MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR
JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE, P&E CADRE (ELECTRICAL WING) UNDER POWER & ELECTRICITY DEPARTMENT,
GOVERNMENT OF MIZORAM, JULY-2023

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. FET is a device which has
   (a) high input impedance and is voltage controlled.
   (b) high input impedance and is current controlled.
   (c) low input impedance and is voltage controlled.
   (d) low input impedance and is current controlled.

2. In a transistor
   (a) the conductivity of emitter region is lower than that of base region.
   (b) conductivity of emitter and base region are of the same order.
   (c) the conductivity of emitter region is higher than that of base region.
   (d) None of above

3. A circuit in which the output voltage remains constant irrespective of the value of load resistance, uses
   (a) Silicon diode   (b) Zener diode
   (c) SCR   (d) LED

4. Which of the following transistor amplifier configurations has the highest power gain?
   (a) common base   (b) common collector
   (c) common emitter   (d) common source

5. Which of the following amplifier operations has the highest efficiency?
   (a) Class A   (b) Class B
   (c) Class C   (d) Class D

6. When P-N junction is reverse biased, then
   (a) holes and electrons are attracted towards the junction.
   (b) majority carriers are not affected.
   (c) holes and electrons move away from the junction.
   (d) the barrier breaks down.

7. A push-pull amplifier requires
   (a) equal input voltages in phase.
   (b) equal input voltages with 90° out of phase.
   (c) equal input voltages with 180° out of phase.
   (d) different input voltages with 90° out of phase.

8. Low frequency response of an RC coupled amplifier can be improved by
   (a) increasing the coupling capacitors only.
   (b) increasing the by-pass capacitors only.
   (c) increasing the by-pass capacitor as well as coupling capacitor.
   (d) decreasing the by-pass capacitor.

9. Two binary signals a and b are to be compared. The output expression when the two signals are equal is given by
   (a) $a\bar{b} + a\bar{b}$
   (b) $a\bar{b} + \bar{a}b$
   (c) $\bar{a}\,\bar{b}$
   (d) ab

10. In a full adder, there are
    (a) two binary number inputs and two outputs.
    (b) three binary digit inputs and two binary outputs.
    (c) three binary digit inputs and three binary digit outputs.
    (d) two binary digit inputs and one output.

11. Which of the following circuits can be used as parallel-to-serial converter?
    (a) Digital counter
    (b) Decoder
    (c) De-multiplexer
    (d) Multiplexer

12. The output of JK flip-flop toggles when
    (a) J=1, K=0
    (b) J=0, K=1
    (c) J=1, K=1
    (d) J=0, K=0

13. If the modulation index of an AM wave is changed from 0 to 1, the transmitted power
    (a) increase by 50%
    (b) increase by 75%
    (c) increase by 100%
    (d) remain unaffected

14. In a modulation system, if modulating frequency is double, the modulation index also becomes double. The system is
    (a) FM
    (b) AM
    (c) PM
    (d) both FM and PM

15. FM broadcast band lies in
    (a) VHF band
    (b) UHF band
    (c) SHF band
    (d) HF band

16. The disadvantage of FM over AM is that
    (a) noise is very high for high frequency signal.
    (b) larger bandwidth is required.
    (c) high modulating power is required.
    (d) none of these

17. Which of the following requirements is necessary for fast communication?
    (a) High transmitter power
    (b) Large bandwidth
    (c) Higher channel capacity
    (d) none of these

18. The size of program counter in 8085 microprocessor is

    (a) 12 bit   (b) 16 bit

    (c) 8 bit   (d) 1 byte

19. How many machine cycles does 8085 microprocessor has?

    (a) 9 machine cycles   (b) 7 machine cycles

    (c) 5 machine cycles   (d) 256 machine cycles

20. 8085 microprocessor can address up to

    (a) 65536 locations   (b) 65535 locations

    (c) 256 locations   (d) 16 locations

21. In a three-phase half-wave rectifier, the output voltage is equal to

    (a) the most positive input phase voltage at any instant.

    (b) the difference of most positive and most negative input phases at any instant.

    (c) the average value of the three phases.

    (d) the difference of the two positive phase voltages.

22. An SCR can be brought to forward conducting state with gate-circuit open when the applied voltage exceeds

    (a) the forward breakdown voltage   (b) reverse breakdown voltage

    (c) 1.5V   (d) none of these

23. During forward blocking state, a thyristor is associated with

    (a) large current, low voltage   (b) low current, large voltage

    (c) medium current, large voltage   (d) none of these

24. Turn-off time of an SCR is measured from the instant

    (a) anode current becomes zero.

    (b) anode voltage becomes zero.

    (c) anode voltage and anode current become zero at the same time.

    (d) gate current becomes zero.

25. For continuous conduction in a single-phase semi-converter, each SCR conducts for

    (a) α (b) π

    (c) $\alpha + \pi$ (d) $\pi - \alpha$

26. In a single-phase full converter, the output voltage during overlap is equal to

    (a) zero   (b) source voltage

    (c) source voltage minus the inductance drop   (d) none of these

27. A cycloconverter is a

    (a) frequency changer from higher to lower frequency with one-stage conversion.

    (b) frequency changer from higher to lower frequency with two-stage conversion.

    (c) frequency changer from lower to higher frequency with one-stage conversion.

    (d) Either (a) or (b)

28. The transistor in the circuit shown is operating in
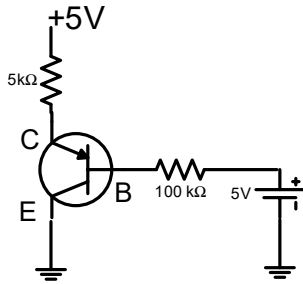
(a) cut-off region   (b) active region

(c) saturation region   (d) either in the active or saturation region

29. The type of power amplifier which exhibits crossover distortion in its output is

(a) Class A   (b) Class B

(c) Class C   (d) Class D

30. An amplifier has an open loop gain of 100, an input impedance of 1 k$\overline{\text{w}}$, and an output impedance of 100$\overline{\text{w}}$. A feedback network with a feedback factor of 0.99 is connected in a voltage series feedback mode. The new input and output impedances respectively are

(a) 10Ω and 1Ω (b) 10Ω and $10k\Omega$

(c) $100k\Omega$ and 1Ω (d) $100k\Omega$ and 10Ω

31. If a signal has frequency components which lie in the range of 0.001 Hz to 10Hz, then which of the following types of coupling should be chosen in a multistage amplifier designed to amplify this signal?

(a) RC coupling   (b) Transformer coupling

(c) Direct coupling   (d) Double-tuned coupling

32. In order to get the original signal from the sampled signal, it is necessary to use

(a) low-pass filters   (b) high-pass filters

(c) band-pass filters   (d) band-stop filters

33. A 4-bit synchronous counter uses flip-flop 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

34. A 4 bit pre-settable UP counter has preset input 0101. The preset operation takes place as soon as the counter becomes maximum 1111. The modulus of the counter is

(a) 5   (b) 10

(c) 11   (d) 15

35. A, B, C and D are input bits, and Y is the output bit in the XOR gate circuit of the figure given below. Which of the following statements about the sum S of A, B, C, D and Y is correct?
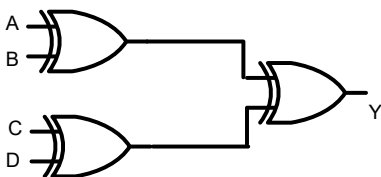
(a) S=1 only if the sum of A, B, C and D is odd   (b) S is always either zero or odd

(c) S is always either zero or even   (d) S=1 only if the sum of A, B, C and D is even

36. The output Q_n of a J-K flip-flop is zero. If it change to 1 when a clock pulse is applied, then input J_n and K_n are respectively

    (a) 1 and X   (b) 0 and X

    (c) X and 0   (d) X and 1

37. The address bus of inlet 8085 is 16 bit wide and hence the memory which can be accessed by this address bus is

    (a) 112 KB   (b) 4 KB

    (c) 16 KB   (d) 64 KB

38. How many address lines are needed to address each memory location in a 2048 x 4 memory chip?

    (a) 10   (b) 11

    (c) 12   (d) 18

39. When used with I/O devices, the term intelligent implies

    (a) a colour output capability   (b) speech processing capability

    (c) features to support offline and online tasks   (d) high speed printing capability

40. Stack pointer is a storage which comes into use

    (a) whenever a data is read from the memory

    (b) whenever a data is written into the memory

    (c) whenever the output variable is sent out of the CPU

    (d) whenever an interrupt or high priority call comes from external devices

41. In a 8085 microprocessor, the following sequence of instructions is executed:

    STC

    CMC

    MOVE A, B

    RAL

    MOVE B, A

    After the last instruction, the output will

    (a) rotate the contents of the accumulator and store it in B

    (b) get the contents of B register into accumulator and rotate it to left by one bit

    (c) double contents of B register

    (d) manipulate carry in A and B

42. The modulation index of an AM wave is changed from 0 to 1.

    (a) unchanged   (b) halved

    (c) doubled   (d) increased by 50%

43. 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

44. Time division multiplex

    (a) can be used with PCM only

    (b) combines five groups into a super group

    (c) stacks 24 channels in adjacent frequency slots

    (d) interleaves pulses belonging to different transmissions

45. In single-pulse modulation used in PWM inverters, V_s is the input DC voltage. For eliminating third harmonic, the magnitude of rms value of fundamental component of output voltage and pulse width are respectively,

(a) $\dfrac{2\sqrt{2}}{\pi}Vs, 120^o$

(b) $\dfrac{4}{\pi}Vs, 60^o$

(c) $\dfrac{2\sqrt{2}}{\pi}Vs, 60^o$

(d) $\dfrac{4}{\pi}Vs, 120^o$

46. In a single-phase full converter, if á and â are firing and extinction angles respectively, then the load current is

(a) discontinuous if $(\beta - \alpha) < \pi$

(b) discontinuous if $(\beta - \alpha) > \pi$

(c) discontinuous if $(\beta - \alpha) = \pi$

(d) discontinuous if $(\beta - \alpha) \le \pi$

47. 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

48. Turn-on time of an SCR can be reduced by using a

(a) rectangular pulse of high amplitude and narrow width

(b) rectangular pulse of low amplitude and wide width

(c) triangular pulse

(d) trapezoidal pulse

49. In a 3-phase semi-converter, for firing angle less than or equal to 60º, freewheeling diode conducts for

(a) 30º

(b) 60º

(c) 90º

(d) Zero degree

50. A 3-phase, fully controlled, converter is feeding power into a DC load at a constant current of 150 A. The rms current through each thyristor of the converter is

(a) 50 A

(b) 100 A

(c) $\dfrac{150\sqrt{2}}{\sqrt{3}}$

(d) $\dfrac{150}{\sqrt{3}}$

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. Explain the effect of temperature on a p-n junction diode.

2. Draw and explain transistor R-C coupled amplifier with special reference to frequency response. Also state its advantages and disadvantages.

3. Implement the given function $F = \sum m(1, 3, 5, 6)$ using a 4:1 multiplexer.

4. Draw and explain the operation of a 4 bit adder cum subtractor circuit.

5. What is d.c chopper? Discuss with necessary circuit diagram the principle of operation of a step-down chopper.

6. State the advantages and disadvantages of GTO thyristor as compared to conventional thyristor. Why is a GTO thyristor preferred over SCR in chopper and inverter circuit?   **(3+2=5)**

7. A three-phase full converter is operating with a purely resistive load (R=10Ω). If $\alpha = 75^o$ calculate,
    (a) average load voltage
    (b) rms load voltage
   Assume the supply voltage to be 415V and supply frequency=50Hz.

8. State the advantages and disadvantages of digital communication over analog communication.

9. Briefly explain the different types of addressing modes of 8085 microprocessor.

10. Explain the effect of freewheeling diode in details. Also, justify the statement "freewheeling diode improves the power factor of the system."

11. Explain the sinusoidal pulse width modulation used in single phase inverter and draw its waveform.

12. Explain briefly the process of encoding and decoding operation of PCM system.

13. Draw the time domain and frequency domain waveforms of an AM wave.

14. Define frequency modulation and derive its time domain equation.

15. Draw and explain the basic elements of a communication system with a block diagram.

16. Write the differences between synchronous and Asynchronous Counters.

17. With circuit schematic explain the operation of a two input TTL NAND gate.

18. What are the differences between peripheral I/O and memory mapped I/O Schemes?

19. What are assembler directives? List any four assembler directives and its usage.

20. What is the concept of negative feedback in amplifiers? List out the advantages of negative feedback in amplifiers.

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