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, JUNE-2022

ELECTRONICS & COMMUNICATION ENGINEERING

PAPER-II

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. Two thin parallel wires are carrying current in the same direction. The force experienced between them is :

(a) Repulsive (b) No force exists

(c) Attractive (d) Perpendicular to their axis joining wires

2. Which one of the following is not correct Maxwell equation?

(a) $\nabla \times \bar{H} = \frac{d\bar{D}}{dt} + \bar{J}$ (b) $\nabla \times \bar{E} = \frac{d\bar{B}}{dt}$

(c) $\nabla \times \bar{D} = \rho$ (d) $\nabla \times \bar{B} = 0$

3. A plane EM wave at an oblique incidence at Brewster angle then the reflected wave will be :

(a) Purely parallel polarized (b) Purely perpendicular polarized

(c) Both (d) Neither of the two

4. For a lossy transmission line, the characteristics impedance does not depend on :

(a) Frequency of operation on the line (b) Load of the line

(c) Conductivity of the conductor (d) Inductance of the line

5. The power reflected along a matched transmission line with characteristics impedance Z_0 is :

(a) Zero (b) Infinity

(c) Depends on Z_0 (d) Not depends on Z_0

6. In a waveguide, the evanescent modes are said to occur if :

(a) Phase constant is zero (b) Phase constant is real

(c) Phase constant is imaginary (d) The signal has constant frequency

7. A good current buffer has :

(a) Low-input impedance and low-output impedance

(b) Low-input impedance and high-output impedance

(c) High-input impedance and low-output impedance

(d) High-input impedance and high-output impedance

8. Voltage series feedback (also called series shunt feed-back) results in :

(a) Increase in both input and output impedance

(b) Decrease in both input and output impedance

(c) Increase in input impedance and decrease in output impedance

(d) Decrease in input impedance and increase in output impedance

9. A transistor circuit employing base bias with collector feedback has greater stability than the one without feedback. It is because of :

(a) Reduction of I_c in magnitude

(b) I_c becoming independent of β

(c) Negative feedback effect

(d) Reduction of V_{BE}

10. Presence of emitter bypass capacitor adversely affects the :

(a) Low frequency response

(b) Medium frequency response

(c) High frequency response

(d) Complete frequency response

11. Which one of the following is a wideband amplifier?

(a) RF amplifier

(b) IF amplifier

(c) Video amplifier

(d) AF amplifier

12. The operational amplifier is basically a :

(a) Low gain ac amplifier

(b) High gain dc amplifier

(c) High gain RC coupled amplifier

(d) Low gain transformer-coupled amplifier

13. The circuit that will work as OR gate in positive level, will work as _____ gate in negative level logic.

(a) NOR gate

(b) NAND gate

(c) Both NAND and NOR gate

(d) AND gate

14. The unit of $\nabla \times H$ is :

(a) Ampere

(b) Ampere/meter

(c) Ampere/meter^2

(d) Ampere-meter

15. Find the reflection coefficient of the wave with SWR of 3.5.

(a) 0.55

(b) 0.23

(c) 0.48

(d) 0.68

16. The incoming solar radiation at a place on the surface of the earth is 1.2 KW/m^2 . The amplitude of the electric field corresponding to this incident power is nearly equal to :

(a) 80 mV / m

(b) 2.5 V / m

(c) 30 V /m

(d) 950 V / m

17. The depth of penetration of a wave in a lossy dielectric increases with increasing :

(a) Conductivity

(b) Permeability

(c) Wavelength

(d) Permittivity

18. Standing waves occurs due to :

(a) Impedance match

(b) Impedance mismatch

(c) Reflection

(d) Transmission

19. An antenna when radiating, has a highly directional radiation pattern. When the antenna is receiving its radiation pattern :

(a) Is more directive

(b) Is less directive

(c) Is the same

(d) Exhibits no directivity all

20. At saturation, which of these is not true for a BJT?

(a) The collector current I_C cannot increase further

(b) The base current I_B, cannot increase further

(c) The collector-to-emitter voltage, V_{CE} is due to the non-zero internal resistance of BJT

(d) V_{CE}(saturation) is the minimum voltage drop between C and E

21. Two stages of a multistage amplifier have a gain of 50 and 20. The dB voltage gain is :

(a) 3 (b) 30

(c) 300 (d) 1000

22. Ripple factor of half wave rectifier is _____.

(a) 1.414 (b) 1.21

(c) 1.3 (d) 0.48

23. If input frequency is 50Hz then ripple frequency of center tapped full wave rectifier will be equal to :

(a) 100Hz (b) 50Hz

(c) 25Hz (d) 500Hz

24. What is the role of emitter resistance in the transistor amplifying circuit?

(a) To prevent thermal runaway (b) To prevent increase in gain

(c) To lower the output impedance (d) To increase gain

25. In a class B amplifier, it is found that DC power is 25W, find the ac power.

(a) 10 W (b) 62.5 W

(c) 25 W (d) 50 W

26. What is the use of the compensation capacitor in op-amp?

(a) Improves the amplification of op-amp (b) Decreases the slew rate of op-amp

(c) Increases the bandwidth of op-amp (d) Op-amp acts as all pass filter

27. What is the duty cycle of the output of an astable multivibrator?

(a) 50% (b) 100%

(c) 75% (d) 55%

28. What is the characteristic of a good control system?

(a) Insensitive to the parameter variation but sensitive to the input commands

(b) Neither sensitive to parameter variations nor sensitive to input commands

(c) Insensitive to the input command

(d) Sensitive to parameter variation

29. If a system is given unbounded input then the system is :

(a) Stable (b) Unstable

(c) Not defined (d) Linear

30. Phase lag network :

(a) Maintains constant velocity gain (b) Increases bandwidth

(c) Decreases system stability (d) Decreases velocity gain

31. To increase the bandwidth of a control system, we may use :

(a) Phase lag compensator (b) Phase lead compensator

(c) Phase leg-lead compensator (d) All of these

32. A bulb in a staircase has two switches, one switch being at the ground floor and the other one at the first floor. The bulb can be turned ON and also can be turned OFF by and one of the switches irrespective of the state of the other switch. The logic of switching of the bulb resembles.

(a) an AND gate
(b) an OR gate
(c) an XOR gate
(d) a NAND gate

33. The Boolean function Y = AB + CD is to be realized using only 2 input NAND gates. The minimum number of gates required is :

(a) 2
(b) 3
(c) 4
(d) 5

34. Which characteristic of IC in Digital Circuits represents a function of the switching time of a particular transistor?

(a) Fan – out
(b) Fan – in
(c) Power dissipation
(d) Propagation delay

35. A basic S-R flip-flop can be constructed by cross-coupling of which basic logic gates?

(a) AND or OR gates
(b) XOR or XNOR gates
(c) NOR or NAND gates
(d) AND or NOR gates

36. The highest noise margin is offered by

(a) TTL
(b) ECL
(c) IIL
(d) CMOS

37. The minimum number of NAND gates required to implement $A \oplus B \oplus C$ is :

(a) 8
(b) 10
(c) 9
(d) 6

38. Sum of product form can be implemented by using :

(a) AND-OR
(b) NAND-NAND
(c) NOR-NOR
(d) Both a and b

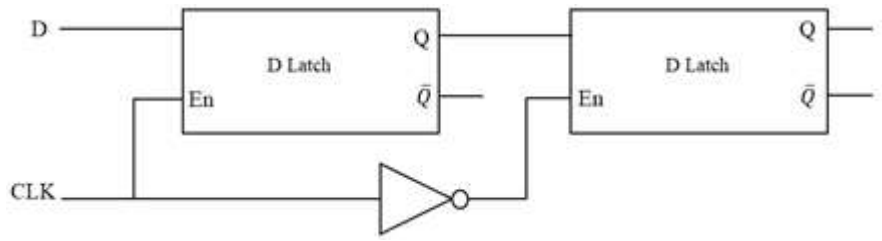
39. What are the minimum number of 2 to 1 multiplexer required to generate a 2-input AND gate and 2-input EX-OR gate?

(a) 1 and 2
(b) 1 and 3
(c) 1 and 1
(d) 2 and 2

40. A flip-flop is popularly known as

(a) A stable multivibrator
(b) Bistable multivibrator
(c) Monostable multivibrator
(d) None of these

41. The circuit shown in the figure is a :



(a) Toggle Flip-Flop
(b) J-K Flip-Flop
(c) S-R Latch
(d) Master-Slave D Flip-Flop

42. A full-adder can be made out of :

(a) Two half -adders
(b) Two half-adders and a NOT gate
(c) Two half-adders and a AND gate
(d) Two half-adders and a OR gate

43. Which of the following is not a characteristics of negative feedback system?

(a) Rejection of disturbance signal
(b) High sensitivity to parameter variations
(c) Reduction in gain
(d) Accuracy in tracking steady state value

44. Which one of the following is not a closed loop system?

(a) Respiratory system of an animal
(b) Execution of a program by computer
(c) Air condition system
(d) Driving a car

45. A system transfer function has some poles lying on the imaginary axis and it is :

(a) Marginally stable
(b) Unstable
(c) Conditionally stable
(d) Unconditionally stable

46. A 10 bit D/A converter given a maximum output of 10.23V. The resolution is

(a) 10 mV
(b) 20 mV
(c) 15 mV
(d) 25 mV

47. How many select lines are contained in a multiplexer with 1024 inputs and one output?

(a) 512
(b) 258
(c) 64
(d) 10

48. The output frequency of a mod-12 counter is 6 kHz. Its input frequency is :

(a) 6 kHz
(b) 500 Hz
(c) 24 kHz
(d) 72 kHz

49. To construct a 512 K x 8 memory , the number of 32 K x 4 memory circuit required is :

(a) 16
(b) 32
(c) 8
(d) 64

50. The memory technology which needs the least power is :

(a) ECL
(b) TTL
(c) MOS
(d) CMOS

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. What is cavity resonator? What is the special feature of cavity resonator? Explain the excitation mechanism of a cavity resonator.

2. Explain the conditions to be full fill for faithful amplification.

3. Describe the electrical characteristics of an ideal OPAMP. Draw the equivalent circuit and ideal voltage transfer curve of an OPAMP.

4. Realise (a) 2-input NOR gate using 2-input NAND gate (b) EX-OR gate using NOR gate only.

5. Draw the circuit of Master-Slave JK flip-flop and explain the operation of the circuit.

6. With the help of truth table and circuit diagram explain the operation of ring counter.

7. Define Transient response and steady state response of a system. Obtain the expression for unit impulse response of first order system.

8. Define the following frequency domain specifications

(a) Resonant frequency
(b) bandwidth
(c) resonant peak
(d) Gain margin
(e) phase margin

9. The characteristics equation of a feedback control system is

$$s^4 + 20Ks^3 + 5s^2 + 10s + 15 = 0$$

Find the range of K for which system is stable.

10. Derive Poisson's and Laplace equation.

11. Derive Maxwell's equation in point form and integral form using Gauss's law.

12. Derive the expression for ripple factor and efficiency of a full wave rectifier.

13. A 24 V, 600 mW zener diode is used for providing a 24 V stabilized supply to a variable load. If the input voltage is 32 V, calculate the value of series resistance required and diode current when the load is 1200 W.

14. Explain how an opamp can be used as a subtractor.

15. Determine the range of values of K so that the system having the following characteristic equation will be stable: $s(s^2+2s+3)(s+2) + K=0$.

16. State Routh-Hurwitz's criterion. Describe the necessary conditions for stability.

17. Explain phase lag compensator with a neat circuit and derive the expression for the transfer function of a lag compensator.

18. State and prove Consensus theorem.

19. Design a synchronous mod-7 counter using SR flip flops.

20. With the help of a neat diagram explain the working of a Successive Approximation type ADC.

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