

ENTRANCE EXAMINATION FOR ADMISSION, MAY 2012.

M.Tech. (ELECTRONICS)

COURSE CODE : 304

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 304

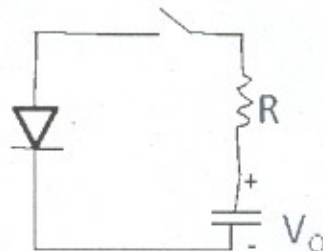
Time : 2 Hours

Max : 400 Marks

Instructions to Candidates :

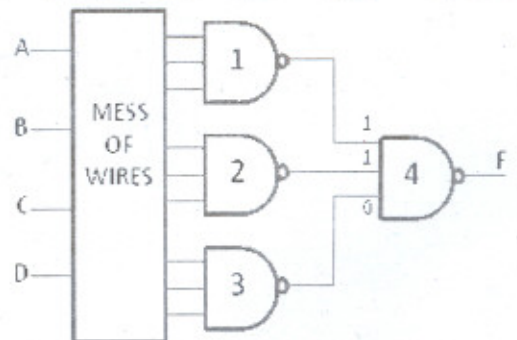
1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each of the question carefully and shade the relevant 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.

- The dominant mechanism for the motion of charge carriers in forward and reverse biased silicon P-N junctions are:
 - Drift in forward bias, diffusion in reverse bias
 - Diffusion in forward bias, drift in reverse bias
 - Drift in both forward and reverse bias
 - Diffusion in both forward and reverse bias
- In a P-channel FET, the charge carriers are:
 - Electrons
 - Holes
 - Both Electrons and holes
 - Ions
- A capacitive transducer uses two quartz diaphragms of area 750 mm^2 separated by a distance 35 mm . A pressure 900 kN/m^2 when applied to the top diaphragms produces a deflection of 0.6 mm . The capacitance is 370 pF when no pressure is applied to the diaphragms. Then the value of capacitance after the application of a pressure of 900 kN/m^2 is
 - 306.6 nF
 - $306.6 \text{ }\mu\text{F}$
 - 306.6 pF
 - 306.6 F
- A diode circuit is shown in figure with $R = 44 \text{ }\Omega$ & $C = 0.1 \text{ }\mu\text{F}$. The capacitor has an initial voltage $V_0 = 220 \text{ V}$. If switch is closed at $V = 0$, then the peak diode current and energy dissipated in the resistor R is 5 A and 2.42 mJ respectively. Then the capacitor voltage at $t = 2 \text{ }\mu\text{s}$ is
 - 13.964 V
 - 13.964 mV
 - 139.64 V
 - None of the above
- The lowering of the energy barrier at the cathode because of the positive gradient of potential at cathode is commonly known as
 - Skin effect
 - Johnson effect
 - Avalanch mechanism
 - Schottky effect
- The variation of transistor gain in its low frequency region is identical to that of a
 - Low pass filter
 - High pass filter
 - Band pass filter
 - None of the above
- The input resistance of FET in the low frequency small signal operation is
 - Almost infinite
 - High
 - Medium
 - Very small



8. A load that has a resistance of $10\ \Omega$ is to be connected to a supply that has a constant voltage of 120V. If its desired that the current to the load be varied from 3 to 5 amperes, what are the resistance and the current rating of the series rheostat that permit this variation?
- (A) $30\ \Omega$, 5A (B) $10\ \Omega$, 10A
(C) $20\ \Omega$, 10A (D) $20\ \Omega$, 10A
9. The number of independent loops for a network with n nodes and b branch is
- (A) $n-1$ (B) $b-n$ (C) $b-n+1$ (D) $b+n+1$
10. The input resistance of a MOSFET is of the order of
- (A) $1\ \text{M}\Omega$ (B) $10\ \text{M}\Omega$ (C) $100\ \Omega$ (D) $10^4\ \text{M}\Omega$
11. $XY + YZ + X'Z = XY + X'Z$ is an example for
- (A) Demorgan's theorem (B) Consensus theorem
(C) Duality (D) Commutative law
12. The minterm expansion of f is $\sum m(3,4,5,6,7)$, then maxterm expansion of f
- (A) $\prod M(3,4,5,6,7)$ (B) $\sum m(3,4,5,6,7)$
(C) $\sum m(0,1,2)$ (D) $\prod M(0,1,2)$
13. For two input OR gate we can represent $x + y$. Similarly for NAND gate is
- (A) $x \uparrow y$ (B) $x \downarrow y$
(C) $x \cap y$ (D) $x \Delta y$
14. The Boolean function $F = \sum (0,1,2,8,10,11,14,15)$ gives the minimized function
- (A) $w'x'y' + x'z' + w'y'$ (B) $w'x'y' + xz + w'y'$
(C) $w'x'y' + x'z' + wy$ (D) $wx'y' + x'z' + w'y'$

15. The circuit below was designed to implement the logic equation $F = AB'D + BC'D' + BCD$, but it is not working properly. The input wires to gates 1,2 and 3 are so tightly packed, it would take you a while to trace them all back to see whether inputs are correct. It would be nice to only have to trace whichever one is incorrectly wired. When $A = B = 0$ and $C = D = 1$, the inputs and outputs of gate 4 are as shown. Then, which of the gates either is connected incorrectly or is malfunctioning



- (A) Gate 1 (B) Gate 2
(C) Gate 3 (D) Gate 4

16. Saturated logic circuits have inherently:

(A) Short saturation delay time	(B) Low switching speed
(C) Higher power speed	(D) Lower noise margin

17. CMOS family uses only:

(A) MOSFETs and registers	(B) MOSFETs
(C) NMOS circuit	(D) Bipolar transistor

18. TTL family has:

(A) Less noise margin	(B) Smaller speed
(C) Power dissipation of 100 mw at 25°C	(D) Fan-out of 50

19. The process used in fabricating the components of monolithic ICs is:

(A) Diffusion	(B) Evaporation
(C) Sputtering	(D) Oxidation

20. How many layers of different materials are in the basic structure of IC:

(A) 1	(B) 2	(C) 3	(D) 4
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21. The discrete-time signal $x(n)=(-1)^n$ is periodic with fundamental period:

(A) 6	(B) 4	(C) 2	(D) 0
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22. Two sequences $x_1(n)$ and $x_2(n)$ are related by $x_2(n) = x_1(-n)$. In the Z-domain their ROC's are :

(A) The same	(B) Reciprocal of each other
(C) Negative of each other	(D) Complements of each other

23. The unit impulse response of a linear time invariant system is the unit step function $u(t)$. For $t>0$, the response of the system to an excitation $e^{-at} u(t), a>0$ will be:

(A) ae^{-at}	(B) $1-e^{-at}/a$	(C) $a(1-e^{-at})$	(D) $1-e^{-at}$
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24. The auto-correlation function of a rectangular pulse of duration T is:

(A) A rectangular pulse of duration T	(B) A rectangular pulse of duration 2T
(C) A triangular pulse of duration T	(D) A triangular pulse of duration 2T

25. The Fourier transform of a rectangular pulse existing between $t = -T/2$ to $t = T/2$ is
 (A) A Sinc squared function (B) A Sinc function
 (C) A Sine squared function (D) A Sine function
26. If R_1 is the region of convergence of $x(n)$ and R_2 is the region of convergence of $y(n)$, then the region of convergence of $x(n)$ convoluted $y(n)$ is
 (A) $R_1 + R_2$ (B) $R_1 - R_2$ (C) $R_1 \cap R_2$ (D) $R_1 \cup R_2$
27. The continuous time system described by $y(t) = x(t^2)$ is:
 (A) Causal, linear and time varying
 (B) Causal, non-linear and time varying
 (C) Non causal, non-linear and time invariant
 (D) Non causal, linear and time invariant
28. A band pass signal extends from 1 KHz to 2 KHz. The minimum sampling frequency needed to retain all information in the sampled signal is:
 (A) 1 KHz (B) 2 KHz
 (C) 3 KHz (D) 4 KHz
29. The system characterized by the equation $y(t) = aX(t) + b$ is:
 (A) Linear for any value of b (B) Linear if $b > 0$
 (C) Linear if $b < 0$ (D) Non-linear
30. $X(n) = a^{|n|}$, $|a| < 1$ is:
 (A) An energy signal
 (B) A power signal
 (C) Neither energy nor a power signal
 (D) An energy as well as a power signal
31. The "Superposition theorem" is essentially based on the concept of
 (A) Duality (B) Linearity
 (C) Reciprocity (D) Non-linearity
32. The Q- factor of a coil is given by
 (A) Its power factor $\cos \phi$.
 (B) Ratio of max. energy stored & energy dissipated per cycle.
 (C) Reciprocal of its power factor.
 (D) Ratio R/Z .

33. In an R - L - C circuit, the phase of the current with respect to the circuit voltage will be
 (A) Leading
 (B) Same
 (C) Lagging
 (D) Depends upon the value of L and C
34. The frequency of DC supply is
 (A) Zero (B) 16 Hz (C) 50 Hz (D) 100 Hz
35. Static Capacitors are used for
 (A) Power improvement (B) Current improvement
 (C) Voltage improvement (D) Power factor improvement
36. Q factor of an inductive coil is given by
 (A) R/Z (B) $2\pi f L/R$
 (C) $2\pi f RL$ (D) L/R
37. In India, electrical power is transmitted by
 (A) 1 - phase a.c. system (B) 3-wire d.c. system
 (C) 3-phase 3-wire a.c. system (D) 2-wire d.c. system
38. A network that does not have either voltage or current sources is called
 (A) Active network (B) Passive network
 (C) Resistive network (D) Dummy network
39. The Power- factor at resonance in R-L-C circuit is
 (A) Zero (B) Unity
 (C) 0.5 lagging (D) 0.5 leading
40. Which of the following bulbs will have the least resistance?
 (A) 220 V, 60 W (B) 220 V, 100 W
 (C) 115 V, 60 W (D) 115 V, 100 W
41. The temperature in a auditorium is given by $T=2x^2 + y^2 - 2z^2$. A mosquito located at (2, 2, 1) in the auditorium desires to fly in such a direction that it will get warm as soon as possible. The direction, in that it must fly is
 (A) $8u_x + 8u_y - 4u_z$ (B) $2u_x + 2u_y - 1u_z$
 (C) $4u_x + 4u_y - 4u_z$ (D) $-(2u_x + 2u_y - 1u_z)$

42. The phasor magnetic field intensity for a 400 MHz uniform plane wave propagating in a certain lossless material is $(6u_y - j5u_z)e^{-j18x}$ A/m. The phase velocity V_p is
- (A) 43×10^6 m/s (B) 2.2×10^7 m/s
(C) 1.4×10^8 m/s (D) None of the above
43. A rectangular waveguide is filled with a polyethylene ($\epsilon_r = 2.25$) and operates at 24 GHz. The cutoff frequency of a certain mode is 16 GHz. The intrinsic impedance of this mode is
- (A) 2248 Ω (B) 337.2 Ω
(C) 421.4 Ω (D) 632.2 Ω
44. 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
45. Two identical rectangular waveguide are joined end to end where $a = 2b$. One guide is air filled and other is filled with a lossless dielectric of ϵ_r . It is found that up to a certain frequency single mode operation can be simultaneously ensured in both guide. For this frequency range, the maximum allowable value of ϵ_r is
- (A) 4 (B) 2 (C) 1 (D) 6
46. A parallel-plate guide operates in the TEM mode only over the frequency range $0 < f < 3$ GHz. The dielectric between the plates is Teflon ($\epsilon_r = 2.1$). The maximum allowable plate separation b is
- (A) 3.4 cm (B) 4.8 cm
(C) 4.3 cm (D) 8.6 cm
47. A Hertzian dipole at the origin in free space has $dl = 10$ cm and $I = 20 \cos(2\pi \times 10^7 t)$ A. The $|E|$ at the distant point (100, 0, 0) is
- (A) 0.252 V/m (B) 0.126 V/m
(C) 0.04 V/m (D) 0.08 V/m
48. An antenna can be modeled as an electric dipole of length 4 m at 3 MHz. If current is uniform over its length, then radiation resistance of the antenna is
- (A) 1.974 Ω (B) 1.263 Ω
(C) 2.186 Ω (D) 2.693 Ω
49. An antenna has directivity of 100 and operates at 150 MHz. The maximum effective aperture is
- (A) 31.8 m² (B) 62.4 m²
(C) 26.4 m² (D) 13.2 m²

50. 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
51. The function of an amplitude limiter in an FM receiver is
 (A) To eliminate any change in amplitude of received FM signal
 (B) To reduce amplitude of the signal to suit IF amplifier
 (C) To amplify low frequency signals
 (D) None of these
52. In FM, the noise can be further decreases by
 (A) Decreasing deviation
 (B) Increasing deviation
 (C) Keeping deviation constant
 (D) None of these
53. In AM, if modulation index is more than 100%, then
 (A) Power of the wave increases
 (B) Efficiency of transmission increases
 (C) The wave gets distorted
 (D) Bandwidth increases
54. A radio receiver is tuned to 710 KHz and its oscillator frequency is 885 KHz. The image frequency would be
 (A) 1420 KHz (B) 1770 KHz
 (C) 1050 KHz (D) 1060 KHz
55. The padders in receivers is used to improve
 (A) Tracking (B) Image frequency rejection
 (C) Noise reduction (D) Sensitivity
56. Which of the following is not uniformly distributed over all frequencies?
 (A) White noise (B) Flicker noise
 (C) Short noise (D) Thermal noise
57. The function of baffles in speaker system is
 (A) To allow high frequencies to pass
 (B) To provide stability to the speaker
 (C) To avoid cancellation of compression and rarefaction of air
 (D) To produce echo effect

58. An FM wave is represented by $(e = 12 \sin(6 \times 10^8 t + 5 \sin[1250t]))$, the modulating index is
- (A) 6 (B) 12
(C) 10 (D) 5
59. Frequency and phase modulations differ in
- (A) Different definitions of the modulation indices
(B) Their actual waveform
(C) Compatibility towards each other
(D) All of these
60. Telephone receiver employs
- (A) Condenser Microphone (B) Carbon Microphone
(C) Crystal Microphone (D) None of these
61. The Nyquist rate of a signal is
- (A) f_{\max} sample/sec (B) $2 f_{\max}$ samples/sec
(C) $1/ f_{\max}$ samples/sec (D) $1/2 f_{\max}$ samples/sec
62. A signal of maximum frequency of 8KHz is sampled at Nyquist rate. The time intervals between two successive samples will be
- (A) 125 μ sec (B) 1250 μ sec
(C) zero (D) 62.5 μ sec
63. 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
64. In PCM, for 128 standard quantizing levels, the maximum error will be
- (A) $1/128$ of the total amplitude range
(B) $1/256$ of the total amplitude range
(C) $1/64$ of the total amplitude range
(D) $1/4$ of the total amplitude range
65. Satellite tracking stations are located in remote areas in order to minimise the effect of
- (A) Solar noise (B) Cosmic noise
(C) Man-made noise (D) Thermal noise

66. The entropy rate of a communication system is
 (A) Total information transmitted (B) Maximum of Information
 (C) Average information (D) Information rate
67. Which of the following statement about PCM is incorrect?
 (A) PCM requires small bandwidth
 (B) PCM is a digital system
 (C) PCM is inherently most noise resistant
 (D) All of these
68. In differential PSK
 (A) Power requirement is twice that is coherent detection
 (B) Noise excursions cancel in the comparison process
 (C) Above both are correct
 (D) None of these
69. In digital transmission, impulse noise can cause loss of
 (A) Digital signal (B) S/N ratio
 (C) Synchronization (D) All of these
70. For a periodic function, the spectral density and the auto-correlation functions are
 (A) Z-transform (B) Laplace transform pair
 (C) One and the same thing (D) Fourier transform pair
71. The line equalizers are employed in modems to correct
 (A) Frequency variations (B) Phase variations
 (C) Amplitude variations (D) None of these
72. The number of special function registers in 8051 microcontroller is
 (A) 21 (B) 41 (C) 51 (D) 31
73. The number of memory cycles required to execute the following 8085 instruction LDA 3000H would be
 (A) 2 (B) 4 (C) 3 (D) 5

74. In 8085, TRAP is
 (A) Always mask able
 (B) Cannot interrupt a service sub-routine
 (C) Used for catastrophic events like temporary power failure
 (D) Lowest priority interrupts
75. The mnemonics used in writing a program is called
 (A) Object program (B) Fetch cycle
 (C) Micro-instructions (D) Assembly Language
76. The data pointer of 8051 microcontroller is
 (A) 16 bit (B) 8 bit (C) 32 bit (D) 64 bit
77. Interaction between a CPU and a peripheral device that takes place during an I/O operation is known as
 (A) Flagging (B) Handshaking
 (C) Relocating (D) Subroutine
78. The first machine cycle of an instruction is always
 (A) A memory read cycle (B) A memory write cycle
 (C) Fetch cycle (D) A I/O read cycle
79. How many and what are the machine cycles needed for execution of XTHL?
 (A) 1, Fetch
 (B) 3, Fetch, Memory read and write
 (C) 4, Fetch, 2 Memory read and 2 Memory write
 (D) 5, Fetch, 2 Memory read and 2 Memory write
80. An interrupt service request is service
 (A) After the execution of the current instructions is completed
 (B) Immediately on receipt of request
 (C) At the end of the current machine cycle
 (D) None of these
81. An organ pipe which is open at both ends resonates at its fundamental frequency. Neglecting any end effects, what wavelength is formed by this pipe in this mode of vibration if the pipe is 2 meters long?
 (A) 2 meters (B) 4 meters
 (C) 6 meters (D) 8 meters

82. According to the second law of thermodynamics, energy tends to become more and more unavailable for conversion from:
- (A) Thermal to kinetic energy
 - (B) Kinetic to thermal energy
 - (C) Thermal to mechanical energy
 - (D) Mechanical to thermal energy
83. An ice skater is rotating with her arms extended. When she pulls in her arms her rate of rotation increases. Which of the following statements dealing with the process is TRUE?
- (A) Her moment of inertia is increased.
 - (B) Kinetic energy is conserved.
 - (C) The skater does work when pulling in her arms.
 - (D) Angular momentum is increased
84. The temperature of a gas measures the:
- (A) number of calories of heat present
 - (B) average kinetic energy of the particles in the gas
 - (C) exact number of particles in the gas
 - (D) potential energy of the gas
85. It is a very hot day. You are in a special kitchen, in that there are no exits and the walls of this kitchen are thermally very well insulated. If you open the refrigerator door, the room will eventually:
- (A) Cool off
 - (B) Remain the same
 - (C) Heat up
 - (D) None of the above
86. Consider two water drops at a temperature T . These drops are NOT allowed to exchange energy with their environment. These two drops collide and combine. How does the temperature of these drops change when they combine? Does it?
- (A) Decrease
 - (B) Remain the same
 - (C) Increase
 - (D) $1/T$

87. Which of the following quantities has the GREATEST influence on the overall efficiency of a conventional (Rankine cycle) electric generating station burning fossil fuels?
- (A) Steam temperature at the steam turbine inlet
 - (B) Net heating value of the fuel
 - (C) Steam pressure at the steam turbine inlet
 - (D) Pounds of ash and sulfur per pound of fuel
88. The theory which ascribes wave-like properties to particles is called:
- (A) General relativity
 - (B) Quantum mechanics
 - (C) Special relativity
 - (D) Classical mechanics
89. Imagine that a 20 mile diameter hole is bored along the diameter of the Earth extending from the North Pole to the South Pole, that all air and gases are pumped out of this hole, and that the temperature throughout this hole is maintained at 300 Kelvins. A boy throws a ping pong ball into this hole. The ping pong ball would:
- (A) Fall to the center of the Earth and remain forever suspended there.
 - (B) Fall to the opposite side of the Earth's surface and remain forever suspended there.
 - (C) Forever oscillate in simple harmonic motion along the hole between the loci of the hole with the opposite surfaces of the Earth.
 - (D) None of the above.
90. When a liquid moves through a pipe having a varying diameter, the pressure against the inside walls of the pipe will be:
- (A) the same throughout
 - (B) lowest where the diameter is smallest
 - (C) lowest where the diameter is largest
 - (D) lowest where the velocity of flow is lowest
91. A fair coin is to be tossed 8 times. What is the probability that more of the tosses will result in heads than will result in tails?
- (A) $23/64$
 - (B) $1/3$
 - (C) $87/256$
 - (D) $93/256$
92. How many integers from 0 to 1000 are divisible by 30 but not by 16?
- (A) 29
 - (B) 30
 - (C) 31
 - (D) 32

93. Let $v_1 = (1, 1, 0, 1)$, $v_2 = (1, 1, 1, 1)$, $v_3 = (4, 4, 1, 1)$ and $v_4 = (1, 0, 0, 1)$ be elements of R^4 . The set of vectors $\{v_1, v_2, v_3, v_4\}$ is
 (A) Linearly independent (B) Linearly dependent
 (C) Null (D) None of the above
94. If $A^2 = A$ then matrix A is called
 (A) Null matrix (B) Transpose Matrix
 (C) Identity Matrix (D) Idempotent Matrix
95. Let λ be an eigen value of matrix A then A^T , the transpose of A , has an eigenvalue as
 (A) $1/\lambda$ (B) λ (C) $1+\lambda$ (D) $1-\lambda$
96. The system of equations is said to be inconsistent if it has
 (A) Unique solution
 (B) Infinitely small solutions
 (C) No solution
 (D) Identity solution
97. The integrating factor of the differential equation $x(1+y^2) dy + y(1+x^2) dx = 0$ is
 (A) $1/x$ (B) $1/y$ (C) xy (D) $1/xy$
98. The functions x, x^2, x^3 defined on an interval I , are always
 (A) Linearly dependent
 (B) Homogeneous
 (C) Identically zero or one
 (D) Linearly independent
99. The vector field function \vec{I} is called solenoidal if
 (A) $\text{curl } \vec{I} = 0$ (B) $\text{div } \vec{I} = 0$
 (C) $\text{grad } \vec{I} = 0$ (D) $\text{grad div } \vec{I} = 0$
100. In solving any problem, odds against A are 4 to 3 and odds in favour of B in solving the same problem are 7 to 5. The probability that the problem will be solved is
 (A) $5/21$ (B) $15/21$
 (C) $16/21$ (D) $69/84$