the system reliability
(2) reduce the required transmitter power
(3) Both
(4) None

47. PPM is a :
(1) Linear Modulation Technique
(2) Analogue Modulation Technique
(3) Digital Modulation Technique
(4) Discrete Modulation Technique

48. A superhetrodyne receiver with an IF of 450 kHz is tuned to signal of 1200 kHz, the image frequency is :
(1) 750 kHz (2) 1500 kHz (3) 2250 kHz (4) 2100 kHz

49. On a clear day the atmoshpheric noise is strongest during :
(1) Morning Hours (2) Mid-day (3) After-noon (4) Nights

50. A telephone receiver uses a permanent magnet is order to :
(1) avoid second harmonic distortion
(2) be more sensitive
(3) give a large bandwidth
(4) None of the above

51. "SPUTNIK-1" was launched by the country in the year :
(1) USA, 1957 (2) USSR, 1957 (3) USA, 1959 (4) USSR, 1959

52. The power gain of a horn antenna of square aperture. Let the dimension of each side be 4λ :
(1) 208.49 (2) 200.96 (3) 194.35 (4) 190.46

53. How many stations are spread over India for Indian Doordarshan ?
(1) 600 (2) 700 (3) 800 (4) 1000

54. Which shift keying technique is used in wireless/mobile communication ?
(1) PSK (2) BPSK (3) MSK (4) QPSK

55. For $\varepsilon_b/N_o = 7$ dB in case of 16 QAM modulation scheme, calculate the error probability :
(1) 4.4×10^{-2} (2) 2.4×10^{-4} (3) 4.4×10^{-4} (4) 2.4×10^{-2}

56. Which *one* is the error correction code ?
(1) Gold code (2) Golay code
(3) Convolution code (4) Binary code

57. VSAT stands for :
(1) Very Small Area Terminal (2) Very Small Aperture Terminal
(3) Very Small Area Tropical (4) Very Small Aperture Tropical

58. The noise temperature of a 6 GHz reciever system having the following gains and noise temperatures :
$T_{in} = 75k$ $T_{rf} = 75k$, $T_m = 400k$, $T_{if} = 1000k$, $G_{xf} = 23$ dB, $G_m = 0$ dB, $G_{if} = 35$ dB.
(1) 150 K (2) 153 K (3) 155 K (4) 157 K

59. Which *one* is analog multiple access technique in satellite communication ?
(1) TDMA (2) FDMA
(3) CDMA (4) Multi Carrier CDMA

60. Input impedance of an circuited loss line of length λ is :
(1) infinity (2) finite capacitive reactance
(3) finite inductive reactance (4) None of the above

61. The units of pulse dispersion in optical fibre is :
(1) ns/km . nm (2) ns/km (3) ns (4) None of the above

62. 1 μW power corresponds to :
(1) -10 dB (2) -20 dB (3) -30 dB (4) -40 dB

63. The process of combining text with symbols is called :

(1) Mark up (2) Combination (3) Lineup (4) Mixing

64. What does PBX stands for ?

(1) Private Branch Telephone (2) Public Branch Exchange

(3) Private Branch Exchange (4) Private Box Exchange

65. Computers, printers or cash registers are examples of types of :

(1) DCE (2) *Mux* (3) DTE (4) Code sets

66. Which organization is responsible for creating OSI ?

(1) ITU (2) ISO (3) IBM (4) IEEE

67. The range over which an optical source emits light is known as :

(1) Line width (2) Beam width (3) Band width (4) HPBW

68. For the system $X = \begin{bmatrix} 2 & 0 \\ 0 & 4 \end{bmatrix} X + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u$; $y[40]X$ with u as unit impulse and with zero initial state, the output, y, becomes :

(1) $2e^{2t}$ (2) $4e^{2t}$ (3) $2e^{4t}$ (4) $4e^{4t}$

69. When compression parameter, μ is 285 minimum signal to noise ratio required as 50 dB, 1024 quantizing levels, then L is :

(1) 1002 (2) 1008 (3) 1006 (4) 1012

70. The blind speed of the MTI radar can be avoided by changing the :

(1) carrier frequency (2) pulse repetition frequency

(3) antenna rotation rate (4) transmitted power

71. A Silica fibre has measured losses of 1.5 dB/km at 1.3 μm and 0.5 dB/km at 1.5 μm. If a total fibre loss of 20 dB can be tolerated in a single link then determine appropriate repeater spacing for operation at 1.3 μm :

(1) 8.4 km (2) 13.3 km (3) 15.7 km (4) None of these

72. How many times is the value of $\frac{a}{\lambda}$ is approximately larger for parabolic refractive index profile single mode fibre than for a single mode step index fibre ?

(1) 1.4 (2) 2.4 (3) 2.8 (4) 3.8

73. If the value of critical angle is 73.2° and refractive index of first medium is 1.52. Determine the refractive index of the another medium :
(1) 2.12 (2) 1.98 (3) 1.56 (4) 1.46

74. Which one is TEM mode of propagation of light ?
(1) $E = E_t, E_z = 0, E_z \neq 0$ (2) $H = H_t, E_z = 0, E_z = 0$
(3) $E = E_t, H = H_t, E_z = 0, H_z = 0$ (4) $E = E_t, H = H_t, E_z \neq 0, H_z = 0$

75. What is the ratio of stimulated emission rate to the spontaneous emission rate of an incandescent lamp operating at wavelength of 1.5 μm and at a temperature of 900 K :
(1) 3.21×10^{-3} (2) 3.21×10^{-5} (3) 2.31×10^{-3} (4) 2.31×10^{-5}

76. Photons of energy 4.5×10^{-21} J are incident on InGaAs photodiode having responsivity 0.9 A/W. If the optical power level is 20 μW, then find the value of photo current generated :
(1) 10 μA (2) 10 mA (3) 15 μA (4) 18 μA

77. Which of the following photodetectors has the fastest response time for fibre optic link ?
(1) Photo transistor (2) Light dependent resistor
(3) PIN diode (4) Photodiode

78. The configuration utilized by a line communication system capable of transmitting data at a rate of 100 mbps is :
(1) co-axial cable (2) open wire line system
(3) optical fibre system (4) twisted wire system

79. The colour of LED can be changed by :
(1) changing the doping level of semiconductors
(2) using different band gap semiconductors
(3) increasing the applied voltage
(4) None of the above

80. Assuming a Gaussian frequency response, the 3 dB optical bandwidth for an LED corresponding to a 3 dB electrical bandwidth of 50 MHz will be:
(1) 25 MHz (2) 70.7 MHz (3) 100 MHz (4) 50 MHz

81. If the cell-site antenna height is doubled, there will be :
(1) an increase in propagation path loss by 6 dB
(2) reduction in path loss by 6 dB
(3) reduction in path loss by 12 dB
(4) no change in path loss

82. Ultra Wide Band technology is used primarily for :
(1) connecting wireless devices inside a home at very high speeds
(2) displaying web pages on a cellular phone
(3) transmitting data at distance upto 56 km
(4) finding a location of a vehicle within a small city

83. For a cluster of size 7, the carrier-to- interference ratio C/I is approximately :
(1) 73.5 (2) 147 (3) 1.5 (4) 7

84. The minimum separation between a transmitter antenna and a receiving antenna at the cell site must be ensured in order to avoid :
(1) co-channel interference (2) adjacent channel interference
(3) intermodulation (4) received desensitization

85. The total number of channels available in extended spectrum US-AMPS cellular standard are :
(1) 312 (2) 416 (3) 666 (4) 832

86. The distributed dynamic channel assignments scheme is primarily based on :
(1) Frequency sense distance (2) C/I ratio
(3) Signal to noise ratio (4) Either (1) or (2) or (3)

87. Throughput of a pure ALOHA system is given by :
(1) $\lambda e^{-2\lambda T}$ (2) $\lambda e^{-\lambda T}$ (3) $(1/\lambda) e^{-2\lambda T}$ (4) $(1/\lambda) e^{2\lambda T}$

88. The channel bandwidth in USDC/IS-54 cellular standard is :
(1) 10 kHz (2) 25 kHz (3) 30 kHz (4) 200 kHz

89. The ε_b/N_o is usually of what value which depends on the speed of the mobile user, propagation conditions, the diversity scheme used in CDMA systems :
(1) 6 dB (2) 9 dB (3) 12 dB (4) 18 dB

90. In closed loop power control, the base station sends power control messages to the mobile user about once every :
(1) one millisecond (2) ten millisecond
(3) hundred millisecond (4) one second

91. A non-anticipative system is a :
(1) Static system (2) Dynamic system
(3) Causal system (4) Both (2) and (3)

92. The signal $\alpha^n u(n)$ is an energy signal if :
(1) $|\alpha|<1$ (2) $|\alpha|>1$ (3) $|\alpha|=1$ (4) $|\alpha|=0$

93. The autocorrelation of $x(n)=\{2,1\}$ is :
(1) $\{2,5,2\}$ (2) $\{4,4,1\}$ (3) $\{2,1\}$ (4) $\{2,1,2,1\}$

94. Which sequence ***cannot*** be the inverse Z – transform of $\left\{\frac{1}{1-3Z^{-1}}-\frac{1}{1-4Z^{-1}}\right\}$.
(1) $3^n u(n)-4^n u(n)$
(2) $-3^n u(-n-1)+4^n u(n-1)$
(3) $3^n u(n)+4^n u(-n-1)$
(4) $-3^n u(-n-1)-4^n u(n)$

95. The FT of a discrete time signal is periodic with period :
(1) 2π (2) $\Uparrow$ (3) ∞ (4) Finite

96. FT of $2^n u(n)$ is :
(1) $\frac{1}{1-2e^{-jw}}$ (2) $\frac{1}{1-2e^{jw}}$ (3) $\frac{1}{1+2e^{jw}}$ (4) Does not exist

97. The DTFT is the transform evaluated along the :
(1) Imaginary axis of Z-plane
(2) Real axis of Z-plane
(3) Unit circle in Z-plane
(4) Entire Z-plane

98. The DFT of a real signal is $X(k)=\{1,2-j,2,2+j\}$. What is its signal energy ?
(1) 15 (2) 7 (3) 12 (4) not defined

99. For the number of stages in the computation of DFT by radix-2 FFT to be 8, how many samples must $x(n)$ have :
(1) 256 (2) 128 (3) 512 (4) 8

100. Butter worth filters have :
(1) Wideband transition region
(2) Sharp transition region
(3) Oscillation in the transition region
(4) None of the above