

MIZORAM PUBLIC SERVICE COMMISSION
TECHNICAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF
INSPECTOR OF LEGAL METROLOGY
UNDER FOOD, CIVIL SUPPLIES & CONSUMER AFFAIRS, GOVT. OF MIZORAM
NOVEMBER, 2023

ELECTRONICS & COMMUNICATION ENGINEERING
PAPER-II

Time Allowed : 2 hours

Full Marks : 200

All questions carry equal mark of 2 each.

Attempt all questions.

1. The Maxwell's equation, $\nabla \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$ is based on
 - (a) Ampere's law
 - (b) Gauss's law
 - (c) Faraday's law
 - (d) Coulomb's law
2. The unit of $\nabla \times H$ is
 - (a) Ampere
 - (b) Ampere/meter
 - (c) Ampere/meter²
 - (d) Ampere-meter
3. Which one of the following is not correct Maxwell equation?
 - (a) $\nabla \times \vec{H} = \frac{d\vec{D}}{dt} + \vec{J}$
 - (b) $\nabla \times \vec{E} = \frac{d\vec{B}}{dt}$
 - (c) $\nabla \times \vec{D} = \rho$
 - (d) $\nabla \times \vec{B} = 0$
4. Find the reflection coefficient of the wave with SWR of 3.5.
 - (a) 0.55
 - (b) 0.23
 - (c) 0.48
 - (d) 0.68
5. The incoming solar radiation at a place on the surface of the earth is 1.2 KW/m². The amplitude of the electric field corresponding to this incident power is nearly equal to
 - (a) 80 mV / m
 - (b) 2.5 V / m
 - (c) 30 V / m
 - (d) 950 V / m
6. The depth of penetration of a wave in a lossy dielectric increases with increasing
 - (a) Conductivity
 - (b) Permeability
 - (c) Wavelength
 - (d) Permittivity
7. A transmission line of 50 Ω characteristic impedance is terminated with a 100 Ω resistance. The minimum impedance measured on the line is equal to
 - (a) 0 Ω
 - (b) 25 Ω
 - (c) 50 Ω
 - (d) 100 Ω

8. A uniform plane electromagnetic wave incident normally on a plane surface of a dielectric material is reflected with a VSWR of 3. What is the percentage of incident power that is reflected?
- (a) 10% (b) 25%
(c) 50% (d) 75%
9. A rectangular waveguide supports
- (a) TEM (b) TE and TM
(c) TM (d) TE
10. The power reflected along a matched transmission line with characteristics impedance Z_0 is
- (a) Zero (b) Infinity
(c) Depends on Z_0 (d) None of these
11. The gain of an antenna of effective area A is given by
- (a) $G = \frac{4\pi\lambda}{A^2}$ (b) $G = \frac{4\pi A}{\lambda}$
(c) $G = \frac{4\pi\lambda}{\lambda^2}$ (d) $G = \frac{4\pi\lambda^2}{A^2}$
12. Standing waves occurs due to
- (a) Impedance match (b) Impedance mismatch
(c) Reflection (d) Transmission
13. If the reflection coefficient for a transmission line is 1.4, then the standing wave ratio for the line is
- (a) 0.4 (b) 0.6
(c) 2.3333 (d) 1.3333
14. An antenna when radiating, has a highly directional radiation pattern. When the antenna is receiving its radiation pattern
- (a) Is more directive (b) Is less directive
(c) Is the same (d) Exhibits no directivity all
15. The far field of an antenna varies with distance r as
- (a) $1/r$ (b) $1/r^2$
(c) $1/r^3$ (d) $1/\sqrt{r}$
16. Units of the vector magnetic potential are
- (a) A/m^2 (b) A/m
(c) Wb/m^2 (d) Wb/m
17. Identify which one of the following is not satisfy the wave equation
- (a) $50.e^{j(\omega t - 2z)}$ (b) $\text{Cos}[\omega(10z + 2t)]$
(c) $\text{Cos } x.\text{Cos } t$ (d) $\text{Cos}(y^3 + 5t)$
18. A plane EM wave at an oblique incidence at Brewster angle then the reflected wave will be
- (a) Purely parallel polarized (b) Purely perpendicular polarized
(c) Both (a) & (b) (d) Neither (a) nor (b)

19. For a dipole antenna
- (a) The radiation intensity is maximum along the normal to the dipole axis
 - (b) The current distribution along its length is uniform irrespective of the length
 - (c) The effective length equals its physical length
 - (d) The input impedance is independent of the location of the feed – point
20. An antenna in free space receives $2\mu W$ of power when the incident electric field is 20 mV/m rms. The effective aperture of the antenna is
- (a) 0.005 m^2
 - (b) 0.05 m^2
 - (c) 1.885 m^2
 - (d) 3.77 m^2
21. A lossless transmission line having $50\ \Omega$ characteristic impedance and length $\lambda/4$ is short circuited at one end and connected to an ideal voltage source of 1V at the other end. The current drawn from the voltage sources is
- (a) 0
 - (b) 0.02 A
 - (c) ∞
 - (d) None of the these
22. A parabolic dish antenna has a conical beam 2° wide. The directivity of the antenna is approximately
- (a) 20 dB
 - (b) 30 dB
 - (c) 40 dB
 - (d) 50 dB
23. A person with a receiver is 5 km away from the transmitter. What is the distance that this person must move further to detect a 3 – dB decrease in signal strength?
- (a) 942 m
 - (b) 2070 m
 - (c) 4978 m
 - (d) 5320 m
24. If the standing wave ratio for a transmission line is 1.4, then the reflection coefficient for the line is
- (a) 0.16667
 - (b) 0.96
 - (c) 1.6667
 - (d) 0.01667
25. S parameters are expressed as a ratio of
- (a) Voltage and current
 - (b) Impedance at different ports
 - (c) Incident and the reflected voltage waves
 - (d) None of the above
26. At saturation, which of these is not true for a BJT?
- (a) The collector current I_C cannot increase further
 - (b) The base current I_B , cannot increase further
 - (c) The collector-to-emitter voltage, V_{CE} is due to the non-zero internal resistance of BJT
 - (d) $V_{CE}(\text{saturation})$ is the minimum voltage drop between C and E
27. A good current buffer has
- (a) Low-input impedance and low-output impedance
 - (b) Low-input impedance and high-output impedance
 - (c) High-input impedance and low-output impedance
 - (d) High-input impedance and high-output impedance
28. For a transistor amplifier with self-biasing network, the following components are used: $R_1=4\ \Omega\ K$, $R_2=4\ K\ \Omega$ and $R_E=1\ K$. the appropriate value of the stability factor S will be
- (a) 4
 - (b) 3
 - (c) 2
 - (d) 1.5

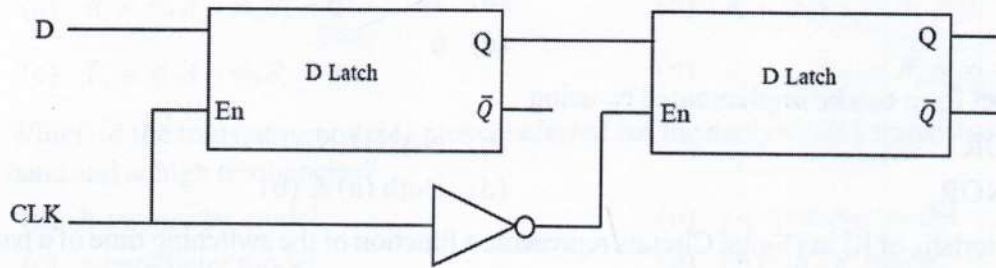
29. The ideal op-amp has the following characteristics
- (a) $R_i = \infty, A = \infty, R_o = 0$ (b) $R_i = 0, A = \infty, R_o = 0$
(c) $R_i = \infty, A = \infty, R_o = \infty$ (d) $R_i = 0, A = \infty, R_o = \infty$
30. Which of the transistor model is most preferred for the analysis of a transistor circuit both at mid-band and at high frequencies?
- (a) h-parameter model (b) y-parameter model
(c) s-parameter model (d) Hybrid - π model
31. Two stages of a multistage amplifier have a gain of 50 and 20. The dB voltage gain is
- (a) 3 (b) 30
(c) 300 (d) 1000
32. Ripple factor of half wave rectifier is _____
- (a) 1.414 (b) 1.21
(c) 1.3 (d) 0.48
33. If input frequency is 50Hz then ripple frequency of center tapped full wave rectifier will be equal to
- (a) 100Hz (b) 50Hz
(c) 25Hz (d) 500Hz
34. Voltage series feedback (also called series shunt feed-back) results in
- (a) Increase in both input and output impedance
(b) Decrease in both input and output impedance
(c) Increase in input impedance and decrease in output impedance
(d) Decrease in input impedance and increase in output impedance
35. What is the role of emitter resistance in the transistor amplifying circuit?
- (a) To prevent thermal runaway (b) To prevent increase in gain
(c) To lower the output impedance (d) To increase gain
36. If the differential voltage gain and the common mode voltage gain of a differential amplifier are 48 dB and 2 dB respectively, then its common mode rejection ratio is
- (a) 23 dB (b) 25 dB
(c) 46 dB (d) 50 dB
37. What happens when class B amplifier is in a quiescent state?
- (a) No current flows through the transistor
(b) Maximum current flows through the transistor
(c) Half of the maximum current flows through the transistor
(d) Quarter of the maximum current flows
38. Presence of emitter bypass capacitor adversely affects the
- (a) Low frequency response (b) Medium frequency response
(c) High frequency response (d) Complete frequency response
39. Negative resistance are incorporated in oscillator for _____
- (a) Sustained oscillation (b) Damped oscillation
(c) Biasing the oscillator (d) Increasing amplitude of oscillation

40. What is the use of the compensation capacitor in op-amp?
(a) Improves the amplification of op-amp (b) Decreases the slew rate of op-amp
(c) Increases the bandwidth of op-amp (d) Op-amp acts as all pass filter
41. What is the duty cycle of the output of an astable multivibrator?
(a) 50% (b) 100%
(c) 75% (d) 55%
42. If the maximum collector current due to signal alone is 3 mA, then zero signal collector current should be at least equal to
(a) 6 mA (b) 2mA
(c) 3 mA (d) 1 mA
43. The biasing circuit has a stability factor of 50. If due to temperature change, ICBO changes by $1 \mu\text{A}$, then I_C will change by
(a) $100 \mu\text{A}$ (b) $25 \mu\text{A}$
(c) $20 \mu\text{A}$ (d) $50 \mu\text{A}$
44. For good stabilization in voltage divider bias, the current I_1 flowing through R_1 and R_2 should be equal to or greater than
(a) $10 I_B$ (b) $3 I_B$
(c) $2 I_B$ (d) $4 I_B$
45. For proper amplification by a transistor circuit, the operating point should be located at the _____ of the d.c. load line
(a) The end point (b) Middle
(c) The maximum current point (d) None of the above
46. In a class B amplifier, it is found that DC power is 25W, find the ac power.
(a) 10 W (b) 62.5 W
(c) 25 W (d) 50 W
47. For a perfect power amplifier output power rating will be _____ if the output impedance is halved.
(a) Halved (b) Squared
(c) Doubled (d) Square rooted
48. Which type of feedback is used by Hartley oscillator?
(a) Voltage series feedback (b) Current series feedback
(c) Voltage shunt feedback (d) Current shunt feedback
49. Amplifier gain for RC phase shift oscillation, to obey Barkhausen's criteria should be minimum of _____
(a) 43 (b) 4
(c) 10 (d) 29
50. Distortion level in the output of RC phase shift network will be less than
(a) 1% (b) 2%
(c) 5% (d) 10%
51. The circuit efficiency of a class A amplifier can be increased with
(a) Low rating resistor (b) Transformer coupled load
(c) Low dc power input (d) Direct coupled load

52. Which one of the following is a wideband amplifier?
(a) RF amplifier (b) IF amplifier
(c) Video amplifier (d) AF amplifier
53. The operational amplifier is basically a
(a) Low gain ac amplifier (b) High gain dc amplifier
(c) High gain RC coupled amplifier (d) Low gain transformer-coupled amplifier
54. Find the approximate frequency of output waveform of a monostable multivibrator given that $RC = 20 \times 10^{-3}$ and feedback factor = 0.3.
(a) 200Hz (b) 142Hz
(c) 233Hz (d) 250 Hz
55. Given that a feedback network is shunt-series, and output load is $10k \Omega$, what is the output voltage across it given that transfer gain is 10, source current is 20mA and feedback current is 10mA?
(a) 1V (b) 2V
(c) 10V (d) 20V
56. Find the output voltage of an ideal op-amp. If V_1 and V_2 are the two input voltages
(a) $V_O = V_1 - V_2$ (b) $V_O = A \times (V_1 - V_2)$
(c) $V_O = A \times (V_1 + V_2)$ (d) $V_O = V_1 \times V_2$
57. A differential amplifier has a transistor with $\beta_0 = 100$, is biased at $I_{CQ} = 0.48\text{mA}$. Determine the value of CMRR and A_{CM} , if $R_E = 7.89k \Omega$ and $R_C = 5k \Omega$.
(a) 49.54 Db (b) 49.65 dB
(c) 49.77 dB (d) 49.60 dB
58. A Boolean function is given as $Y = A(A + \bar{B})$. Its simplified form is
(a) A (b) B
(c) \bar{B} (d) AB
59. The circuit that will work as OR gate in positive level, will work as _____ gate in negative level logic.
(a) NOR gate (b) NAND gate
(c) Both NAND and NOR gate (d) AND gate
60. A bulb in a staircase has two switches, one switch being at the ground floor and the other one at the first floor. The bulb can be turned ON and also can be turned OFF by and one of the switches irrespective of the state of the other switch. The logic of switching of the bulb resembles.
(a) an AND gate (b) an OR gate
(c) an XOR gate (d) a NAND gate
61. The Boolean function $Y = AB + CD$ is to be realized using only 2 input NAND gates. The minimum number of gates required is
(a) 2 (b) 3
(c) 4 (d) 5
62. The highest noise margin is offered by
(a) TTL (b) ECL
(c) IIL (d) CMOS

63. The minimum number of NAND gates required to implement $A \oplus B \oplus C$ is
(a) 8 (b) 10
(c) 9 (d) 6
64. Sum of product form can be implemented by using
(a) AND-OR (b) NAND-NAND
(c) NOR-NOR (d) Both (a) & (b)
65. Which characteristic of IC in Digital Circuits represents a function of the switching time of a particular transistor?
(a) Fan – out (b) Fan – in
(c) Power dissipation (d) Propagation delay
66. The canonical sum of product form of the function $y(A,B) = A + B$ is _____
(a) $AB + BB + A'A$ (b) $AB + AB' + A'B$
(c) $BA + BA' + A'B'$ (d) $AB' + A'B + A'B'$
67. A major advantage of DTL over the earlier resistor–transistor logic is the _____
(a) Increased fan out (b) Increased fan in
(c) Decreased fan out (d) Decreased fan in
68. What are the minimum number of 2 to 1 multiplexer required to generate a 2-input AND gate and 2-input EX-OR gate?
(a) 1 and 2 (b) 1 and 3
(c) 1 and 1 (d) 2 and 2
69. A 2-bit synchronous counter uses flip-flops with propagation delay time of 25 ns each. The maximum possible time required for change of state will be
(a) 25 ns (b) 50 ns
(c) 75 ns (d) 100 ns
70. A basic S-R flip-flop can be constructed by cross-coupling of which basic logic gates?
(a) AND or OR gates (b) XOR or XNOR gates
(c) NOR or NAND gates (d) AND or NOR gates
71. When is a flip-flop said to be transparent?
(a) When the Q output is opposite the input
(b) When the Q output follows the input
(c) When you can see through the IC packaging
(d) When the Q output is complementary of the input
72. A 6 bit ladder D/A converter has input 101001. For $1 = 10\text{ V}$ and $0 = 0\text{ V}$, The output is
(a) 4.23 (b) 6.51
(c) 5.52 (d) 9.23
73. A flip-flop is popularly known as
(a) A stable multivibrator (b) Bistable multivibrator
(c) Monostable multivibrator (d) None of these
74. The flip-flop that is not affected by race around condition
(a) T flip-flop (b) J-K flip-flop
(c) S-R flip-flop (d) None of these

75. The circuit shown in the figure is a



- (a) Toggle Flip-Flop
 - (b) J-K Flip-Flop
 - (c) S-R Latch
 - (d) Master-Slave D Flip-Flop
76. A 10 bit D/A converter given a maximum output of 10.23V. The resolution is
- (a) 10 mV
 - (b) 20 mV
 - (c) 15 mV
 - (d) 25 mV
77. An 8 bit successive approximation analog to digital converter has full scale reading of 2.55 V and its conversion time for an analog input of 1V is $20 \mu s$. The conversion time for a 2V input will be
- (a) $10 \mu s$
 - (b) $20 \mu s$
 - (c) $40 \mu s$
 - (d) $50 \mu s$
78. The minimum number of flip-flops that can be used to construct a modulus-5 counter is _____
- (a) 3
 - (b) 8
 - (c) 5
 - (d) 10
79. A full-adder can be made out of
- (a) Two half-adders
 - (b) Two half-adders and a NOT gate
 - (c) Two half-adders and a AND gate
 - (d) Two half-adders and a OR gate
80. For a S-R flip-flop, S and R are made equal to 1. What is the value of Q?
- (a) Unchanged
 - (b) Clear to 0
 - (c) Set to 1
 - (d) Indeterminate
81. The output frequency of a mod-12 counter is 6 kHz. Its input frequency is
- (a) 6 kHz
 - (b) 500 Hz
 - (c) 24 kHz
 - (d) 72 kHz
82. To construct a 512 K x 8 memory, the number of 32 K x 4 memory circuit required is
- (a) 16
 - (b) 32
 - (c) 8
 - (d) 64
83. The minimum number of comparators required to build n bit flash ADC is
- (a) 2^{n-1}
 - (b) 2n
 - (c) 2^n
 - (d) $2^n - 1$
84. For a given sample-and-hold circuit, if the value of the hold capacitor is increased, then
- (a) Droop rate decreases and acquisition time decreases
 - (b) Droop rate decreases and acquisition time increases
 - (c) Droop rate increases and acquisition time decreases
 - (d) Droop rate increases and acquisition time increases

85. How many select lines are contained in a multiplexer with 1024 inputs and one output?
(a) 512 (b) 258
(c) 64 (d) 10
86. The memory technology which needs the least power is
(a) ECL (b) TTL
(c) MOS (d) CMOS
87. Which of the following is not a characteristics of negative feedback system?
(a) Rejection of disturbance signal (b) High sensitivity to parameter variations
(c) Reduction in gain (d) Accuracy in tracking steady state value
88. Which one of the following is not a closed loop system?
(a) Respiratory system of an animal (b) Execution of a program by computer
(c) Air condition system (d) Driving a car
89. Despite of presence of negative feedback, control system still have problems of instability because the
(a) Components used have non-linearities
(b) Dynamic equation of the subsystems is not known exactly
(c) Mathematical analysis involves approximations
(d) System has a large negative phase angle at high frequencies
90. What is the characteristic of a good control system?
(a) Insensitive to the parameter variation but sensitive to the input commands
(b) Neither sensitive to parameter variations nor sensitive to input commands
(c) Insensitive to the input command
(d) Sensitive to parameter variation
91. If a system is given unbounded input then the system is:
(a) Stable (b) Unstable
(c) Not defined (d) Linear
92. Root locus is used to calculate:
(a) Marginal stability (b) Absolute stability
(c) Conditional stability (d) Relative stability
93. A system has the following transfer function $G(s) = \frac{10(s+5)(s+50)}{s^2(s+1)(s^2+3s+10)}$. The type and order of the system are, respectively
(a) 4 and 9 (b) 4 and 7
(c) 5 and 7 (d) 7 and 5
94. If the closed-loop transfer function of a control system is given as $T(s) = \frac{s-5}{(s+2)(s+3)}$, then the system is
(a) An unstable system (b) AN uncontrollable system
(c) A minimum phase system (d) Non-minimum phase system

95. Nichol's chart is useful for determining the
- (a) Open loop frequency response
 - (b) Open loop and closed frequency response
 - (c) Close loop frequency response
 - (d) Time response
96. If the gain K of the system increases, the steady state error of the system
- (a) Decreases
 - (b) Increases
 - (c) May increase or decrease
 - (d) Remains unaltered
97. A system transfer function has some poles lying on the imaginary axis and it is
- (a) Marginally stable
 - (b) Unstable
 - (c) Conditionally stable
 - (d) Unconditionally stable
98. With regards to the filtering capacity the lead and lag compensators are respectively
- (a) Low pass and high pass filter
 - (b) High pass and low pass filter
 - (c) Both high pass filter
 - (d) Both low pass filter
99. Phase lag network
- (a) Maintains constant velocity gain
 - (b) Decreases bandwidth
 - (c) Increases system stability
 - (d) All of these
100. In a lag network, the inductor is used due to its
- (a) High reactance
 - (b) Time delay and hysteresis loss
 - (c) High cost
 - (d) Large size
