

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

ELECTRICAL ENGINEERING PAPER - III

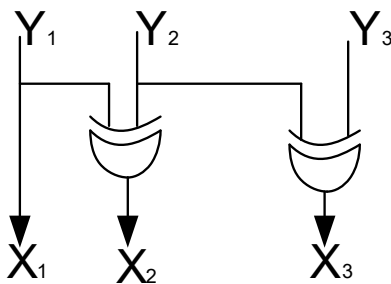
Time Allowed : 2 hours

Full Marks : 200

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

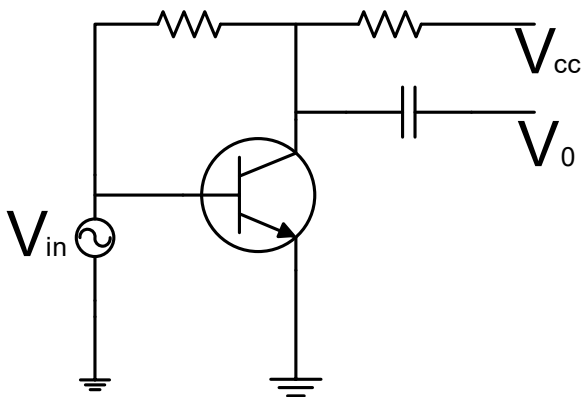
Attempt all questions.

- As compared to full wave rectifier using two diodes, the four diode bridge rectifier has the dominant advantage of
 - higher current carrying capacity
 - lower peak inverse voltage requirement
 - lower ripple factor
 - higher efficiency
- The 'Pinch-off' voltage of a JFET is 5 V. Its 'Cut-off' voltage is
 - $(5.0)^{1/2}$ V
 - 2.5 V
 - 5.0 V
 - $(5.0)^{3/2}$ V
- In a transistor amplifier, the reverse saturation current I_0 is
 - doubled for every 10°C rise in temperature
 - doubled for every 1°C rise in temperature
 - increased linearly with temperature
 - doubled for every 5°C rise in temperature
- In which of the following codes a binary number $Y_1 Y_2 Y_3$ is converted by the circuit given below?



- Excess-3 code
 - Gray code
 - Decimal code
 - BCD code
- In a transistor, the forward bias across the base emitter junction is kept constant and the reverse bias across the collector base junction is increased. Neglecting the leakage across the collector base junction and the depletion region generation current, the base current will
 - increase
 - decrease
 - remain constant
 - none of these

6. The circuit of the figure is example



- (a) current series feedback
 - (b) current shunt feedback
 - (c) voltage series feedback
 - (d) voltage shunt feedback
7. In a bistable multivibrator, commutating capacitors are used to
- (a) increase the base storage charge
 - (b) provide a.c. coupling
 - (c) increase the speed of response
 - (d) alter the frequency of the output
8. An amplifier with resistive negative feedback has two left half plane poles in its open loop transfer function. The amplifier
- (a) will always be unstable at high frequencies
 - (b) will be stable for all frequencies
 - (c) may be unstable, depending upon the feedback factor
 - (d) will oscillate at low frequencies
9. The reduced form of the Boolean expression $A[B + C(\overline{AB + AC})]$ is
- (a) $\overline{A}B$
 - (b) $A\overline{B}$
 - (c) AB
 - (d) $AB + B\overline{C}$
10. The set of transistor characteristics that enables a to be directly determined from the slope is
- (a) The common emitter output characteristics
 - (b) The common emitter transfer characteristics
 - (c) The common base input characteristics
 - (d) The common base transfer characteristics
11. In a p^+n junction diode under reverse bias, the magnitude of electric field is maximum at
- (a) the edge of the depletion region on the p-side
 - (b) the edge of the depletion region on the n-side
 - (c) the p^+n junction
 - (d) the centre of the depletion region on the n-side
12. Reverse recovery current in a diode depends upon
- (a) forward field current
 - (b) storage charge
 - (c) temperature
 - (d) PIV
13. The digital multiplexer is basically a combination logic circuit to perform the operation
- (a) AND-AND
 - (b) OR-OR
 - (c) AND-OR
 - (d) OR-AND

14. High power efficiency of the push pull amplifier is due to the fact that
- each transistor conducts on different cycle of the input
 - transistor are placed in CE configuration
 - there are no quiescent collector current
 - low forward biasing voltage is required
15. The input resistance of a common emitter stage can be increased by
- unbypassing emitter resistance
 - bootstrapping
 - biasing it at low quiescent current
 - using compounded BJTs
- The correct sequence in descending order of the effectiveness of these methods is
- 2, 4, 1 and 3
 - 4, 3, 2 and 1
 - 2, 4, 3 and 1
 - 4, 2, 3 and 1
16. The Q output of a J-K flip-flop is '1'. The output does not change when a clock-pulse is applied. The inputs J and K will be respectively (X-denotes don't care state)
- 0 and X
 - X and 0
 - 1 and 0
 - 0 and 1
17. A class-B push-pull type amplifier with transformer coupled load uses two transistors rated 10W each. What is the maximum power output one can obtain at the load from this circuit?
- 40 W
 - 50 W
 - 60 W
 - 70 W
18. For a transconductance amplifier, input and output resistance are respectively
- ∞ and 0
 - 0 and ∞
 - 0 and 0
 - ∞ and ∞
19. The drain gate capacitance of a junction FET is 2 pF. Assuming a common source voltage gain of 20, what is the input capacitance due to Miller effect?
- 21 pF
 - 40 pF
 - 42 pF
 - 10 pF
20. The switching speed of ECL is very high, because the transistors
- are switched between cut-off and saturation regions
 - and switches between active and saturation regions
 - and switches between active and cut-off regions
 - may operate in any of three regions
21. In a J-K flip flop the output Q_n is '1'. It does not change when a clock pulse is applied. The possible combination of J_n and K_n could be (X denote don't care)
- 'X' and '0'
 - 'X' and '1'
 - '0' and 'X'
 - '1' and 'X'
22. Which of the following flip flop cannot be converted to D-type (delay) flip-flop?
- S-R flip-flop
 - J-K flip-flop
 - Master slave flip-flop
 - None of these
23. The flip-flop used in shift register are generally
- SR flip flop
 - JK flip-flop
 - D flip-flop
 - T flip-flop

24. The efficiency of a class B amplifier is 72% when the supply voltage is 24 V. The peak to peak output-voltage is
- (a) 20 V (b) 22 V
(c) 25 V (d) 16 V
25. The total capacity of ROM with 1024 rows and 4 columns is
- (a) 4096 (b) 1024
(c) 256 (d) 512
26. A 4 bit ripple counter and a 4 bit synchronous counter are made using flip-flops having a propagation delay of 10 ns each. If the worst case delay in the ripple counter and the synchronous counter be R and S respectively, then
- (a) R=10 ns, S=40 ns (b) R=40 ns, S=10 ns
(c) R=10 ns, S=30 ns (d) R=30 ns, S=10 ns
27. In a bistable multivibrator, commutating capacitors are used to
- (a) increase the base storage charge (b) provide a.c. coupling
(c) increase the speed of response (d) alter the frequency of the output
28. The unity gain frequency of an op-amp is 1 MHz for a non inverting amplifier. The value of rise time when a negative feedback is used with $A_f=1000$, is given by
- (a) 3.5 m sec (b) 35 m sec
(c) 0.35 m sec (d) 0.035 msec
29. What is the minimum number of NAND gates required to implement $A + \overline{A}\overline{B} + \overline{A}B$?
- (a) 0 (b) 1
(c) 4 (d) 7
30. What is the purpose of impedance matching between the output of previous stage and input of next stage in a cascaded amplifier?
- (a) To achieve high efficiency (b) To achieve maximum power transfer
(c) To achieve reduced distortion (d) To achieve reduced noise
31. The program counter in a 8085 microprocessor is a 16-bit register, because
- (a) It counts 16 bits at time
(b) There are 16 address lines
(c) It facilitates the user storing 16-bit data temporarily
(d) It has to fetch two 8-bit data at a time
32. The interfacing device used for the generator of accurate time delay in a microcomputer system is
- (a) Intel-8251 (b) Intel-8257
(c) Intel-8253 (d) Intel-8259
33. An I/O processor controls the flow of information between
- (a) cache memory and I/O devices (b) main memory and I/O devices
(c) two I/O devices (d) cache and main memories
34. In an 8085 microprocessor system, the RST instruction will cause an interrupt
- (a) only if an interrupt service routine is not being executed
(b) only if a bit in the interrupt mask is made 0
(c) only if interrupts have been enabled by an EI instruction
(d) none of these

35. Memory-mapped I/O-scheme for the allocation of address to memories and I/O devices, is used for
(a) small systems (b) large systems
(c) both large and small systems (d) very large systems
36. The highest priority of interrupt in 8085 microprocessor system is
(a) RST 7.5 (b) RST 6.5
(c) INTR (d) TRAP
37. In a 16-bit microprocessor, words are stored in two consecutive memory locations. The entire word can be read in one operations provided the first
(a) word is even (b) word is odd
(c) memory location is odd (d) memory address is even
38. In a microprocessor, the register which holds the address of the next instruction to be fetched is
(a) accumulator (b) program counter
(c) stack pointer (d) instruction register
39. What is the direction of control bus?
(a) Unidirectional into mP
(b) Unidirectional out of mP
(c) Bidirectional
(d) Mixed direction i.e. some lines into mP and some others out of mP
40. What is the total number of memory locations and input-output devices that can be addressed with a processor having 16-bits address bus, using memory mapped I/O?
(a) 64K memory locations and 256 I/O devices
(b) 256 I/O devices and 65279 memory locations
(c) 64K memory locations and no I/O devices
(d) 64K memory locations or input-output devices
41. How many and which types of machine cycles are needed to execute PUSH PSW an Intel 8085 A microprocessor
(a) 2, Fetch and memory write (b) 3, Fetch and 2 memory write
(c) 3, Fetch and 2 memory read (d) 3, Fetch, Memory read and memory write
42. Consider the following 8085 instruction
MVI A, A9H
MVI B, 57H
ADD B
ORA A
The flag status (S, Z, CY) after the instruction ORA A is executed, is
(a) (0, 1, 1) (b) (0, 1, 0)
(c) (1, 0, 0) (d) (1, 0, 1)
43. Both the ALU and control section of CPU employ which special purpose storage locations?
(a) Buffers (b) Decoders
(c) Accumulators (d) Registers
44. The synchronisation between micro-processor and memory is done by
(a) ALE signal (b) HOLD signal
(c) READY signal (d) None of these

45. The instruction INR B is executed if
- (a) carry is generated after addition
 - (b) carry is not generated after addition
 - (c) zero is the result of summation
 - (d) zero is not the result of summation
46. If push and pop operation on a stack takes 1 unit time, how much time would it take to delete an element in n^{th} position to bottom?
- (a) 1
 - (b) n
 - (c) n^2
 - (d) Cannot be determined from the given data
47. In 8085 microprocessor, the value of the most significant bit of the result following the execution of any arithmetic or Boolean instruction is stored in the
- (a) carry status flag
 - (b) auxiliary carry status flag
 - (c) sign status flag
 - (d) zero status flag
48. The power failure alarm must be connected to which one of the following interrupt of 8085?
- (a) RST 7.5
 - (b) TRAP
 - (c) INTR
 - (d) HOLD
49. In an 8085 microprocessor, the instruction CMP B has been executed while the contents of accumulation is less than of register B. As result carry flag and zero flag will be respectively.
- (a) set, reset
 - (b) reset, set
 - (c) reset, reset
 - (d) set, set
50. When RET instruction is executed by any subroutine then
- (a) the top of the stack will be popped out and assigned to the PC
 - (b) without any operation, the calling program would resume from instruction immediately following the call instruction
 - (c) the PC will be incremented after the execution of the instruction
 - (d) without any operation, the calling program would resume from instruction immediately following the call incremented after the execution of the instruction
51. The transmission bandwidth is doubled in FM. The SNR is
- (a) also doubled
 - (b) improved four fold
 - (c) decreased by one fourth
 - (d) unaffected
52. Consider the case that noise phase modulates the FM wave. As the noise sideband frequency approaches the carrier frequency, the noise amplitude
- (a) remains constant
 - (b) is decreased
 - (c) is increase
 - (d) is equalized
53. Which one of the following statements is correct? The capacitor charging time in the AM envelope demodulator is based on the time for one
- (a) half cycle of the carrier frequency
 - (b) quarter cycle of the carrier frequency
 - (c) half cycle of the lowest audio frequency
 - (d) quarter cycle of the highest audio frequency
54. To overcome slope overload problem, which type of the integrator is used in delta modulation?
- (a) Fixed slope integrator
 - (b) Variable slope integrator
 - (c) Linear slope integrator
 - (d) Bipolar integrator
55. The waveform $A \cos(\omega_1 t + k \cos \omega_2 t)$ is
- (a) amplitude modulated
 - (b) frequency modulated
 - (c) phase modulated
 - (d) frequency as well as phase modulated

56. A carrier is amplitude modulated by 4 signals of frequency 10 kHz, 15 kHz, 20 kHz and 25 kHz. What is the bandwidth of the modulated signal?
- (a) 25 kHz (b) 50 kHz
(c) 70 kHz (d) 140 kHz
57. An analog signal having 5 KHz bandwidth is sampled at double times the nyquist rate, and each sample is quantised into one of 256 equally likely levels. The information rate of this source is
- (a) 80 kb/s (b) 160 kb/s
(c) 240 kb/s (d) 320 kb/s
58. In an AM system, for satisfactory operation, carrier frequency must be n times the bandwidth of message-signal. What is the value of n?
- (a) > 2 (b) > 5
(c) > 10 (d) > 50
59. In double sideband suppressed carrier modulation, the modulated wave undergoes phase reversal, whenever
- (a) modulating signal's amplitude decreases (b) modulating signal's amplitude increases
(c) modulating signal crosses zero (d) carrier signal crosses zero
60. The transmission bandwidth is doubled in FM. The SNR is
- (a) also doubled (b) improved four fold
(c) decreased by one fourth (d) unaffected
61. A pre-emphasis circuit provides extra noise immunity by
- (a) boosting the bass frequencies (b) amplifying the higher audio frequencies
(c) pre-amplifying the whole audio band (d) converting the phase modulation to FM
62. For a pulse amplitude modulation (PAM) transmission of voice signal having maximum frequency $f_m=3$ KHz. Calculate the transmission bandwidth given sampling frequency $f_s=8$ KHz and pulse duration $z=0.1 T_s$
- (a) $BW \geq 20$ KHz (b) $BW \geq 80$ KHz
(c) $BW \geq 40$ KHz (d) None of these
63. The most common modulation system used for telegraphy is
- (a) Frequency-shift keying (b) Two tone modulation
(c) Pulse-code modulation (d) Single-tone modulation
64. 15 signal each bandlimited to 15 KHz are to be transmitted over a single channel by frequency division multiplexing. If AM-SSB modulation guardband of 3 KHz is used, the bandwidth of multiplex signal will be
- (a) 267 KHz (b) 270 KHz
(c) 534 KHz (d) 540 KHz
65. An FM signal with a deviation δ is passed through a mixer, and has its frequency reduced fivefold. The deviation in the output of the mixer is
- (a) 5δ (b) indeterminate
(c) $\delta/5$ (d) δ
66. In an FM stereo multiplex transmission, the
- (a) sum signal modulates the 19 kHz subcarrier
(b) difference signal modulates the 19 kHz subcarrier
(c) difference signal modulates the 38 kHz subcarrier
(d) difference signal modulates the 67 kHz subcarrier

67. If two signals modulate the same carrier with different modulation depths of 0.3 and 0.9, the resulting modulation signal will
- (a) be over-modulated
 - (b) have the resultant modulation limited to 1.0
 - (c) have the resultant modulation index around 0.82
 - (d) have the resultant modulation index around 0.95
68. To prevent overloading of the last IF amplifier in a receiver, one should use
- (a) Squelch
 - (b) Variable sensitivity
 - (c) Variable selectivity
 - (d) Double conversion
69. One of the following methods cannot be used to remove the unwanted sideband in SSB. This is the
- (a) filter system
 - (b) phase-shift method
 - (c) third method
 - (d) balanced modulator
70. The purpose of free-wheeling in a thyristor controlled ac to dc converter is to
- (a) Reduce the current of its associated thyristor to zero so that commutation can take place
 - (b) Share the load current of its associated thyristor
 - (c) Conduct the load current when its associated thyristor is turned off
 - (d) Maintain voltage across load at constant value
71. A gate-turn-off (GTO) thyristor
- (a) Requires a special turn-off circuit like a thyristor
 - (b) Can be turned off by removing the gate pulse
 - (c) Can be turned off by a negative current pulse at the gate
 - (d) Can be turned off by a positive current pulse at the gate
72. Inverters are used in
- (a) Induction heating
 - (b) UPS
 - (c) Both
 - (d) None of these
73. The main reason for connecting a pulse transformer at a output stage of a thyristor triggering circuit is to
- (a) amplify the power of the triggering pulse
 - (b) provide electrical isolation
 - (c) reduce the turn on time of the thyristor
 - (d) avoid spurious triggering of the thyristor due to noise
74. Turn-on and turn-off times of transistor depend on
- (a) Static characteristic
 - (b) Junction capacitances
 - (c) Current gain
 - (d) None of these
75. A chopper operating at a fixed frequency is feeding an R-L load. As the duty ration of the chopper increased from 25% to 75%, the ripple in the load current
- (a) remains constant
 - (b) decreases, reaches a minimum at 60% duty ratio and then increases
 - (c) increases, reaches a maximum at 50% duty ratio and then decreases
 - (d) keeps on increasing as the duty ratio is increased
76. The most suitable device for high frequency inversion in SMPS is
- (a) BJT
 - (b) IGBT
 - (c) MOSFET
 - (d) GTO

77. Which semiconductor power device out of the following is not a current triggered device?
- (a) Thyristor (b) GTO
(c) Triac (d) MOSFET
78. If the amplitude of the gate pulse to thyristor is increased then
- (a) both delay time and rise time would increase
(b) the delay time would increase but the rise time would decrease
(c) the delay time would decrease but the rise time would increase
(d) the delay time would decrease while the rise time remains unaffected
79. A voltage source inverter is normally employed when
- (a) source inductance is large and load inductance is small
(b) source inductance is small and load inductance is large
(c) both load and source inductances are small
(d) both source and load inductances are large
80. An inter-group reactor is used in a single-phase cycloconverter circuit to
- (a) Reduced current-ripples (b) Reduce voltage-ripples
(c) Limit circulating current (d) Limit di/dt in the semiconductor switch
81. a.c. voltage regulators are widely used in
- (a) traction drives
(b) fan drives
(c) synchronous motor drives
(d) slip power recovery scheme of slip-ring induction motor
82. If a diode is connected anti-parallel with a thyristor, then
- (a) both turn-off power loss and turn-off time decrease
(b) turn-off power loss decreases but turn-off time increases
(c) turn-off power loss increases but turn-off time decreases
(d) the arrangement works as a triac
83. What is the waveform of the current flowing through the diode in a buck-boost converter
- (a) Square wave (b) Triangular wave
(c) Trapezoidal wave (d) Sinusoidal wave
84. In a thyristor, ratio of latching current to holding current is
- (a) 0.4 (b) 1.0
(c) 2.5 (d) 6.0
85. R-C snubber is used in parallel with the thyristor to
- (a) reduce dv/dt across it
(b) reduce di/dt through it
(c) limit current through the thyristor
(d) ensure its conduction after gate signal is removed
86. AC voltage regulators are widely used in
- (a) traction drives
(b) fan drives
(c) synchronous motor drives
(d) slip power recovery scheme of slip-ring induction motor

87. A current source inverter is obtained by inserting a large
(a) inductance in series with dc supply (b) capacitance in parallel with dc supply
(c) inductance in parallel with dc supply (d) capacitance in series with dc supply
88. In a three-phase semi-conductor, if firing angle is less than or equal to 60° , then the duration of conduction of each thyristor and diode would be respectively
(a) 60° and 60° (b) 90° and 30°
(c) 120° and 120° (d) 180° and 180°
89. A d.c. chopper has a resistive load of 10 ohms and an input voltage of 220 V. When the chopper switch is 'ON', its voltage drop is 2V and the chopping frequency is 1 KHz. If the duty cycle is 50%, then the average output voltage will be
(a) 100 V (b) 103 V
(c) 106 V (d) 109 V
90. In a switched-mode power supply (SMPS), after conversion of a.c. supply to a highly filtered d.c. voltage, a switching transistor is switched ON and OFF at a very high speed by a pulse width modulator (PWM) which generates very-high frequency square pulses. The frequency of the pulses typically in the range of
(a) 100 Hz-200Hz (b) 500 Hz-1 kHz
(c) 2 kHz-5 kHz (d) 20 kHz-50 kHz
91. The feedback diodes in a d.c. to a.c. thyristor inverter
(a) freewheeling the load current
(b) provide reverse bias effectively to the thyristors for turn-off
(c) improve the switching properties of the inverter
(d) improve the harmonic distortion of the inverter output current
92. In forward-bias portion of the thyristor's i-v characteristic, the number of stable operating regions is
(a) One (b) Two
(c) Three (d) None
93. In a three phase voltage source inverter operating in a square wave mode, the output line voltage is free from
(a) 3rd harmonic (b) 7th harmonic
(c) 11th harmonic (d) 13th harmonic
94. In single-pulse modulation of PWM inverters, the pulse width is 120° . For an input voltage of 220 V dc, the r.m.s. value of output voltage is
(a) 179.63 V (b) 254.04 V
(c) 127.02 V (d) 185.04 V
95. In a commutation circuit employed to turn off an SCR, satisfactory turn-off is obtained when
(a) circuit turn-off time < device turn-off time (b) circuit turn-off time > device turn-off time
(c) circuit time constant > device turn-off time (d) circuit time constant < device turn-off time
96. In a thyristor dc chopper, which type of commutation results in best performance?
(a) Voltage commutation (b) Current commutation
(c) Load commutation (d) Supply commutation

- 97.** In phase controlled rectifiers
- (a) the power factor is unaffected by phase control
 - (b) the power factor worsens if the delay angle is small
 - (c) the power factor worsens for increasing delay angle
 - (d) the power factor worsens for large output voltage
- 98.** The circulating current inductor is required in a dual converter to
- (a) Improve power factor
 - (b) Smoothen the waveform of circulating current
 - (c) Limit the circulating current
 - (d) Increase the circulating current
- 99.** The feedback diodes in a d.c. to a.c. thyristor inverter
- (a) Freewheel the load current
 - (b) Provide reverse bias effectively to the thyristors for turn-off
 - (c) improve the switching properties of the inverter
 - (d) improve the harmonic distortion of the inverter output current
- 100.** When a line commutated converter operates in the inverter mode, it
- (a) draws both real and reactive power from the ac supply
 - (b) delivers both real and reactive power to the ac supply
 - (c) delivers real power to the ac supply
 - (d) draws reactive power from the ac supply

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