

MIZORAM PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF M.E.S.
UNDER POWER & ELECTRICITY DEPARTMENT, AUGUST, 2018.

ELECTRICAL ENGINEERING
PAPER - III

Time Allowed : 3 hours

FM : 200

SECTION - A (Multiple Choice questions)

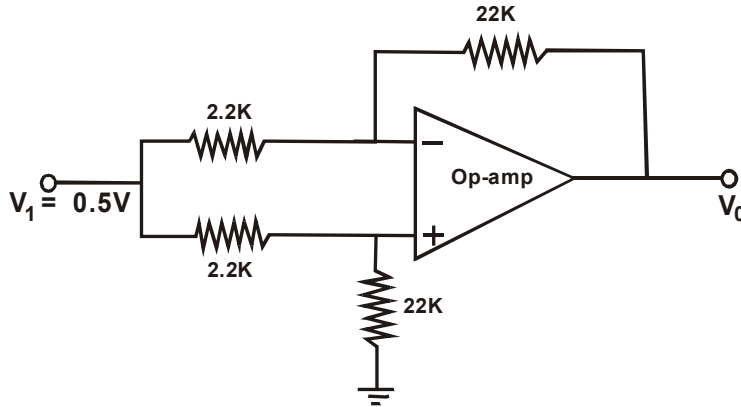
(100 Marks)

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 early effect in a bipolar junction transistor is caused by
 - (a) Fast turn-on
 - (b) Fast turn off
 - (c) Large collector base reverse bias
 - (d) Large emitter base forward bias
2. Reverse recovery current in a diode depends upon
 - (a) Forward field current
 - (b) Storage charge
 - (c) Temperature
 - (d) PIV
3. 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
4. The junction capacitance of a p-n junction depends on
 - (a) Doping concentration only
 - (b) Applied voltage only
 - (c) Both doping concentration and applied voltage
 - (d) Barrier potential only
5. The type of power amplifier which exhibits crossover distortion in its output is
 - (a) Class A
 - (b) Class B
 - (c) Class AB
 - (d) Class C
6. Negative feedback in an amplifier
 - (a) Reduce gain
 - (b) Increases frequency and phase distortions
 - (c) Reduces bandwidth
 - (d) Increases noise

7. In the op-amp circuit shown below (assuming ideal op-amp)



- (a) $V_0 = 0$ (b) $V_0 = -5 \text{ V}$
 (c) $V_0 = 5 \text{ V}$ (d) $V_0 = -2 \text{ V}$

8. For a given op-amp, $\text{CMMR} = 10^5$ and differential gain $= 10^5$. What is the common mode gain of the op-amp?

- (a) 10^{10} (b) 2×10^5
 (c) 10^5 (d) 1

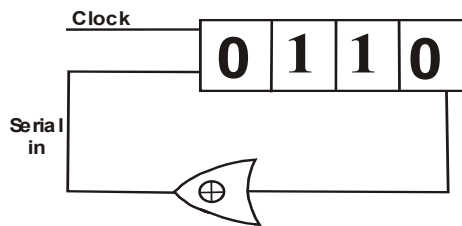
9. Which of the following flip-flop cannot be converted to D-type (delay) flip-flop?

- (a) S-R flip-flop (b) J-K flip-flop
 (c) Master slave flip-flop (d) None of these

10. Race around condition always arise in a

- (a) Combination circuit (b) Asynchronous circuit
 (c) Synchronous circuit (d) Digital circuit

11. The initial content of the 4 bit serial-in-parallel-out right-shift shift register shown in figure is 0110. After three clock pulses applied, the contents of the shift register will be



- (a) 0000 (b) 0101
 (c) 1010 (d) 1111

12. The total capacity of a ROM with 1024 rows and 4 columns is

- (a) 4096 (b) 1024
 (c) 256 (d) 512

13. What is the minimum number of NAND gates required to implement $A + A\bar{B} + A\bar{B}C$?

- (a) 0 (b) 1
 (c) 4 (d) 7

14. The number of unused states in a 4-bit Johnson counter is

- (a) 2 (b) 4
 (c) 8 (d) 12

15. 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
16. Number of machine cycles required for RET instruction in 8085 microprocessor is
 - (a) 1
 - (b) 2
 - (c) 3
 - (d) 5
17. The instruction RST-5 is written in a program. The programme will jump to location
 - (a) 0020H
 - (b) 0024H
 - (c) 0028H
 - (d) 002CH
18. Which one of the following is the software interrupt of 8085 microprocessor?
 - (a) TRAP
 - (b) INTR
 - (c) RST 7
 - (d) RST 7.5
19. The highest priority in 8085 microprocessor system is
 - (a) RST 7.5
 - (b) RST 6.5
 - (c) INTR
 - (d) TRAP
20. How many I/O ports can be accessed by direct method
 - (a) 8
 - (b) 256
 - (c) 32 K
 - (d) 64 K
21. The mnemonics used in writing a program is called
 - (a) Assembly language
 - (b) Fetch cycle
 - (c) Microinstruction
 - (d) Object program
22. What is the memory word addressing capability in 8085
 - (a) 32 K
 - (b) 64 K
 - (c) 256 K
 - (d) 512 K
23. If the accumulator of 8085 microprocessor contains 37H and the previous operation has set the carry flag, the instruction ACI 56H will result in
 - (a) 8DH
 - (b) 8EH
 - (c) 17H
 - (d) 18H
24. In the 8085 microprocessor , the RST6 instruction transfers the program execution to the following locations
 - (a) 30H
 - (b) 24H
 - (c) 48H
 - (d) 60H
25. The transmission bandwidth is doubled in FM. The SNR is
 - (a) Also doubled
 - (b) Improved four fold
 - (c) Decreased by one fourth
 - (d) Unaffected
26. The noise temperature about 4306 K. The noise figure will be
 - (a) 3 dB
 - (b) 6 dB
 - (c) 12 dB
 - (d) 24 dB

27. 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
28. 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
29. The modulation index of an AM wave is changed from 0 to 1. The transmitted power is
- (a) Unchanged
 - (b) Halved
 - (c) Doubled
 - (d) Increase by 50 percent
30. 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 transmission
31. Telephone traffic is measured
- (a) With echo cancelers
 - (b) By the relative congestion
 - (c) In terms of the grade of service
 - (d) In erlangs
32. 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) 8 KHz
33. Quantizing noise occurs in
- (a) Time division multiplex
 - (b) Frequency division
 - (c) Pulse code modulation
 - (d) Pulse width modulation
34. Addition of two periodic signals will always be
- (a) Periodic
 - (b) Aperiodic
 - (c) May or may not be periodic
 - (d) Insufficient data
35. The most commonly used filters in SSB generation are
- (a) Mechanical
 - (b) RC
 - (c) LC
 - (d) Low pass
36. IGBT is used for application in
- (a) Low power
 - (b) Medium power
 - (c) High power
 - (d) None of these
37. Triacs cannot be used in a.c. voltage regulator for a
- (a) Resistive load
 - (b) Back emf load
 - (c) Inductive load
 - (d) Resistive inductive load
38. 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

39. A DC link chopper as compared to AC link
- (a) Efficient
 - (b) Less costly
 - (c) Bulky
 - (d) Both (a) and (b)
40. Cycloconverter can be considered as a.c. –a.c. converter with conversion of
- (a) 1 Stage
 - (b) 2 Stage
 - (c) 3 Stage
 - (d) None of these
41. Turn on and turn off times of transistor depend on
- (a) Static characteristic
 - (b) Junction capacitance
 - (c) Current gain
 - (d) None of the above
42. A four quadrant chopper cannot be operated as
- (a) One quadrant chopper
 - (b) Cycloconverter
 - (c) Inverter
 - (d) Bi-directional rectifier
43. In a 3-phase semiconverter, for firing angle less than or equal to 60° , free wheeling diode conducts for
- (a) 30°
 - (b) 60°
 - (c) 90°
 - (d) 0°
44. A boost regulator has an input voltage of 5 V and the average output voltage of 15 V. The duty cycle is
- (a) $3/2$
 - (b) $2/3$
 - (c) $5/2$
 - (d) $15/2$
45. The correct sequence of the following devices in the increasing order of turn off times is
- (a) MOSFET, IGBT, BJT, Thyristor
 - (b) IGBT, MOSFET, BJT, Thyristor
 - (c) Thyristor, BJT, MOSFET, IGBT
 - (d) MOSFET, BJT, IGBT, Thyristor
46. A 1-phase H.W controlled rectifier with R-L-E load has firing angle and extinction angle 30° and 210° respectively. The source frequency is 50 Hz. The circuit turn off time is
- (a) $\frac{1}{60}$ sec
 - (b) $\frac{1}{90}$ sec
 - (c) $\frac{1}{120}$ sec
 - (d) $\frac{1}{180}$ sec
47. Power diodes has characteristics of
- (a) High power, high speed
 - (b) Low power, low speed
 - (c) Low power, high speed
 - (d) High power, low speed
48. Which one of the following is used as the main switching element in a switched mode power supply operating in 20 kHz to 100 kHz range?
- (a) Thyristor
 - (b) MOSFET
 - (c) Triac
 - (d) UJT
49. The snubber circuit is used in thyristor circuits for
- (a) Triggering
 - (b) $\frac{dv}{dt}$ protection
 - (c) $\frac{di}{dt}$ protection
 - (d) Phase shifting
50. In a thyristor, ratio of latching current to holding current is
- (a) 0.4
 - (b) 1.0
 - (c) 2.5
 - (d) 6

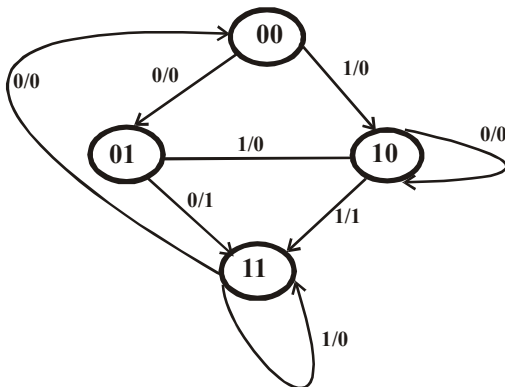
SECTION - B (Short answer type question)

(100 Marks)

All questions carry equal marks of 5 each.

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

1. With the help of neat diagram, describe the construction and operation of a n-channel MOSFET. (5)
2. What is a multistage amplifier circuit? Explain the working of transistor R-C coupled amplifier with neat diagram. (1+4)
3. Calculate current gain, voltage gain, input impedance and output admittance using h-parameter model of a generalised transistor amplifier. (5)
4. Design a MOD-4 ripple counter using J-K flip flop. (5)
5. Plot the logical expression $ABCD + \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}C + AB$ on a 4 variable K-map and obtain the simplified expression from the map. (5)
6. Draw the block diagram of 8086 microprocessor and write the difference between memory mapped I/O and I/O mapped I/O. (3+2)
7. A sequential circuit has one i/p and one o/p. The state diagram is shown in figure. Design the sequential circuit using S-R Flip flop. (5)



8. Briefly explain the different types of instructions for 8085 microprocessor. (5)
9. Briefly explain the different types of addressing mode in 8086 microprocessor. (5)
10. Draw and explain the function of programmable interrupt controller (IC 8259). (5)
11. Show that, in 100% tone modulated AM signal, 67% power is wasted while 33% of power is useful. (5)
12. What is the difference between NBFM and WBFM? A baseband signal of frequency 3 KHz is used to frequency modulates a carrier to achieve frequency deviation of 6 KHz. Find out the bandwidth of the FM signal. (2+3=5)
13. Draw the block diagrams of transmitter and receiver for PCM system. What is the concept of quantization noise? (3+2=5)
14. In a binary PCM system, the output SNR is to be held to a minimum of 40 dB. Determine the number of required levels and find the corresponding output signal to quantization noise ratio. If the signal frequency is 4 KHz, what is the bandwidth? (5)

15. Justify the statement, “Higher the gate current, lower is the forward break over voltage”. (5)
16. Describe the significance of $\frac{di}{dt}$ and $\frac{dv}{dt}$ in SCRs. (5)
17. A 3-phase half wave controlled converter is fed from 3-phase, 400 V, 50 Hz source and is connected to load taking a constant current of 36 A. Thyristor have a voltage drop of 1.4 V. Calculate (a) average value of load voltage for a firing angle of 30° and 60° . (b) Average and rms current ratings as well as PIV of thyristor and (c) average power dissipated in each thyristor. (5)
18. Describe the principle of dc chopper. Derive an expression for its average output voltage. (3+2=5)
19. A single phase full bridge inverter using transistors and diodes is feeding a load of $R=3\Omega$ with input dc voltage of 60 V. Calculate: (a) rms value of (i) output voltage and (ii) fundamental component of output voltage (b) output power (c) fundamental frequency output power (d) average and peak currents of each transistor. (5)
20. Describe flyback SMPS with relevant equivalent circuits and waveforms. (5)

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