

**MIZORAM PUBLIC SERVICE COMMISSION**  
**TECHNICAL COMPETITIVE EXAMINATIONS FOR**  
**JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE (AE/SDO)**  
**UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT,**  
**GOVERNMENT OF MIZORAM, JANUARY-2024**

**ELECTRICAL ENGINEERING**  
**PAPER-III**

Time Allowed : 3 hours

FM : 200

**SECTION - A (Multiple Choice questions) (100 Marks)**

*All questions carry equal mark of 2 each. Attempt all questions.*

*This Section should be answered only on the OMR Response Sheet provided.*

1. The simplified form of logic function  $Y = \overline{(A.B)} \cdot \overline{(A.B)}$  is
  - (a)  $A+B$
  - (b)  $AB$
  - (c)  $\overline{A} + \overline{B}$
  - (d)  $\overline{AB} + A\overline{B}$
2. The binary number 110011 is to be converted to gray code. The number of gates and type required are
  - (a) 6, AND
  - (b) 6, XNOR
  - (c) 6, XOR
  - (d) 5, XOR
3. If  $\alpha = 0.98$ ,  $I_{CO} = 6\mu A$  and  $I_B = 100\mu A$  for a transistor, then the value of  $I_C$  will be
  - (a) 2.3 mA
  - (b) 3.1 mA
  - (c) 4.6 mA
  - (d) 5.2 mA
4. The output  $Q_n$  of a J-K flip-flop is zero. If change to 1 when a clock pulse is applied. The output  $J_n$  and  $K_n$  are respectively
  - (a) 1 and X
  - (b) 0 and X
  - (c) X and 0
  - (d) X and 1
5. In a communication system, noise is most likely to affect the signal
  - (a) at the transmitter
  - (b) in the channel
  - (c) in the information source
  - (d) at the destination
6. A tunnel diode is
  - (a) High resistivity p-n junction diode
  - (b) A slow switching device
  - (c) An amplifying device
  - (d) A very heavily doped p-n junction diode
7. The effective channel length of a MOSFET in saturation decreases
  - (a) gate voltage
  - (b) drain voltage
  - (c) source voltage
  - (d) body voltage

8. An 'Assembler' for a microprocessor is used for
  - (a) Assembly of processors in a production line
  - (b) Creation of new programs using different modules
  - (c) Translation of a program from assembly language to machine language
  - (d) Translation of a higher level language into English text
9. How many I/O ports can be accessed by direct method?
  - (a) 8
  - (b) 256
  - (c) 32 K
  - (d) 64 K
10. An advantage of memory interlacing is that
  - (a) a larger memory is obtained
  - (b) effective speed of the memory is increased
  - (c) the cost of the memory is reduced
  - (d) a non-volatile memory is obtained
11. 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
12. The program counter in a 8085 microprocessor is a 16-bit register, because
  - (a) Small systems
  - (b) Large systems
  - (c) Both large and small systems
  - (d) Very large systems
13. In frequency modulation, if the frequency of the modulating voltage is doubled, the rate of deviation of carrier frequency
  - (a) doubles
  - (b) becomes four times
  - (c) becomes half
  - (d) remains unaltered
14. Which of the following 3-phase AC to DC converter requires neutral point connection?
  - (a) 3-phase semi-conduction
  - (b) 3-phase full converter
  - (c) 3-phase half-wave converter
  - (d) 3-phase full converter with diodes
15. If gate current is increased, the anode-cathode voltage at which SCR closes is
  - (a) increased
  - (b) decreased
  - (c) maximum
  - (d) least
16. For an SCR, di/dt protection is achieved through the use of
  - (a) L in series with SCR
  - (b) R in series with SCR
  - (c) RL in series with SCR
  - (d) RLC in series with SCR
17. Turn-on and turn-off times of transistor depend on
  - (a) Static characteristic
  - (b) Junction capacitances
  - (c) Current gain
  - (d) None of these
18. Which of the following logic families is well suited for high speed operations?
  - (a) TTL
  - (b) MOS
  - (c) ECL
  - (d) CMOS
19. In a double side band (DSB) full carrier AM transmission system, if modulation index is doubled, then ratio of the total sideband power to the carrier power increases by a factor of
  - (a) 1
  - (b) 2
  - (c) 3
  - (d) 4

20. The current gain of a bipolar transistor drops at high frequencies because of
- (a) Transistor capacitance
  - (b) High current effects in the base
  - (c) Parasitic inductive elements
  - (d) The early effect
21. For a full adder, determine the output for the input  $A = 1$ ,  $B = 0$ , and carry in = 1
- (a) Sum = 0 with carry of 0
  - (b) Sum = 0 with carry of 1
  - (c) Sum = 1 with carry of 0
  - (d) Sum = 1 with carry of 1
22. Determine the output frequency for a frequency division circuit that contains 12 flip-flops with an input clock frequency of 20.48 MHz.
- (a) 10.24 kHz
  - (b) 5 kHz
  - (c) 30.24 kHz
  - (d) 15 kHz
23. Number of valance electron in Germanium
- (a) 2
  - (b) 5
  - (c) 6
  - (d) 4
24. In a zener regulator, the change in load current produces, change in
- (a) Zener voltage
  - (b) Zener current
  - (c) Both (a) & (b)
  - (d) None of these
25. Which of the following flag condition is used for BCD arithmetic operations in microprocessor?
- (a) Sign flag
  - (b) Auxiliary carry flag
  - (c) Parity flag
  - (d) Zero flag
26. Negative feedback in amplifier
- (a) Reduced gain
  - (b) Reduced bandwidth
  - (c) Increase phase distortion
  - (d) Increase noise
27. FM modulation, when the modulation index increases, the transmitted power?
- (a) Half
  - (b) Decreased
  - (c) Doubled
  - (d) Unchanged
28. Which of the following is the correct sequence of operations in a microprocessor?
- (a) Opcode fetch, memory read, memory write, I/O read, I/O write
  - (b) Opcode fetch, memory write, memory read, I/O read, I/O write
  - (c) I/O read, opcode fetch, memory read, memory write, I/O write
  - (d) I/O read, opcode fetch, memory write, memory read, I/O write
29. Commercial Frequency deviation of FM is
- (a) 70 kHz
  - (b) 75 kHz
  - (c) 80 kHz
  - (d) 65 kHz
30. Which of the following type of multiplexing uses pulse code modulation?
- (a) Frequency division multiplexing
  - (b) Time division multiplexing
  - (c) Code division multiplexing
  - (d) Amplitude limited multiplexing
31. How many flip-flops are there in a flag register of 8085 microprocessor?
- (a) 4
  - (b) 5
  - (c) 7
  - (d) 10
32. In a class B amplifier, the output current flows for
- (a) Less than half input
  - (b) More than half input
  - (c) Half input
  - (d) One complete cycle

33. Which of the following is an uncontrolled device?  
(a) Power diode (b) Power transistor  
(c) Power MOSFET (d) Power IGBT
34. Which of the following is not a method of turning ON an SCR?  
(a) Gate triggering (b) Temperature triggering  
(c) Light triggering (d) Emitter triggering
35. The regenerative braking is applicable for a single-phase full-wave bridge converter at the SCR firing angle  
(a) equal to  $90^\circ$  (b) greater than  $90^\circ$   
(c) less than  $90^\circ$  (d) greater than  $180^\circ$
36. In a three-phase full converter, the six SCRs are triggered at an interval of  
(a)  $30^\circ$  (b)  $60^\circ$   
(c)  $90^\circ$  (d)  $120^\circ$
37. A DC-DC chopper can be used on  
(a) pulse-width modulation only  
(b) frequency modulation only  
(c) amplitude modulation only  
(d) both pulse with modulation and frequency modulation
38. In a current source inverter (CSI), if frequency of output voltage is  $f$  Hz, then the frequency of voltage input to CSI is  
(a)  $f$  (b)  $2f$   
(c)  $f/2$  (d)  $3f$
39. Output voltage of a single-phase bridge inverter, fed from a fixed DC source, is varied by  
(a) varying the switching frequency (b) pulse-width modulation  
(c) pulse amplitude modulation (d) All of these
40. Switched mode power supply (SMPS) is superior to linear power supplies in respect of  
(a) size and efficiency (b) efficiency and regulation  
(c) regulation and noise (d) noise and cost
41. For which of the following devices, is DMA the most suitable?  
(a) Keyboard (b) Mouse  
(c) Joy stick (d) Hard disk
42. Output of assembler in machine codes is referred to as  
(a) Object program (b) Source program  
(c) Macro-instruction (d) Symbolic addressing
43. In a low-level AM system, amplifiers following the modulator  
(a) Linear devices (b) Harmonics devices  
(c) Class C amplifiers (d) Nonlinear devices
44. Time division multiplex  
(a) can be used with PCM only  
(b) combines five groups into a supergroup  
(c) stacks 24 channels in adjacent frequency slots  
(d) interleaves pulses belonging to different transmissions

45. Quantizing noise can be reduced by increasing  
(a) bandwidth (b) sampling rate  
(c) number of standard quantum levels (d) all the these
46. In a SCR,  
(a) gate current is directly proportional to forward breakover voltage  
(b) as gate current is raised, forward breakover voltage reduces  
(c) gate current has to be kept on continuously for conduction  
(d) forward breakover voltage is low in the forward blocking state
47. If firing angle in a SCR rectifier is increased, output is  
(a) increased (b) maximum  
(c) decreased (d) unaffected
48. Removal of emitter bypass capacitor from the common emitter amplifier results  
(a) Reduced voltage gain (b) Increased voltage gain  
(c) No change in voltage gain (d) Infinity voltage gain
49. In common base amplifier which of the following is wrong?  
(a) Input impedance low (b) Voltage gain about 150  
(c) Used for audio frequency application (d) Current gain is less than one
50. The action of JFET in its equivalent circuit can be represented as  
(a) Current controlled current source (b) Current controlled voltage source  
(c) Voltage controlled current source (d) Voltage controlled voltage source

**SECTION - B (Short answer type question) (100 Marks)**

*All questions carry equal marks of 5 each.*

*This Section should be answered only on the Answer Sheet provided.*

1. Why are multistage amplifiers used? What are its drawbacks? What is the significance of a load line in an amplifier?
2. Draw the circuit of a full adder and explain.
3. Distinguish between memory mapped I/O and I/O mapped I/O.
4. What is a flag? How many flags are there in 8085? Explain the flag register of 8085 microprocessor.
5. Explain the function of ALE signal in the 8085 microprocessor.
6. What is modulation? Why is modulation necessary in communication system?
7. Explain asynchronous time division multiplexing of PCM signals.
8. Describe the holding current and latching current as applicable to an SCR with the help of its static V-I characteristics.
9. With the help of neat diagram, explain the operation of resistance firing circuit.
10. Draw the circuit of a two-quadrant chopper and explain its working briefly.

11. Explain with the help of neat power-diagram and associated waveforms, the operation of a single-phase half-wave controlled converter with RL load.
12. The number of silicon atoms per  $m^3$  is  $5 \times 10^{28}$ . This is doped simultaneously with  $5 \times 10^{22}$  atoms per  $m^3$  of Arsenic and  $5 \times 10^{20}$  per  $m^3$  atoms of Indium. Calculate the number of electrons and holes. Given that  $n_i = 1.5 \times 10^{16} m^{-3}$ . Is the material n-type or p-type?
13. Design the logic diagram of a circuit for addition/subtraction. Use a control variable  $w$  and a circuit that functions as a full-adder when  $w=0$ , as a full-subtractor when  $w=1$ .
14. Derive the expressions for higher and lower cut-off frequency of a multistage amplifier
15. Design a modulo-5 counter using D flip-flop the unused states of which go to one of the valid counting state at next clock trigger
16. Design a microprocessor system to interface an  $8K \times 8$  EPROM and  $8K \times 8$  RAM
17. What are the various differences between bipolar junction transistor (BJT) and metal-oxide semiconductor field-effect transistor (MOSFET)?
18. A single-phase full bridge diode rectifier is supplied from 230 V, 50 Hz source. The load consists of  $35 \Omega$  resistance and a large inductance so as to supplies the load current constant. Calculate average output voltage and the load current.
19. Define latching and holding current as applicable to a silicon controlled rectifier (SCR). What are the necessary conditions for turning on of an SCR?
20. What do you mean by sinusoidal pulse width modulation? Show the pulse signals generation procedure through suitable waveforms.

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