ENTRANCE EXAMINATION FOR ADMISSION, MAY 2011.
Ph.D. (ELECTRONICS AND COMMUNICATION ENGINEERING)
COURSE CODE : 138

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 138

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 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. If $\varepsilon_r = 2$ for a dielectric medium, its electric susceptibility is

(A) 1 (B) 2 (C) 3 (D) $2\ \varepsilon_0$

2. The magnetic field in an ideal conductor is

(A) Zero (B) Infinite

(C) Finite (D) The same as its outside field

3. The intrinsic impedance of the medium whose $\sigma = 0, \varepsilon_r = 9$ and $\mu r = 1$ is

(A) $40\pi\Omega$ (B) $9\ \Omega$ (C) $120\ \pi\Omega$ (D) $60\ \pi\Omega$

4. The wavelength of a wave with a propagation constant $0.1\ \pi + j\ 0.2\ \pi$ is

(A) 10 m (B) 20 m (C) 30 m (D) 25 m

5. By far ———— polarization is used for high frequency applications

(A) Linear (B) Circular (C) Elliptical (D) Horizontal

6. A ship sailing at a radial speed of 10 m/s towards an HF radar operating at 3 MHz would produce a Doppler shift of

(A) 0.1 Hz (B) 0.2 Hz (C) 1 Hz (D) 2 KHz

7. A pulse compression radar is operating with expanded and compressed pulse widths of 5μS and 100nS respectively. Its range resolution is

(A) 15 m (B) 150 m (C) 1.5 Km (D) 75 m

8. If the target cross-section is rapidly changing the best choice for accurate tracking is

(A) Monopulse tracking (B) Conical scan tracking

(C) Lobe switching (D) Sequential lobing

9. A radar in which the radar beam is steered electronically is

(A) Tracking radar (B) MTI radar

(C) Phase array radar (D) SAR

10. A SAR operating at 10GHz uses an antenna whose effective aperture is 5m. Its cross-range resolution would be

(A) 2.5 m (B) 5 m (C) 10 m (D) 15 m

11. A basis vector for a vector space V may be defined as a set of vectors in V which

(A) are mutually orthogonal

(B) are linearly independent

(C) span the space V

(D) are linearly independent and span the space V

12. The value of $\int_{\pi/4}^{\pi/4} \cos \omega t \, \delta(t) \, dt$ is ———— where $\delta(t)$ denotes

(A) 0 (B) 1 (C) $\pi/4$ (D) $\sqrt{2}$

13. A signal x(t) has energy E. Then the signal x(at), $a>0$, has an amount of energy given by

(A) aE (B) E/a (C) a^2E (D) E/a^2

14. A signal x(t) $5\cos(240\pi t)$ was sampled at a frequency F_s. The signal recovered from the samples was, however, found to be $3\cos(110\pi t)$. The sampling frequency F_s is equal to ———— samples per second.

(A) 175 (B) 350 (C) 130 (D) 65

15. If $X(z) = \frac{z^2}{z^3 - 2z^2 + 1}$ and x(n) is right sided sequence then x(3) is

(A) 0 (B) 2 (C) 4 (D) 1

16. If X(k) is the k-th DFT coefficient of a discrete sequence x(n) of length N whose sampling frequency is F_s then X(k) corresponds to a frequency of

(A) $\frac{kF_s}{N}$ (B) $\frac{kF_s}{2N}$ (C) $\frac{2kF_s}{N}$ (D) $\frac{kF_s}{N-1}$

17. An LTI system has a gain independent of frequency and produces a time-delay of τ seconds for all frequencies. Which of the following statement is true?

(A) It produces phase distortion

(B) Its phase-shift versus frequency relationship is linear

(C) It produces a constant phase-shift for all frequencies

(D) None of the above

18. If x(n) is of finite duration and has N samples, then its autocorrelation $r_{xx}(k)$ will have a duration of ———— samples.

(A) 2N (B) N^2 (C) 2N-1 (D) 2N+1

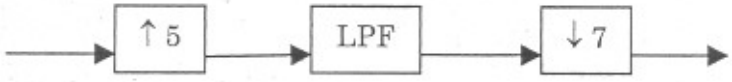
19. The discrete time LTI system described by the difference equation

$y(n) + a_1y(n-1) + a_2y(n-2) = x(n)$ is stable if

(A) $|a_2| < 1$, $|a_1| < 1 + a_2$ (B) $|a_1| < 1$, $|a_2| < 1$

(C) $|a_1| < 1$, $|a_2| < 1 + a_1$ (D) none of these

20. What should be the cut-off frequency of the lowpass filter shown in the following multirate digital signal processing system?



(A) $\pi/5$ (B) $\pi/7$ (C) $\pi/35$ (D) $12\pi/35$

21. The minimum number of multipliers required to realize an FIR filter with system function $H(z) = 1+2\,z^{-1} + (3/2)\,z^{-2} + 5\,z^{-3} + (3/2)z^{-4} + 2z^{-5} + z^{-6}$ is

(A) 7 (B) 4 (C) 8 (D) 3

22. The transform which possess the 'multi-resolution' property is _____ transform.

(A) Fourier (B) Short-time Fourier

(C) Cosine (D) Wavelet

23. For an 8-bit image x(m,n), the transformation y(m,n)=255-x(m,n) will yield

(A) a dark image (B) a bright image

(C) negative of x(m,n) (D) same as x(m,n)

24. The wavelet coefficients of an image after second-level decomposition is shown below:

16	7	12	10
-7	8	8	4
4	-3	4	-3
2	-2	-2	0

The initial threshold required for encoding and decoding of an image using EZW algorithm is

(A) 8 (B) 16 (C) 32 (D) 64

25. An analog signal bandlimited to 10KHz is sampled at Nyquist rate and quantized to 4 levels of a PCM system with probabilities ½ , ¼ , 1/8 and 1/8. The rate of information transmission is

(A) 35000 bits/sec (B) 17500 bits/sec

(C) 52500 bits/sec (D) 70000 bits/sec

26. The length and the Impedance of a quarter wave transformer to match 90 ohms source with 40 ohms load in a dielectric substance of dielectric constant 4 at 3 GHz are

(A) 1.25 cm and 40 ohms (B) 2.5 cm and 40 ohms,

(C) 1.25 cm and 60 Ohms (D) 2.5 cm and 60 ohms

27. TEM wave propagating in y direction has

(A) Ey = Hy =0 (B) Ey=Hy =Non zero

(C) Ey=Hy=1 (D) Ey=0, Hy=1

28. The planar transmission line that supports pure TEM mode is

(A) Stripline (B) Coplanar waveguide

(C) Slot line (D) FIN line

29. The minimum and maximum values of the VSWR is

(A) 0 and infinity (B) 0 and 1

(C) 1 and infinity (D) –infinity and infinity

30. Microstrip line is said to support Quasi TEM mode because

(A) Transverse components of EH are ZERO

(B) Transverse components of EH are NON ZERO

(C) Longitudinal components of EH are zero

(D) None

31. Shorted 1/8 wave length transmission line (lossless) acts as

(A) INDUCTOR (B) CAPACITOR

(C) RESONATOR (D) None

32. S Band of frequency range is

(A) 1-2 GHz (B) 2-4 GHz (C) 4-8 GHz (D) 8-12 GHz

33. 1/8 WAVELENTH transmission line matches

(A) (3 + j4) ohms source to 5 ohms load (B) (3 + j4) ohms source to 3 ohms load

(C) (3 + j4) Ohms source to 4 ohms load (D) None

34. The capacitance with and without a dielectric material inside a planar transmission line are 8 micro farads and 2 microfarads respectively. The effective dielectric constant is

(A) 4 (B) 2 (C) 16 (D) None

35. Conformal mapping technique belongs to

(A) Quasi static Analysis (B) Full wave analysis

(C) Hybrid analysis (D) None

36. If the VSWR is 1 at the input port of a microwave component then

(A) S11 = 0 (B) S11=1

(C) S11 = infinity (D) None

37. S11 of an ideal transformer of turns ration 10 : 1 is

(A) 99/101 (B) 101/99 (C) 9/11 (D) 11/9

38. 'PUSHING' is a phenomenon in

(A) Magnetron (B) TWT (C) Klystron (D) Gunn diode

39. All three ports of an ideal lossless reciprocal waveguide component can be MATCHED

(A) TRUE (B) FALSE

40. A transmission line having the characteristic impedance of 100 ohms is terminated with a load impedance of 150 ohms. The load reflection coefficient is given by

(A) 0.2 (B) 0.5 (C) 0.66 (D) 0.3

41. When a collision is detected in a network using CSMA/CD,

(A) The frame is immediately resent

(B) A jam signal is sent by the station

(C) The backoff value is set to zero

(D) The backoff value is decremented by 1

42. On a network that uses Network address translation, ———— has translation table

(A) Switch (B) Router

(C) Server (D) None of the above

43. Identify the class of IP address 191.1.2.3

(A) class A (B) class B (C) class C (D) class D

44. The simple mail transfer protocol utilizes ———— to send its module to another host

(A) TCP (B) UDP (C) DNS (D) ARP

45. Spread spectrum LAN makes use of ———— frequency range
(A) 5.5 to 5.575 GHz
(B) 18.825 to 19.205 GHZ
(C) 2.4 to 2.48 GHz
(D) 9.25 to 12.25 GHz

46. Access network is running between
(A) end users
(B) routers
(C) routers and gateways
(D) end users and edge routers

47. Datagram mode of transmission ensures
(A) Reliable data transmission
(B) Sequential order transmission
(C) Real time transmission
(D) All of the above

48. In the transmission structure of ISDN the D channel
(A) carries channel signaling information
(B) carries high speed data signals
(C) supporting both control and data signaling
(D) carries only low speed digital signal

49. The basic channel structure of ISDN consists of
(A) Two full duplex 64kbps B channel
(B) Two full duplex 16kbps D channel
(C) One D channel at 64 kbps
(D) 1.55 mbps rate B and D channel

50. The Frame relay transmission is supported in
(A) X.25 network
(B) ATM network
(C) Internet
(D) System network architecture SNA

51. ATM adaptation layer type 2 supports
(A) constant bit rate services
(B) variable bit rate services
(C) both (A) and (B)
(D) reduced transmission overhead services

52. The SDH level 4 supports ———— bit rate
(A) 155.52 Mbps
(B) 34.368 Mbps
(C) 622.080 Mbps
(D) 1.544 Mbps

53. The world wide standard for the digital transmission network is
(A) Plesiochronous digital hierarchy
(B) Synchronous digital hierarchy
(C) Synchronous optical network
(D) None of the above

54. The IGMP protocol is used in
(A) Error reporting
(B) Multicast routing
(C) Address resolution
(D) Congestion and flow control

55. An example for hash function is

(A) message digest (B) checksum

(C) cyclic redundancy checks (D) all of the above

56. A bridge has access to the ———— address of a station on the same network

(A) network (B) physical

(C) router (D) none of the above

57. ———— is the collection of protocols that provide security at the IP layer level

(A) TLS (B) SSH (C) PGP (D) Ipsec

58. A method to provide for the secure transport of email is called

(A) TLS (B) SA (C) PGP (D) Ipsec

59. ———— is the control protocol that adds functionalities to the streaming process

(A) RTSP (B) HTTP (C) TCP/IP (D) SIP

60. A DNS response is classified as ———— if the information comes from a cache memory

(A) authoritative (B) unauthoritative

(C) iterative (D) recursive

61. An antenna of impedance 45-j10 Ω is directly connected to a 50 Ω transmission line. The matching efficiency is

(A) 90 % (B) 100 % (C) 98.6 % (D) 92 %

62. A power of 100W is radiated from an isotropic radiator. The power radiated per unit solid angle and power density at a distance of 10 km from the antenna are respectively

(A) 25 W, 10 W (B) $25/\pi$ W, $25/100\ \pi$ W

(C) 7.96 W, 0.08 μW (D) 0.08 μ W, 7.96 W

63. An antenna is to be used from 60 to 65 Hz. Its length has been cut for 60 Hz. The tuning element needed is

(A) An adjustable capacitor (B) An adjustable inductor

(C) A variable resistor (D) Any of the above

64. The input impedance of an end fed Hertz antenna is

(A) 1000 Ω (B) 73 Ω

(C) Depends on length (D) 300 Ω

65. Two isotropic antennas are separated by a distance of two wavelengths. If both antennas are fed with currents of equal phase and magnitude, the number of lobes in the radiation pattern in the horizontal plane is

(A) 2 (B) 4 (C) 6 (D) 8

66. A TV transmitting aerial is fixed on top of a 150m tower located on a mountain of 1200m high. The range of the transmitter in Km is

(A) 152 (B) 51 (C) 0.152 (D) 0.051

67. An antenna has again of 40 dB at a frequency of 300MHz. The effective area of the antenna in m^2 is

(A) 796 (B) 10^4 (C) 2500 (D) 3183

68. A low frequency transmitting antenna has a radiation resistance of 0.2 Ω and a loss resistance of 1 Ω. If the current fed into antenna is 50A the radiated power in W is

(A) 500 (B) 2500 (C) 3000 (D) 10

69. In a step inex fiber, what is the cut-off frequency of the LP_{11} mode?

(A) 0.0 (B) 2.405 (C) 3.832 (D) 5.520

70. Two single mode fibers with MFDs of 10μm and 9μm are spliced. What is the splice loss in dB?

(A) 0.048 (B) 0.24 (C) 1 (D) 3

71. With an OTDR, it is possible to know

(A) The location dependence of attenuation (B) The overall link length
(C) Splice and connector losses (D) All of the above

72. The material for making an efficient LED should be

(A) An indirect BandGap semiconductor (B) A direct BandGap semiconductor
(C) A metal (D) An insulator

73. The highest wavelength that silicon can absorb is 1.12μm. What is the approximate bandgap of Si?

(A) 1.1 eV (B) 1.4 eV (C) 1.7 eV (D) 2.3 eV

74. Which wavelength is most suitable for pumping an EDFA?

(A) 0.85μm (B) 0.98 μm (C) 1.30 μm (D) 1.55 μm

75. Which of the following process is used to compensate for the GVD-induced dispersion in a Soliton?

(A) FWM (B) SPM
(C) CPM (D) All of the above

76. Silicon diodes are preferred to germanium diodes for high temperature operation because

(A) Doping of silicon is a simple process

(B) Rate of increase of reverse saturation current with temperature is more in the case of silicon

(C) The reverse saturation current of silicon diodes is smaller than that of germanium

(D) Silicon diodes can be used to rectify even very small voltages.

77. The frequency of ripple in the output voltage of a 3Φ half controlled bridge rectifier depends on the

(A) Firing angle (B) Load inductance

(C) Load resistance (D) Supply frequency

78. The switching speed of a P-N junction having a heavily doped P region depends primarily on

(A) The mobility of minority carriers in the P region

(B) The lifetime of minority carriers in the P region

(C) The mobility of majority carriers in the N region

(D) The lifetime of minority carriers in the N region

79. Due to illumination by light, the electron and hole concentrations in a heavily doped n type semi-conductor increase by Δn and Δp respectively. If n_i is the intrinsic concentration, then

(A) $\Delta n < \Delta p$ (B) $\Delta n > \Delta p$

(C) $\Delta n = \Delta p$ (D) $\Delta n \times \Delta p = n_i^2$

80. When a reverse bias is applied to the Gate of JFET the depletion region width

(A) Is uniform in the channel

(B) Is wider near the source and tapers near the drain

(C) Is wider near the drain and tapers near the source

(D) Is nil

81. The temperature of a silicon transistor is increased from -55°C to 175°C. Then

(A) I_{co} increases, β decreases, V_{BE} decreases

(B) I_{co} decreases, β decreases, V_{BE} decreases

(C) I_{co} increases, β increases, V_{BE} increases

(D) I_{co} increases, β increases, V_{BE} decreases

82. In a class B push-pull amplifier Vcc=25 volts pek voltage output amplitude Vm= 16 volts; R_L = 8 ohms. The dc power Pdc supplied is given by

(A) 10 watts (B) 16 watts (C) 20 watts (D) 32 watts

83. A CE amplifier with un bypassed emitter resistor R_E = 0.1 K ohms has a collector load Rc = 5 K ohms hfe=99 and hie = 1 K ohm. The best estimate for Av is given by
(A) 45 (B) 50 (C) 99 (D) 495

84. An amplifier with midband gain A = 500 has a negative feedback applied of value β = 1/100. Given the upper cut-off without feedback was 60 KHz, with feedback it becomes
(A) 10 KHz (B) 12 KHz (C) 300 KHz (D) 360 KHz

85. A miller integrator has an aiming potential of 30 volts. The sweep voltage at the output is 10 volts. The open loop gain of the OP amplifier is 104. The percentage sweep error is then
(A) 1/3 (B) 3/100 (C) 1/300 (D) 3/300

86. A certain JK FF has propagation delay of 12ns. The largest MOD counter that can be constructed from these FFs and still operate upto 10MHz is
(A) Any (B) 8 (C) 256 (D) 10

87. With which decoder is it possible to obtain many code conversions?
(A) 2 line to 4 line (B) 3 line to 8 line
(C) Not possible with any decoder (D) 4 line to 16 line decoder

88. How many microseconds it will take to transfer an 8-bit data into a serial-in, parallel out shift register if the clock frequency is 5 MHz?
(A) 0.2 (B) 5 (C) 1.6 (D) 3.2

89. The difference between PLA and ROM is
(A) PLA is a combinational circuit, ROM is a sequential circuit
(B) ROM is a combinational circuit, PLA is a sequential circuit
(C) PLA economises on the number of min-terms
(D) ROM economises on the memory

90. The translator programme that converts source code into machine code line by line is called
(A) Assembler (B) Compiler (C) Loader (D) Interpreter

91. A 10 bit resistive divider is constructed such that the current through the LSB resistor is 100 μA. The maximum current that will flow through the MSB resistor in mA is
(A) 0.2 (B) 1 (C) 51.2 (D) 102.4

92. For a certain 4 bit successive approximation A/D converter, the maximum ladder output is +8V. If a constant +6 V is applied to the analog input the sequence of binary states is
(A) 1111 (B) 1010 (C) 0110 (D) 1011

93. The initial state of MOD-16 down converter is 0110. What state will it be after 37 clock pulses?
(A) Indeterminate (B) 0110 (C) 0101 (D) 0001

94. A 10MHZ square wave clocks a 5 bit ripple counter. The frequency of the 3rd FF's output in MHz is
(A) 2 (B) 1.25 (C) 50 (D) 0.615

95. In FF clocking
(A) Hold time is greater than set up time
(B) Set up time is greater than hold time
(C) Hold time is before edge triggering
(D) Set up time is after edge triggering

96. Among the logic families, the family which can be used at very high frequencies greater than 100MHz in a 4 bit synchronous counter is
(A) TTLAS (B) CMOS (C) ECL (D) TTLLS

97. Among the following gates, the one to be operated under high noise condition is
(A) ECL (B) Zener TL (C) I^2L (D) TTL

98. In register index addressing mode the effective address is given by
(A) The index register value
(B) The sum of the index register value and the operand
(C) The operand
(D) The difference of the index register value and the operand

99. For a μP system using IO mapped IO the following statement is not true
(A) Memory space available is greater
(B) Not all data transfer instructions are available
(C) IO and memory spaces are distinct
(D) IO address space is greater

100. PCHL is useful in implementing
(A) If then else construct (B) While construct
(C) Case construct (D) Call construct
