ENTRANCE EXAMINATION FOR ADMISSION, MAY 2012.

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. Radar range primarily depends upon
   (A) Peak transmitted power
   (B) Average transmitted power
   (C) Square of transmitted power
   (D) Independent of transmitted power

2. One method of solving 'blind speed' problems is to
   (A) use a variable PRT
   (B) change Doppler frequency
   (C) use digital MTI
   (D) use short wavelength

3. The type of modulation scheme used in Iridium system is
   (A) 16-PSK (B) BPSK (C) QAM (D) QPSK

4. Earth station figure-of-merit is defined as
   (A) 10 log(G/T) (B) 10 Ln(G/T) (C) 10 log (GT) (D) 20 log(G/T)

5. When the orbit eccentricity(e) equals zero, the orbit is
   (A) A parabola (B) Circular (C) A hyperbola (D) Elliptical

6. Satellite capacity depends on
   (A) Weight that can be placed in orbit
   (B) Panel area available for energy dissipation
   (C) Transmitter power
   (D) All the above

7. Synchronous satellites orbit the earth once in
   (A) 1 hour (B) 24 hours (C) 10 hours (D) 365 days

8. When r is the radius of circular orbit of a satellite, then orbital period of the satellite is proportional to
   (A) r
   (B) r^2
   (C) $r^{3/2}$
   (D) r^3

9. Which of the following diode is used as detector in radar?
   (A) Gunn diode
   (B) Schottky diode
   (C) Zener diode
   (D) IMPATT diode

10. The resolution of a pulsed radar can be improved by
   (A) decreasing pulse width
   (B) increasing pulse width
   (C) increasing the pulse amplitude
   (D) decreasing the pulse repetition frequency

11. Which of the following is not limitation of AMPS?
(A) limited spectrum
(B) poor privacy protection
(C) low calling capacity
(D) wide coverage area

12. The type of handoff used in CDMA (IS-95) system
(A) Soft handoff
(B) Hard handoff
(C) Fast handoff
(D) Seamless handoff

13. The access method used in DECT system is
(A) FDMA/TDD
(B) TDMA/TDD
(C) FDMA/FDD
(D) TDMA/FDD

14. Larger cells are more useful in
(A) densely populated urban areas
(B) lightly populated urban areas
(C) rural areas
(D) mountain areas

15. The modulation scheme used in GSM system
(A) QPSK
(B) QAM
(C) GMSK
(D) FSK

16. If the bandwidth of the signal is lesser than the bandwidth of the channel, then the type of fading is
(A) Fast fading
(B) Flat fading
(C) Slow fading
(D) None of the above

17. Hata model is valid from
(A) 1500MHz to 2000MHz
(B) 150MHz to 1920 MHz
(C) 150MHz to 1500MHz
(D) None of the above

18. Which of the outdoor model is known as ITS irregular terrain model?
(A) Okumura model
(B) Hata model
(C) PCS model
(D) Longley Rice model

19. The other name for Antenna diversity
(A) Frequency diversity
(B) Space diversity
(C) Time diversity
(D) Hybrid diversity

20. A baud is a unit of
(A) Channel capacity
(B) Information
(C) Signaling speed
(D) None of the above

21. Which of the following material is having the highest refractive index?

(A) diamond (B) air

(C) water (D) glass

22. Optical core can be satisfactorily operated if

(A) RI of the core is lesser than that of cladding

(B) RI of the core is greater than that of cladding

(C) RI of the core is equal to that of cladding

(D) None of the above

23. Function of receiver in optical fibre is to

(A) reshape the degraded signal only

(B) only amplify the degraded signal

(C) both amplify and reshape of the degraded signal

(D) none of the above

24. Total internal reflections can take place when light travels from

(A) Air to glass (B) Water to glass

(C) Air to water (D) Diamond to glass

25. The color of a LED can be changed by

(A) Using different band gap semiconductor

(B) Changing the doping level of semiconductor

(C) Increasing applied voltage

(D) None of the above

26. Which of the following device is more sensitive?

(A) PIN diode (B) APD

(C) Neither (A) or (B) (D) Either (A) or (B)

27. Which of the following is not applicable for LASER?

(A) Provision for confinement (B) Higher emission efficiency

(C) No tuning arrangement (D) Narrow spectral width

28. Loss in fibre is not due to

(A) Impurities (B) Micro bending

(C) Attenuation in fibre (D) Stepped index operation

29. The cable that offers lowest dispersion is
(A) SMSI
(B) MMGI
(C) MMSI
(D) None of the above

30. Q-switched LASER is
(A) Continuous LASER
(B) Short burst LASER
(C) LASER produced by switching operation
(D) Low powered laser

31. In a receiver the input signal is 100 μV, while the internal noise at the input is 10 μV. With amplification the output signal is 2 V, while the output noise is 0.4 V. The noise figure of receiver is
(A) 2
(B) 0.5
(C) 0.2
(D) None of the above

32. A receiver is operated at a temperature of 300 K. The transistor used in the receiver have an average output resistance of 1 kΩ. The Johnson noise voltage for a receiver with a bandwidth of 200 kHz is
(A) 1.8 ΩV
(B) 8.4 ΩV
(C) 4.3 ΩV
(D) 12.6 ΩV

33. A speech signal has a total duration of 20 Sec. It is sampled at the rate of 8 kHz and then PCM encoded. The signal-to-quantization noise ratio is required to be 40 dB. The minimum storage capacity needed to accommodate this signal is
(A) 1.12 KBytes
(B) 140 KBytes
(C) 168 KBytes
(D) None of the above

34. In a PCM system, if the code word length is increased from 6 to 8 bits, the signal to quantization noise ratio improves by the factor.
(A) 8/6
(B) 12
(C) 16
(D) 8

35. A slow FH/MFSK system has the following parameters Number of bits per MFSK symbol = 4. Number of MFSK symbol per hop = 5. The processing gain of the system is
(A) 13.4 dB
(B) 37.8 dB
(C) 6 dB
(D) 26 dB

36. A transmitting antenna with a 300 MHz carrier frequency produces 2 kW of power. If both antennas has unity power gain, the power received by another antenna at a distance of 1 km is
(A) 11.8 mW
(B) 18.4m W
(C) 8.4 μW
(D) 12.7 μW

37. The radiation resistance of an antenna is 63 Ω and loss resistance 7Ω. If antenna has power gain of 16, then directivity is

(A) 48.26 dB (B) 12.5 dB

(C) 38.96 dB (D) 24.7 dB

38. An antenna is desired to operate on a frequency of 40 MHz whose quality factor is 50. The bandwidth of antenna is

(A) 5.03 MHz (B) 800 kHz

(C) 127 kHz (D) None of the above

39. A thin dipole antenna is $\lambda/15$ long. If its loss resistance is 1.2 Ω, the efficiency is

(A) 41.1% (B) 59%

(C) 74.5% (D) 25.5%

40. The air filled cavity resonator has dimension a = 3 cm, b = 2 cm, c = 4 cm. The resonant frequency for the TM_{110} mode is

(A) 5 GHz (B) 6.4 GHz

(C) 16.2 GHz (D) 9 GHz

41. Ionospheric preparation is not possible for microwaves because :

(A) Microwave will be fully absorbed by the Ionospheric layers

(B) These will be an abrupt scattering in all directions

(C) Microwaves will penetrate through the Ionospheric layers

(D) There will be dispersion of microwave energy

42. A waveguide section in a microwave circuit will act as a

(A) Low pass filter (B) Band pass filter

(C) High pass filter (D) Band Stop filter

43. Which one of the following is a transferred electron devices?

(A) BARITT diode (B) IMPATT diode

(C) Gunn diode (D) Step recovery diode

44. In a microwave test bench, why is the microwave signal amplitude modulated at 1 kHz?

(A) To increase the sensitivity of measurement

(B) To transmit the signal to a far-off place

(C) To study amplitude modulation

(D) Because crystal detector fails at microwave frequencies

45. 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 the input end is

(A) 920 ns (B) 460 ns

(C) 230 ns (D) 430 ns

46. A film integrated circuit is

(A) MMIC (B) HIC

(C) Not useful at microwave frequency (D) Direct circuit

47. Substrate material in MMIC is

(A) Glass (B) Cu

(C) Gold (D) SiO

48. Conductor material in MMIC is

(A) Alumina (B) Ag

(C) GaAs (D) SiO

49. Diffusion is

(A) The same as evaporation (B) Epitaxial growth

(C) Adding dopants (D) A method of lithography

50. Lithography is

(A) The process of deposition

(B) The process of evaporation

(C) The process of transferring patterns of geometric shapes

(D) The process of etching

51. A 2 kW carrier is to be modulated to a 90% level. The total transmitted power would be

(A) 3.62 kW (B) 2.81 kW

(C) 1.4 kW (D) None of the above

52. A modulating signal is amplified by a 80% efficiency amplifier before being combined with a 20 kW carrier to generate an AM signal. The required DC input power to the amplifier, for the system to operate at 100% modulation, would be

(A) 5 kW (b) 8.46 kW (C) 12.5 kW (D) 6.25 kW

53. If the modulation index of an AM wave is changed from 0 to 1, the transmitted power

(A) increases by 50% (B) increases by 75%

(C) increases by 100% (D) remains unaffected

54. An AM signal is detected using an envelope detector. The carrier frequency and modulating signal frequency are 1 MHz and 2 kHz respectively. An appropriate value for the time constant of the envelope detector is

(A) 500 μ Sec (b) 20 μ Sec (C) 0.2 μ Sec (D) 1 μ sec

55. For an AM signal, the bandwidth is 10 kHz and the highest frequency component present is 705 kHz. The carrier frequency used for this AM signal is

(A) 695 kHz (B) 700 kHz (C) 705 kHz (D) 710 kHz

56. Circularly polarized antenna is

(A) Parabolic dish (B) Dipole (C) Yagi-uda (D) Helical

57. Antenna efficiency is

(A) g_p/g_d (B) g_d/g_p (C) g_p (D) g_d

58. Antenna radiation efficiency is high when its length is

(A) λ (B) $\lambda/2$ (C) $\lambda/4$ (D) $\lambda/8$

59. For a 100 Ω antenna with 2 A of current, the radiated power is

(A) 400 W (B) 200 W (C) 50 W (D) 25 W

60. Half wave beamwidth of optimum flare horn in E-plane is

(A) $56\lambda/d_E$ (B) $28\lambda/d_E$ (C) $122\lambda/d_E$ (D) 112°

61. If the impedance of a transmission line is 1.119 μH/m and the capacitance is 12.3 PF/m, the time required for the wave to travel 1 m length of the line is

(A) 0.371 nm (B) 0.0371 ms (C) 3.71 ns (D) 3.71 ms

62. Magic Tee is used as

(A) An amplifier (B) An oscillator (C) Mixer (D) A filter

63. H-plane Tee junction

(A) S13 = S23 (B) S31 = S23 (C) S33 = 0 (D) S12 = S22

64. For a reciprocity network

(A) $S_{jj} = S_{ii}$ (B) $S_{ij} = S_{ji}$ (C) $S_{ii} = S_{jj}$ (D) $S_{ji} = S_{ii}$

65. The electron velocity in reflex klystron is

(A) $\sqrt{2e/m^{\frac{1}{v_b}}}$ (B) $\sqrt{2e/mv_b}$ (C) $\sqrt{2m/ev_b}$ (D) $\sqrt{1/2e/mv_b}$

66. Wavelength of Microstrip line is

(A) $V_0/\sqrt{\varepsilon_{reff}}$ (B) $\lambda_0/\sqrt{\varepsilon_r}$ (C) $V_o/\sqrt{\varepsilon_r}$ (D) V_0/f

67. Round wire inductor has 1 = 100 mils, d = 10 mils and its inductance is

(A) 2.451 nH/mil (B) 1.366 nH/mil (C) 1000 mH/mil (D) 10 nH/mil

68. The dimensions of the parameters of a gold planar resistor are 1 = 11 m, d = 0.2 μm, w = 8 mm and its resistance is

(A) 1.68 Ω (B) 0.234 Ω (C) 0.168 Ω (D) 0.0168 Ω

69. Microstrip line invented by

(A) Barrett (B) Barnes (C) Engelmann (D) Wen

70. Important plat forms for RFMEMS is

(A) Coaxial line (B) Two wire line

(C) Planar line (D) Parallel plate line

71. The distribution function of a random variable is obtained by ———— the probability density function.

(A) Differentiation (B) Integration (C) Multiplication (D) Division

72. A probability function is given by $p(0) = 0.3164$, $p(1) = 0.4219$, $p(2) = 0.2109$, $p(3) = 0.0469$ and $p(4) = 0.0039$. Find its mean and variance.

(A) 1.000, 0.750 (B) 1.500, 3.250

(C) 1.000, 0.500 (D) None of the above

73. Let 'E' bean event and let E^C be its complement. If P(E) = 1/3, then

(A) $P(E^c) = 1/3$ (B) $P(E^c) = 5/6$ (C) $P(E^c) = 2/3$ (D) $P(E^c) = 1/6$

74. Let 'X' be a discrete random variable. Denote its distribution function by Fx(x). If Fx(2) = 1/3 and Fx(3) = 2/3, then

(A) $P(2 \le X < 3) = 1/3$ (B) $P(X \ge 2) = 1/3$

(C) $P(X < 2) = 1/3$ (D) $P(2 < X \le 3) = 1/3$

75. Tickets numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn has a number which is a multiple of 3 or 5?

(A) 2/5 (B) 1/2 (C) 9/20 (D) 8/15

76. A Vector space consisting of _____ vectors is called Trivial Vector space.

(A) 3 (B) 2 (C) 0 (D) 1

77. Suppose a population is normally distributed with a mean of 200 and a standard deviation of 40. The probability that $x < 150$ is

(A) 0.1056 (B) 0.1438 (C) 0.1634 (D) 0.3944

78. Which two distributions are useful in analyzing waiting lines or "queues"?

(A) Binomial and Poisson (B) Binomial and normal

(C) Poisson and exponential (D) Exponential and normal

79. A standard normal distribution has a mean of _____ and standard deviation of _____.

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

80. If a random variable X has a uniform distribution with a mean of 10 and the lowest value of x is 5, what is the largest value of x that can exist?

(A) 5 (B) 10 (C) 15 (D) 20

81. An image function $f(x,y)$ is characterized by $f(x,y) = i(x,y)\, r(x,y)$ where

(A) $0 < f(x,y) < \infty$ (B) $0 < f(x,y) < 1$

(C) $1 < f(x,y) < \infty$ (D) $0 < f(x,y) < 255$

82. Sampling of an image is required for

(A) Quantization (B) Sharpening (C) Smoothening (D) Digitization

83. The use of Translation property of Fourier transform is

(A) Centering the low frequency component

(B) Centering the DC component

(C) Centering the high frequency component

(D) All the above

84. To modify and prepare the pixel values of a digitized image to produce a form that is more suitable fix subsequent operations within the generic model, Image ———————— technique is used.

(A) Restoration (B) Segmentation (C) Enhancement (D) Compression

85. To find the bright points in an image, ———————— smoothing filter should be used.

(A) Mean (B) Median (C) Maximum (D) Minimum

86. Consider a gray scale image and apply log transformation with a scaling constant of 1.5. How will the resultant image look like?

(A) high contrast image (B) low contrast image

(C) high brighten image (D) low brighten image

87. Assume that a digital image of size 50×50 is corrupted with impulse noise of 0.15. Approximately how many pixels are corrupted with noise?

(A) 625 (B) 750 (C) 1000 (D) 1500

88. The concept behind law of large numbers is used to ———————— in an image.

(A) Reduce noise (B) Perform segmentation

(C) Perform Compression (D) None of the above.

89. A pixel p at coordinates (x, y) has four horizontal and vertical neighbours whose coordinates are given as

(A) $(x+1, y+1), (x, y+1), (x-1, y-1), (x, y-1)$

(B) $(x+1, y+1), (x+1, y-1), (x-1, y+1), (x-1, y-1)$

(C) $(x+1, y), (x-1, y), (x+1, y+1), (x-1, y-1)$

(D) $(x+1, y), (x-1, y), (x, y+1), (x, y-1)$

90. The D_8 distance (Chessboard distance) between p and q with coordinates (x, y) and (s, t) is defined as

(A) $|x-s|+|y-t|$ (B) Max $(|x-s|, |y-t|)$

(C) Min $(|x-s|, |y-t|)$ (D) $|x-s|^2+|y-t|^2$

91. An offset error in a DAC will show up as an incorrect analog output ————————.

(A) Only for higher input values (B) Only for lower input values

(C) Only for certain (scattered) inputs (D) For all inputs

92. Of the methods listed, the fastest A/D conversion is done by a ————————.
(A) Single slope ramp converter
(B) Dual slope ramp converter
(C) Successive approximation converter
(D) Tracking converter

93. Convolution is used to find
(A) The impulse response of an LTI System
(B) Frequency response of a System
(C) The time response of a LTI system
(D) The phase response of a LTI system

94. The spectral density of white noise is
(A) Exponential (B) Uniform (C) Poisson (D) Gaussian

95. IIR filters
(A) use feedback
(B) are sometimes called recursive filters
(C) can oscillate if not properly designed
(D) all the above

96. Coefficient symmetry is important in FIR filters because it provides
(A) a smaller transition bandwidth (B) less passband ripple
(C) less stopband ripple (D) a linear phase response

97. If a linear phase filter has a phase response of 40 degrees at 200 Hz, what will be its phase response be at a frequency of 400 Hz (assuming that both frequencies are in the passband of the filter)?
(A) 35 degree (B) 40 degree (C) 45 degree (D) 80 degree

98. The final value of $x(t)=[2 + e^{-3t}]\ u(t)$
(A) 2 (B) 3 (C) e^{-3t} (D) 0

99. A DSP convolves each discrete sample with these coefficients : –0.25, –0.25, 1.0, –0.25 and –0.25. This must be a
(A) low pass filter (B) high pass filter
(C) band pass filter (D) band stop filter

100. The basic process that's going on inside a DSP chip is
(A) Quantisation (B) MAC
(C) Logarithmic calculation (D) vector calculations