

# MIZORAM PUBLIC SERVICE COMMISSION

## COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF INSPECTOR OF LEGAL METROLOGY UNDER FOOD, CIVIL SUPPLIES & CONSUMER AFFAIRS DEPARTMENT, GOVERNMENT OF MIZORAM, DECEMBER, 2018

### ELECTRONICS & COMMUNICATION ENGINEERING PAPER - II

Time Allowed : 2 hours

Full Marks : 200

*All questions carry equal marks of two (2) each.  
Attempt all questions.*

- The far field of an antenna varies with distance  $r$  as
  - $1/r$
  - $1/r^2$
  - $1/r^3$
  - $1/r^{-1/2}$
- The line integral of the vector potential  $\vec{A}$  around the boundary of a source  $S$  represents which one of the following?
  - Flux through the surface  $S$
  - Flux density in the surface  $S$
  - Magnetic field intensity
  - Current density
- A charge 'Q' is divided between two point charges. What should be the value of this charge on the objects so that the force between them is maximum?
  - $Q/3$
  - $Q/2$
  - $(Q-2)$
  - $2Q$
- Electric flux through a surface area is the integral of the
  - Normal component of the electric field over the area
  - Parallel component of the electric field over the area
  - Normal component of the magnetic field over the area
  - Parallel component of the magnetic field over the area
- The normal components of electric flux density across a dielectric –dielectric boundary
  - Are discontinuous
  - Are continuous
  - Depends on the magnitude of the surface charge density
  - Depends on the electric field intensity
- The dominant mode in a rectangular waveguide is  $TE_{10}$  because this mode has
  - No attenuation
  - No cut off
  - No magnetic field component
  - The highest cut off wavelength
- The cut off frequency of waveguide depends upon
  - The dimensions of the waveguide
  - The dielectric property of the medium in the waveguide
  - The characteristic impedance of the waveguide
  - The transverse and axial components of the fields

8. A rectangular waveguide has dimensions  $1\text{cm} \times 0.5\text{cm}$ . Its cut off frequency is
- (a) 5 GHz (b) 10 GHz  
(c) 15 GHz (d) 20 GHz
9. Tangential component of the electric field on a perfect conductor will be
- (a) Infinite  
(b) Zero  
(c) Same as the normal field component and  $90^\circ$  out of phase  
(d) Same as the normal field component but  $180^\circ$  out of phase
10. An electric charge of  $Q$  coulombs is located at the origin. Consider electric potential  $V$  and electric field intensity  $E$  at any point  $(x, y, z)$ . Then
- (a)  $E$  and  $V$  are both scalars (b)  $E$  and  $V$  are both vector  
(c)  $E$  is scalar and  $V$  is vector (d)  $E$  is vector and  $V$  is scalar
11. The electric field lines and equipotential lines
- (a) Are parallel to each other (b) Are one and same  
(c) Cut each other orthogonally (d) Can be inclined to each other at any angle
12. If  $\vec{E}$  is the electric field intensity,  $\nabla(\nabla \times \vec{E})$  is equal to
- (a)  $\vec{E}$  (b)  $|\vec{E}|$   
(c) Null vector (d) Zero
13. The equation  $(\nabla \cdot j) = 0$  is known as
- (a) Poisson's equation (b) Laplace equation  
(c) Continuity equation (d) Maxwell equation
14. A medium behaves like dielectric when the
- (a) Displacement current is just equal to the conduction current  
(b) Displacement current is less than the conduction current  
(c) Displacement current is much greater than the conduction current  
(d) Displacement current is almost negligible
15. The return loss of a device is found to be 20 dB. The voltage standing wave ratio (VSWR) and magnitude of reflection coefficient are respectively
- (a) 1.22 and 0.1 (b) 0.81 and 0.1  
(c) -1.22 and 0.1 (d) 2.44 and 0.2
16. A transmission line of  $50 \Omega$  characteristic impedance is terminated with a  $100 \Omega$  resistance. The minimum impedance measured on the line is equal to
- (a)  $0 \Omega$  (b)  $25 \Omega$   
(c)  $50 \Omega$  (d)  $100 \Omega$
17. A transmission line whose characteristic impedance is a pure resistance
- (a) Must be a lossless line (b) Must be a distortion less line  
(c) May not be a lossless line (d) May not be a distortion less line

18. The intrinsic impedance of a lossy dielectric medium is given by

- (a)  $\frac{j\omega\mu}{\sigma}$  (b)  $\frac{j\omega\varepsilon}{\mu}$   
(c)  $\sqrt{\frac{j\omega\mu}{\sigma + j\omega\varepsilon}}$  (d)  $\sqrt{\frac{\mu}{\varepsilon}}$

19. For loss less transmission line  $L = 0.35\text{mH/m}$ ,  $C = 90\text{pF/m}$  and frequency = 500 MHz. Then the magnitude of the propagation constant is

- (a) 14.48 (b) 17.63  
(c) 19.59 (d) 21.20

20. The skin effect in a transmission line is affected by

- (a) The resistivity of the transmission line  
(b) The current magnitude in the transmission line  
(c) The cross section area of the transmission line  
(d) The voltage applied across the transmission line

21. The depth of penetration of a wave in a lossy dielectric increases with increasing

- (a) Conductivity (b) Permeability  
(c) Wavelength (d) Permittivity

22. The unit of  $\nabla \times H$  is

- (a) Ampere (b) Ampere/meter  
(c) Ampere/meter<sup>2</sup> (d) Ampere-meter

23. In a amplifier, variation in  $b$  causes

- (a) Bias instability (b) Bias stability  
(c) Zero bias (d) None of these

24. In a transistor circuit  $I_B$  remains constant but  $b$  increases

- (a) Operating point will go down  
(b) Operating point will go up  
(c) Operating point will not change its position  
(d) Operating point will shift as per value of base current  $I_B$

25. The ideal Opamp 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)  $R_i = 0$ ,  $A = 0$ ,  $R_o = 0$

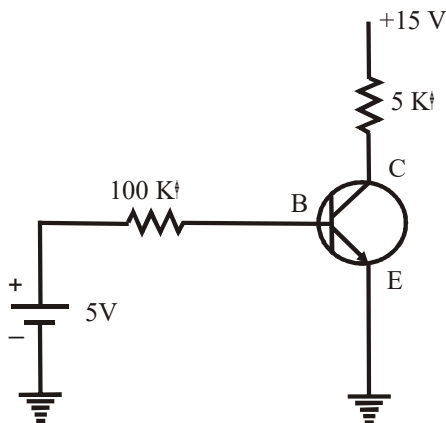
26. If the differential voltage gain and the common mode voltage gain of a differential amplifier are 48 dB and 2 dB respectively, then its common mode rejection ratio is

- (a) 26 dB (b) 36 dB  
(c) 46 dB (d) 56 dB

27. An ideal Opamp is an ideal

- (a) voltage controlled current source (b) current controlled current source  
(c) voltage controlled voltage source (d) current controlled voltage source

28. In a half wave rectifier, the load current flows for what part of the cycle.  
(a)  $360^\circ$  (b)  $180^\circ$   
(c)  $90^\circ$  (d)  $0^\circ$
29. In a full wave rectifier, if the input frequency is 50 Hz, then output frequency will be  
(a) 1 Hz (b) 10 Hz  
(c) 50 Hz (d) 100 Hz
30. The maximum efficiency of full wave rectification is  
(a) 51.2 % (b) 61.2 %  
(c) 71.2 % (d) 81.2 %
31. The ripple factor of a bridge rectifier is  
(a) 0.482 (b) 3.771  
(c) 0.697 (d) 2.111
32. Which rectifier requires four diodes?  
(a) full-wave bridge circuit (b) half-wave voltage doubler  
(c) voltage quadrupler (d) full-wave voltage doubler
33. As compared to transistor amplifier JFET amplifier has  
(a) Higher voltage gain, less input impedance (b) Less voltage gain, less input impedance  
(c) Less voltage gain, higher input impedance (d) Higher voltage gain, higher input impedance
34. The best location for setting a Q-point on dc load line of an FET Amplifier is at  
(a) Saturation point (b) Cutoff point  
(c) Mid-point (d) None of these
35. The emitter resistor  $R_E$  is bypassed by a capacitor in order to  
(a) Stabilize the Q point (b) Cause thermal runaway  
(c) Increase the voltage gain (d) Reduce the voltage gain
36. The transistor as shown in the circuit is operating in

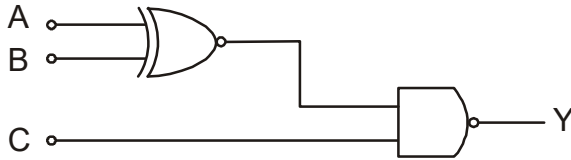


- (a) Cut-off region (b) Saturation region  
(c) Active region (d) Either in active region or saturation region
37. Operating point shift can occur in an amplifier due to which of the following?  
(a) Input frequency variation (b) Noise in the input  
(c) Parasitic capacitance (d) Power supply fluctuation

38. A cascode amplifier has the advantage of
- (a) Low input capacitance
  - (b) Low input impedance
  - (c) High transconductance
  - (d) Large voltage gain
39. An amplifier circuit has an overall current gain of -100 and an input resistance of  $10\text{ kW}$  with a load resistance of  $1\text{ kW}$ . The overall voltage gain of the amplifier is
- (a) 5 dB
  - (b) 10 dB
  - (c) 20 dB
  - (d) 40 dB
40. A buffer amplifier has a gain of
- (a) Infinity
  - (b) Zero
  - (c) Unity
  - (d) Dependent upon the circuit parameters
41. In an amplifier, the coupling capacitors are employed for
- (a) Limiting the bandwidth
  - (b) Matching the impedance
  - (c) Controlling the output
  - (d) Preventing of dc mixing with input or output
42. By increasing the number of identical stages in an amplifier, the gain bandwidth product
- (a) Decreases
  - (b) Becomes unity
  - (c) Remains constant
  - (d) Increases
43. Heat sink is used in the power amplifier circuit
- (a) To increase the output power
  - (b) To reduce the heat loss in the transistor
  - (c) To increase the voltage gain of the power amplifier
  - (d) To increase the collector dissipation rating of the transistor
44. An astable multivibrator is also called
- (a) Free running multivibrator
  - (b) Edge triggered multivibrator
  - (c) Emitter coupled multivibrator
  - (d) Collector coupled multivibrator
45. Which of the follow is not a sinusoidal oscillator?
- (a) Crystal oscillator
  - (b) RC phase shift oscillator
  - (c) LC oscillator
  - (d) Relaxation oscillator
46. Hexadecimal number F is equal to octal number
- (a) 14
  - (b) 15
  - (c) 16
  - (d) 17
47. Binary number 1101 is equal to octal number
- (a) 15
  - (b) 14
  - (c) 12
  - (d) 11
48. The number FF in hexadecimal system has equivalence in decimal system to
- (a) 245
  - (b) 255
  - (c) 265
  - (d) 275
49. A half-adder can be constructed using two 2-input logic gates. One of them is an AND gate, the other is
- (a) EX-OR
  - (b) OR
  - (c) NAND
  - (d) NOR

50. An equivalent 2's complement representation of the 2's complement number 1101 is  
(a) 110100 (b) 001101  
(c) 110111 (d) 111101
51. Combinational circuit  
(a) Always contains memory elements (b) Never contains memory elements  
(c) May sometimes contain memory elements (d) Contains only memory
52. The output Y of a NOR gate for input A and B is  
(a)  $\overline{A+B}$  (b)  $\overline{A+B}$   
(c)  $\overline{\overline{A+B}}$  (d)  $\overline{A} \overline{B}$
53. An X-OR gate can be converted into an inverter by  
(a) Permanently connecting one input to 1 (b) Permanently connecting both inputs to 1  
(c) Permanently connecting one input to 0 (d) Permanently connecting both inputs to 0
54. If A and B are Boolean variables, then what is  $(A+B).(A+\overline{B})$  equals to  
(a) B (b) A  
(c) A+B (d) AB
55. 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
56. 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
57. The minimum number of 2:1 multiplexers required to realize a 4:1 multiplexer is  
(a) 6 (b) 5  
(c) 4 (d) 3
58. D/A converters are generally  
(a) Weighted resistor network (b) Binary ladder network  
(c) Either (a) or (b) (d) Neither (a) nor (b)
59. The Boolean equation  $X = [(A + \overline{B})(B + C)]B$  can be simplified to  
(a)  $X = \overline{A}B$  (b)  $X = A\overline{B}$   
(c)  $X = AB$  (d)  $X = \overline{A}\overline{B}$

60. The output F in the digital logic circuit shown in the figure is



- (a)  $Y = \overline{A}B + AB + \overline{C}$  (b)  $Y = \overline{A}B + \overline{A}\overline{B} + \overline{C}$   
(c)  $Y = A \oplus B + \overline{C}$  (d)  $Y = AB + \overline{C}$
61. The Boolean expression  $Y(A,B,C) = A+BC$  is to be realized using 2-input gates of only one type. What is the minimum number of gates required for the realization?  
(a) 1 (b) 2  
(c) 3 (d) 4 or more
62. What are the minimum numbers of NOT gates and 2-input OR gates required to design the logic of the driver for 7 segment display?  
(a) 3 NOT and 4 OR (b) 2 NOT and 4 OR  
(c) 1 NOT and 3 OR (d) 2 NOT and 3 OR
63. If the sum of products functions  $f(X, Y, Z) = \Sigma(2, 3, 4, 5)$ , the prime implicants are  
(a)  $\overline{X}Y, X\overline{Y}$  (b)  $\overline{X}Y, X\overline{Y}\overline{Z}, X\overline{Y}Z$   
(c)  $\overline{X}Y\overline{Z}, \overline{X}YZ, X\overline{Y}$  (d)  $\overline{\overline{X}Y\overline{Z}}, \overline{\overline{X}YZ}, X\overline{Y}\overline{Z}, X\overline{Y}Z$
64. A half adder can be constructed using  
(a) One X-OR and one OR gate with their inputs connected in parallel  
(b) One X-OR and one OR gate with their outputs connected in series  
(c) One X-OR and one AND gate  
(d) Two X-NOR gates
65. The number of 4-line to 16-line decoders required to make an 8-line to 256-line decoder is  
(a) 16 (b) 17  
(c) 32 (d) 64
66. Which converters uses integrating Opamp  
(a) Dual slope A/D converter (b) Parallel A/D converter  
(c) Single slope A/D converter (d) None of these
67. A 10 bit D/A converter given a maximum output of 10.23 V. The resolution is  
(a) 10 mV (b) 20 mV  
(c) 30 mV (d) 40 mV
68. The number of comparators in a 4-bit flash ADC is  
(a) 17 (b) 16  
(c) 15 (d) 14

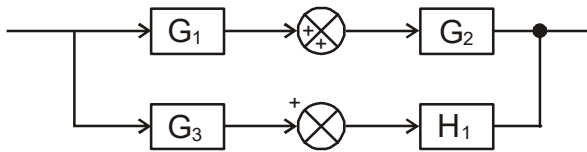
69. A flip-flop is a  
(a) Combinational logic circuit and edge sensitive (b) Sequential logic circuit and edge sensitive  
(c) Combinational logic circuit and level sensitive (d) Sequential logic circuit and level sensitive
70. If  $S = 0$ ,  $R = 1$  in a SR flip-flop, then  
(a)  $Q_{n+1} = TQ_n$  (b)  $Q_{n+1} = T\overline{Q_n} + \overline{T}Q_n$   
(c)  $Q_{n+1} = 0$  (d)  $Q_{n+1} = 1$
71. A J-K flip-flop can be made from an S-R flip-flop by using two additional  
(a) NAND gates (b) OR gates  
(c) NOT gates (d) NOR gates
72. A master-slave flip-flop has the characteristic that  
(a) Change in the input is immediately reflected in the output  
(b) Change in the output occurs when the state of the master is affected  
(c) Change in the output occurs when the state of the slave is affected  
(d) Both the master and the slave states are affected at the same
73. D flip-flop can be configured from a  
(a) J-K flip-flop and an inverter (b) RS flip-flop  
(c) RS flip-flop and an inverter (d) J-K flip flop
74. The characteristics equation of the T flip-flop is given by  
(a)  $Q_{n+1} = TQ_n$  (b)  $Q_{n+1} = T\overline{Q_n} + \overline{T}Q_n$   
(c)  $Q_{n+1} = \overline{T}Q_n$  (d)  $Q_{n+1} = T\overline{Q_n}$
75. A 4-bit Johnson counter is initialized to 0101. Whenever the state 1011 is reached, the counter is reinitialized to 0000 at the next clock active edge. Again when the state 0001 is reached, the counter is initialized back to 0101 at the next clock active edge. The cycle length of the counter is  
(a) 6 (b) 8  
(c) 16 (d) 12
76. Minimum number of J-K flip flops needed to construct a BCD counter is  
(a) 2 (b) 3  
(c) 4 (d) 5
77. Which memory requires periodic recharging  
(a) All ROMS (b) All RAMS  
(c) Static RAM (d) Dynamic RAM
78. A dynamic RAM consists of  
(a) 3 transistors (b) 1 transistor and 1 capacitor  
(c) 2 transistors and 3 capacitors (d) 2 transistors
79. How many flip flops are required to build a binary counter circuit to count from 0 to 1023?  
(a) 1 (b) 10  
(c) 6 (d) 16



- 80.** An R-S latch is a
- (a) Combinational circuit
  - (b) Synchronous sequential circuit
  - (c) One clock delay element
  - (d) One bit memory element
- 81.** Among the following the slowest ADC is
- (a) Flash type
  - (b) Integrating type
  - (c) Successive approximation type
  - (d) Counting type
- 82.** Which of the following is an example of volatile memory?
- (a) ROM
  - (b) RAM
  - (c) PROM
  - (d) E<sup>2</sup>PROM
- 83.** To operate correctly, starting a ring counter requires
- (a) Clearing all the flip-flops
  - (b) Presetting one flip-flop and clearing all others
  - (c) Clearing one flip-flop and presetting all others
  - (d) Presetting all the flip-flops
- 84.** What is the characteristic of a good control system?
- (a) Sensitive to parameter variation
  - (b) Insensitive to input commands
  - (c) Neither sensitive to parameter variation nor sensitive to input commands
  - (d) Insensitive to parameter variation but Sensitive to input commands
- 85.** By using feedback in control systems, the sensitivity to parameter variation is improved. This is achieved at rate the cost of
- (a) Stability
  - (b) Loss of system gain
  - (c) Transient response
  - (d) Reliability
- 86.** In a closed loop control system
- (a) Control action is independent of output
  - (b) Output is independent of input
  - (c) There is no feedback
  - (d) Control action is dependent on output
- 87.** Which one of the following effects in the system is not caused by negative feedback?
- (a) Reduction in gain
  - (b) Increase in bandwidth
  - (c) Increase in distortion
  - (d) Reduction in output impedance
- 88.** The output is said to be zero state response because \_\_\_\_\_ conditions are made equal to zero.
- (a) Initial
  - (b) Final
  - (c) Steady state
  - (d) Impulse response
- 89.** In a signal flow graph, nodes are represented by small \_\_\_\_\_.
- (a) Pointers
  - (b) Squares
  - (c) Circles
  - (d) Rectangular
- 90.** According to the property of impulse test signal, what is the value of an impulse at  $t = 0$ ?
- (a) 0
  - (b) Unity
  - (c) Infinite
  - (d) None of these
- 91.** In second order system, which among the following remains independent of gain (k)?
- (a) Open loop poles
  - (b) Closed loop poles
  - (c) Both (a) and (b)
  - (d) None of these

92. In a speed control system, output rate feedback is used to
- (a) Limit the speed of motor
  - (b) Limit the acceleration of motor
  - (c) Reduce the damping of the system
  - (d) Increase the gain margin

93. What is the overall transfer function of the block diagram shown in the figure?



- (a)  $\frac{G_1G_2 + G_2G_3}{1 + G_2H_1}$
- (b)  $\frac{G_1G_3 + G_2G_3}{1 + G_3H_1}$
- (c)  $G_1G_2 + G_2G_3$
- (d)  $\frac{G_1G_3 + G_2G_3}{1 + G_2G_3H_1}$

94. Signal flow graph is used to find

- (a) Stability of the system
- (b) Controllability of the system
- (c) Transfer function of the system
- (d) Poles of the system

95. A system is described by the transfer function  $G(S) = \frac{100}{(s+1)(s+100)}$ . The dc gain of the system is

- (a) 0.25
- (b) 0.5
- (c) 1
- (d)  $\infty$

96. In transfer function representation, the order of the system is given by

- (a) Highest power of 's' in the numerator polynomial
- (b) Highest power of 's' in the denominator polynomial
- (c) Number of poles at the origin
- (d) Number of zeros on the imaginary axis

97. If the characteristic equation of a closed-loop system is  $s^2 + 2s + 2 = 0$ , then the system is

- (a) Overdamped
- (b) Critically damped
- (c) Under damped
- (d) Undamped

98. For an electric field  $E = E_0 \sin \omega t$ , what is the phase difference between the conduction current and the displacement current?

- (a)  $30^\circ$
- (b)  $45^\circ$
- (c)  $60^\circ$
- (d)  $90^\circ$

99. The 'T' Flip-Flop derives its name from its operation, which is \_\_\_\_\_.

- (a) Toggle
- (b) Trigger
- (c) Transistor
- (d) None of these

100. Digital system has been divided by

- (a) Combinational and Sequential
- (b) Synchronous and asynchronous
- (c) High level logic and Low level logic
- (d) Sum of product and Product of Sum