

# MIZORAM PUBLIC SERVICE COMMISSION

## COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF INSPECTOR OF FACTORIES UNDER LABOUR, EMPLOYMENT, SKILL DEVELOPMENT & ENTREPRENEURSHIP DEPARTMENT, GOVERNMENT OF MIZORAM, 2019

### ELECTRICAL ENGINEERING PAPER - III

Time Allowed : 2 hours

Full Marks : 200

*All questions carry equal marks of 2 each.*

*Attempt all questions.*

- Reverse recovery current in a diode depends upon -
  - forward field current
  - storage charge
  - temperature
  - PIV
- The junction capacitance of a p-n junction depends on -
  - doping concentration only
  - applied voltage only
  - both doping concentration and applied voltage
  - barrier potential only
- Under small signal operation of a diode -
  - its bulk resistance increases
  - its junction resistance predominates
  - it acts like a closed switch
  - it behaves as a clipper
- A zener diode works on the principle of -
  - tunnelling of charge carriers across the junction
  - thermionic emission
  - diffusion of charge carriers across the junction
  - hopping of charge carriers across the junction
- Silicon diode is less suited for low voltage rectifier operation because -
  - it can withstand high temperature
  - its reverse saturation current is low
  - its cut-in voltage is high
  - its breakdown voltage is high
- To obtain very high input and output impedance in a feedback amplifier, the topology mostly used in -
  - voltage series
  - current series
  - voltage shunt
  - current shunt
- A p-n junction diode's dynamic conductance is directly proportional to -
  - the applied voltage
  - the temperature
  - its current
  - the thermal voltage
- The depletion region in semiconductor p-n junction diode has -
  - electrons and holes
  - positive and negative ions on either side
  - neither electron nor ion
  - no holes
- The Ebers-Moll model is applicable to -
  - bipolar junction transistors
  - NMOS transistors
  - unipolar junction transistor
  - junction field-effect transistors

10. In a forward biased photo diode with increase in incident light intensity, the diode current -  
(a) increase  
(b) remain constant  
(c) decrease  
(d) remaining constant, the voltage drop across the diode increase
11. As compared to full wave rectifier using two diodes, the four diode bridge rectifier has the dominant advantage of -  
(a) higher current carrying capacity  
(b) lower peak inverse voltage requirement  
(c) lower ripple factor  
(d) higher efficiency
12. A tunnel diode is -  
(a) high resistivity p-n junction diode  
(b) a slow switching device  
(c) an amplifier device  
(d) a very heavily doped p-n junction diode
13. Why is an external pass resistor used in a voltage regulator?  
(a) For short circuit protection  
(b) For increasing the current that regulator can handle  
(c) For increasing the output voltage  
(d) For improving the regulation
14. The gain of a bipolar transistor drops at high frequencies. This is because of the -  
(a) Coupling and bypass capacitors  
(b) Early effect  
(c) Inter-electrode transistor capacitance  
(d) Both (a) & (c)
15. A triangular-square wave generator uses -  
(a) A sine wave oscillation and a comparator  
(b) An integrator and a comparator  
(c) A differentiator and a comparator  
(d) A sine wave oscillator and a clipper
16. Negative feedback in an amplifier -  
(a) reduces gain  
(b) increases frequency and phase distortions  
(c) reduces bandwidth  
(d) increases noise
17. A differential amplifier is invariably used in the input stage of all op-amps. This is done basically to provide the op-amps with a very high -  
(a) CMMR  
(b) Bandwidth  
(c) Slew rate  
(d) Open-loop gain
18. The cascade amplifier is a multistage configuration of -  
(a) CC-CB  
(b) CE-CB  
(c) CB-CC  
(d) CE-CC
19. For a given op-amp,  $CMMR = 10^5$  and differential gain =  $10^5$ . What is the common mode gain of the op-amp?  
(a)  $10^{10}$   
(b)  $2 \times 10^5$   
(c)  $10^5$   
(d) 1
20. The race around condition exists in J-K flip flop if -  
(a)  $J = 0, K = 1$   
(b)  $J = 1, K = 1$   
(c)  $J = 0, K = 0$   
(d)  $J = 1, K = 1$
21. Which type of the following flip-flop cannot be converted to D-type flip-flop -  
(a) S-R flip-flop  
(b) J-K flip-flop  
(c) Master slave flip-flop  
(d) None of these

22. How many FFs are needed for MOD-16 ring counter and MOD-16 Johnson counter?  
(a) 16, 16 (b) 16, 8  
(c) 4, 8 (d) 8, 16
23. The open collector output of two 2- input NAND gates are connected to a common pull-up resistor. If the inputs of the gates are A, B and C, D respectively, the output is equal to -  
(a)  $\overline{A.B.C.D}$  (b)  $\overline{A.B} + \overline{C.D}$   
(c)  $A.B + C.D$  (d)  $A.B.C.D$
24. The minimised form of the logical expression  $\overline{A}BC + A\overline{B}C + \overline{A}B\overline{C} + A\overline{B}\overline{C}$  is -  
(a)  $\overline{A}C + \overline{B}C + \overline{A}B$  (b)  $\overline{A}C + \overline{B}C + \overline{A}B$   
(c)  $\overline{A}C + \overline{B}C + \overline{A}B$  (d)  $\overline{A}C + \overline{B}C + \overline{A}B$
25. Which one of the following statement is not correct? Conversion of EXCESS-3 code to BCD can be achieved by using -  
(a) Discrete gates (b) 4 : 16 demultiplexer  
(c) A 4 bit full adder (d) A 4 bit half adder
26. In Boolean algebra if  $F = (A + B)(\overline{A} + C)$  then -  
(a)  $F = AB + \overline{A}C$  (b)  $F = AB + \overline{A}B$   
(c)  $F = AC + \overline{A}B$  (d)  $F = \overline{A}C + \overline{A}B$
27. Minimum number of J-K flip-flops needed to construct a BCD counter is -  
(a) 2 (b) 3  
(c) 4 (d) 5
28. Component most likely used for computer static RAM technology is -  
(a) primary memory (b) secondary storage  
(c) cache memory (d) CPU registers
29. Computer memory which is used to store programs and data currently being processed by CPU is -  
(a) mass memory (b) RAM  
(c) non volatile memory (d) PROM
30. Which of the following is not a type of memory?  
(a) RAM (b) FEPROM  
(c) EEPROM (d) ROM
31. An instruction used to set the carry Flag in a computer can be classified as -  
(a) data transfer (b) arithmetic  
(c) logical (d) program control
32. If instruction RST-5 is written in a program. The programme will jump to location -  
(a) 0020 H (b) 0024 H  
(c) 0028 H (d) 002 CH
33. In an 8085 microprocessor system with memory mapped I/O -  
(a) I/O devices have 16 bit addresses  
(b) I/O devices are accessed using IN and OUT instruction  
(c) there can be a maximum of 256 input devices and 256 output devices  
(d) arithmetic and logic operations can be directly performed with the I/O data

34. The highest priority of interrupt in 8085 microprocessor system is -  
(a) RST 7.5 (b) RST 6.5  
(c) INTR (d) TRAP
35. The mnemonics used in writing a program is called -  
(a) assembly language (b) fetch cycle  
(c) microinstruction (d) object program
36. The stack pointer in the 8085 microprocessor is a -  
(a) 16 bit register that point to stack memory locations  
(b) 16 bit accumulator  
(c) memory location in the stack  
(d) flag register used for the stack
37. In 8085 microprocessor system, the direct addressing instruction is -  
(a) MOV A, B (b) MOV B, 0AH  
(c) MOV C, M (d) STA addr
38. What is the memory word addressing capability in 8085?  
(a) 32 K (b) 64 K  
(c) 256 K (d) 512 K
39. Which one of the following is NOT a vectored interrupted?  
(a) TRAP (b) INTR  
(c) RST 3 (d) RST 7.5
40. The number of output pins of a 8085 microprocessor are -  
(a) 40 (b) 27  
(c) 21 (d) 19
41. The number of hardware interrupts (which require an external signal to interrupt) present in an 8085 microprocessor -  
(a) 1 (b) 4  
(c) 5 (d) 15
42. When a subroutine is called, the address of the instruction following the CALL instruction is stored in/on the -  
(a) Stack pointer (b) Accumulator  
(c) Program counter (d) Stack
43. The synchronisation between microprocessor and memory is done by -  
(a) ALE signal (b) HOLD signal  
(c) READY signal (d) None of these
44. A typical cell, for a dynamic RAM can be implemented by using how many MOS transistor?  
(a) Six (b) Five  
(c) One (d) Two
45. In the 8085 microprocessor, the RST6 instruction transfers the program execution to the following locations -  
(a) 30H (b) 24H  
(c) 48H (d) 60H

46. If the accumulator of an Intel 8085 A microprocessor contains 37 H and the previous operation has set the carry flag, the instruction ACI 56 H will result in -
- (a) 8E H (b) 94 H  
(c) 7E H (d) 84 H
47. The contents of accumulator after the execution of following instruction will be -
- MVIA, A7H  
ORA A  
RLC
- (a) CFH (b) 4FH  
(c) 4EH (d) CEH
48. The instruction that does not clear the accumulator of 8085 is -
- (a) XRA A (b) ANI 00H  
(c) MVI A, 00H (d) None of these
49. Effective address is calculated by adding or subtracting displacement value to -
- (a) immediate address (b) relative address  
(c) absolute address (d) base address
50. A 8085 microprocessor program uses all available Jump instructions, each only once. For this program, the total memory (in Bytes) occupied by the Jump instructions is -
- (a) 30 (b) 27  
(c) 24 (d) 18
51. Which one of the following 8085 assembly language instructions does not affect the contents of the accumulator?
- (a) CMA (b) CMP B  
(c) DAA (d) ADD B
52. A microprocessor has 24 address lines and 32 data lines. If it uses 10 bits of op-code, the size of its Memory Buffer Register is -
- (a) 22 bits (b) 24 bits  
(c) 32 bits (d) 14 bits
53. The transmission bandwidth is doubled in FM. The SNR is -
- (a) also doubled (b) improved four fold  
(c) decreased by one fourth (d) unaffected
54. 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 equalised
55. The range of superheterodyne receiver tuning when  $f_{LO} > f_C$  with broadcast frequency ranges 540 to 1600 kHz is -
- (a) 85 – 1145 kHz (b) 540 – 1600 kHz  
(c) 995 – 2055 kHz (d) 1450 – 2510 kHz
56. For 15 bit PCM system the signal to quantisation noise ratio is 20 dB. If the number of bits are increased by 4, the signal to quantisation noise will be -
- (a) increase by 6 dB (b) increase by 12 dB  
(c) increase by 18 dB (d) increase by 24 dB

57. In a low-level AM system, amplifiers following the modulator stage must be -  
(a) linear devices (b) harmonic devices  
(c) class C amplifiers (d) nonlinear devices
58. The noise temperature about 4306K. The noise figure will be -  
(a) 3 dB (b) 6 dB  
(c) 12 dB (d) 24 dB
59. The most commonly used filters in SSB generation are -  
(a) mechanical (b) RC  
(c) LC (d) low-pass
60. Indicate which of the following circuits cannot demodulate SSB -  
(a) Balanced modulator (b) Product detector  
(c) BFO (d) Phase discriminator
61. Addition of two periodic signals will always be -  
(a) Periodic (b) Aperiodic  
(c) May or may not be periodic (d) Insufficient data
62. Indicate which of the following systems is digital -  
(a) Pulse-position modulation (b) Pulse-code modulation  
(c) Pulse-width modulation (d) Pulse-frequency modulation
63. The modulation index of an AM wave is changed from 0 to 1. The transmitted power is -  
(a) unchanged (b) halved  
(c) doubled (d) increased by 50 percent
64. 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
65. Satellite used for intercontinental communications are known as -  
(a) Comsat (b) Domsat  
(c) Marisat (d) Intelsat
66. A 50.004 MHz carrier is to be frequency modulated by a 3 KHz audio tone resulting in a narrow band FM signal. Determine the bandwidth of the FM signal -  
(a) 2 KHz (b) 4 KHz  
(c) 6 KHz (d) 4 MHz
67. Which of the following pulse modulation systems is analog?  
(a) PCM (b) Differential PCM  
(c) PWM (d) Delta
68. If the number of bits per sample in PCM system is increased from  $n$  to  $n+1$ , then the improvement in signal to quantization noise ratio will be -  
(a) 3 dB (b) 6 dB  
(c)  $2n$  dB (d) 0 dB
69. The output of the vertical amplifier applied to the yoke in a TV receiver consists of -  
(a) direct current (b) amplified vertical sync pulses  
(c) a sawtooth voltage (d) a sawtooth current

70. The video voltage applied to the picture tube of a television receiver is fed in -  
(a) between grid and ground (b) to the yoke  
(c) to the anode (d) between grid and cathode
71. A superheterodyne receiver with an IF of 450 kHz is tuned to a signal at 1200 kHz. The Image frequency is -  
(a) 750 kHz (b) 900 kHz  
(c) 1650 kHz (d) 2100 kHz
72. On increasing the number of pulse in rectification the form factor, ripple frequency and efficiency -  
(a) all increase (b) decrease, decrease and increase respectively  
(c) decrease, increase and increase respectively (d) increase, decrease and increase respectively
73. IGBT is used for application in -  
(a) Low power (b) Medium power  
(c) High power (d) None of these
74. TRIAC cannot be used in a.c. voltage regulator for a -  
(a) resistive load (b) back emf load  
(c) inductive load (d) resistive inductive load
75. 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
76. Turn on and turn-off times of a transistor depend on -  
(a) Static characteristics (b) Junction capacitance  
(c) Current gain (d) None of these
77. In the case of a thyristor, di/dt capability can be improved by -  
(a) thermal triggering (b) voltage triggering  
(c) dv/dt triggering (d) gate pulse triggering
78. In a thyristor anode current made up of -  
(a) electrons only (b) electrons or holes  
(c) electrons and holes (d) holes only
79. In a three phase full wave a.c. to d.c. converter, the ratio of output ripple frequency to the supply voltage frequency is -  
(a) 2 (b) 3  
(c) 6 (d) 12
80. A four quadrant chopper cannot be operated as -  
(a) one quadrant chopper (b) cyclo-converter  
(c) inverter (d) bi-directional rectifier
81. A forward voltage can be applied to an SCR after its -  
(a) anode current reduces to zero (b) gate recovery time  
(c) reverse recovery time (d) anode voltage reduces to zero

82. In a 3 phase full converter, the output voltage during overlap is equal to -  
(a) Zero  
(b) Source voltage  
(c) Source voltage minus the inductance drop  
(d) Average value of the conducting phase voltages
83. A single phase diode bridge rectifier supplies a highly inductive load. The load current can be assumed to be ripple free. The ac supply side current waveform will be -  
(a) sinusoidal  
(b) constant dc  
(c) square  
(d) triangular
84. Which of the following does not cause permanent damage of an SCR?  
(a) high current  
(b) high rate of rise of current  
(c) high temperature rise  
(d) high rate of rise of voltage
85. Which of the following devices should be used as a switch in a low power switched mode power supply (SMPS)?  
(a) GTO  
(b) MOSFET  
(c) TRIAC  
(d) THYRISTOR
86. In a thyristor, ratio of latching current to holding current is -  
(a) 0.4  
(b) 1.0  
(c) 2.5  
(d) 6.0
87. In dc choppers, per unit ripple is maximum when duty cycle  $a$  is -  
(a) 0.1  
(b) 0.3  
(c) 0.5  
(d) 0.7
88. The function of snubber circuit connected across an SCR is to -  
(a) suppress  $dv/dt$   
(b) increase  $dv/dt$   
(c) decrease  $dv/dt$   
(d) keep transient overvoltage at a constant value
89. In a three phase voltage source inverter operating in square wave mode, the output line voltage is free from -  
(a) 3<sup>rd</sup> harmonic  
(b) 7<sup>th</sup> harmonic  
(c) 11<sup>th</sup> harmonic  
(d) 13<sup>th</sup> harmonic
90. In a single phase full converter, for continuous conduction, each pair of SCRs conduct for -  
(a)  $\pi - a$   
(b)  $\pi$   
(c)  $a$   
(d)  $\pi + a$
91. A freewheeling diode across inductive load will provide -  
(a) quick turn on  
(b) slow turn off  
(c) reduced utilization factor  
(d) improved power factor
92. Reactive loading of supply lines by a converter is directly dependent on -  
(a) displacement angle only  
(b) displacement angle and distortion factor  
(c) back emf in the load circuit  
(d) circuit configuration
93. In a 3-phase full converter, the six SCRs are fired at an interval of -  
(a)  $30^\circ$   
(b)  $60^\circ$   
(c)  $90^\circ$   
(d)  $120^\circ$

94. In single pulse modulation of PWM inverters, the pulse width is  $120^\circ$ . 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. A step up chopper has source voltage 50 V and output 100 V. If the pulse width is 10  $\mu$ sec, the chopping frequency will be -
- (a) 50 KHz (b) 100 KHz  
(c) 5 KHz (d) 10 KHz
96. Power electronic device with poor turn off gain is -
- (a) a symmetrical thyristor (b) a conventional thyristor  
(c) power bipolar junction transistor (d) gate turn off thyristor
97. A chopper, where voltage as well as current remain negative, is known as -
- (a) type-A (b) type-B  
(c) type-C (d) type-D
98. In a single phase modulation of PWM inverters, third harmonics can be eliminated if pulse width is equal to -
- (a)  $30^\circ$  (b)  $60^\circ$   
(c)  $120^\circ$  (d)  $150^\circ$
99. In a 3-phase bridge inverter, the line to line voltage waveform is
- (1) square wave for  $180^\circ$  mode  
(2) square wave for  $120^\circ$  mode  
(3) stepped wave for  $180^\circ$  mode  
(4) stepped wave for  $120^\circ$  mode
- From these, the correct statements are -
- (a) 1, 3 (b) 2, 3  
(c) 1, 4 (d) 2, 4
100. If a diode is connected in 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) none of these

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