MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE (M.E.S.) UNDER PUBLIC HEALTH DEPARTMENT, GOVERNMENT OF MIZORAM, MAY, 2019.

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. Choose which of following condition is not required for a waveguide to exist.
(a) The dimensions should be in accordance with desired frequency
(b) Cut-off frequency should be minimum 6 GHz
(c) The shape should be spherical
(d) No specific condition is required for waveguide design

2. Which of the following relation will hold good?
(a) $D = \mu H$ (b) $B = \epsilon E$
(c) $E = \epsilon D$ (d) $B = \mu H$

3. The magnetostatics highly relies on which property?
(a) Resistance (b) Capacitance
(c) Inductance (d) Moment

4. The inductance is the measure of
(a) Electric charges stored by the material (b) Emf generated by energising the coil
(c) Magnetic field stored by the material (d) Magnetization of dipoles

5. Find the total flux in a coil of magnetic flux density 12 units and area 7 units.
(a) 0.84 (b) 0.96
(c) 8.4 (d) 9.6

6. The amount of work done in moving a charge from one point to another along an equipotential line or surface charge is
(a) Zero (b) Infinity
(c) One (d) Two

7. "Total electric flux through any closed surface is equal to the charge enclosed by that surface". This is
(a) Lenz's law (b) Gauss's law
(c) Maxwell's law (d) Faraday's law

8. According to the coulomb's law, the force between two point charges is
(a) Directly proportional to the product of the charges
(b) Inversely proportional to the square of the distance between them
(c) Along the line joining them
(d) All of these

9. One electron charge is equal to
(a) 925×10^{-31}C
(b) 1.6019×10^{-19}C
(c) -1.925×10^{-31}C
(d) -1.6019×10^{-19}C

10. When charged particle is projected opposite to direction of magnetic field, it experiences force equal to
(a) qvB × cosu
(b) qvB × sinu
(c) qvB
(d) zero

11. Find the Maxwell equation derived from Faraday's law.
(a) Div(H) = J
(b) Div(D) = I
(c) Curl(E) = -dB/dt
(d) Curl(B) = -dH/dt

12. In which of the following forms can Maxwell's equation not be represented?
(a) Static
(b) Differential
(c) Integral
(d) Harmonic

13. The charge build up in the capacitor is due to which quantity?
(a) Conduction current
(b) Displacement current
(c) Convection current
(d) Direct current

14. Which of the following parameters is not a primary parameter?
(a) Resistance
(b) Attenuation constant
(c) Capacitance
(d) Conductance

15. The networks in which the R, L, C parameters are individually concentrated or lumped at discrete points in the circuit are called
(a) Lumped
(b) Distributed
(c) Parallel
(d) Paired

16. The characteristic impedance of a transmission line with impedance and admittance of 16 and 9 respectively is
(a) 25
(b) 1.33
(c) 7
(d) 0.75

17. The propagation constant of a transmission line with impedance and admittance of 9 and 16 respectively is
(a) 25
(b) 144
(c) 12
(d) 7

18. When a transmission line has a load impedance same as that of the characteristic impedance, the line is said to be
(a) Parallel
(b) Perpendicular
(c) Polarized
(d) Matched

19. The wavelength of a wave with a frequency of 6 GHz in air is

(a) 50 m (b) 5 m

(c) 0.5 m (d) 0.05 m

20. The basic requirements of transmitting antennas are:

(a) High efficiency (b) Low side lobes

(c) Large signal to noise ratio (d) None of the mentioned

21. _____ is a device that converts electrons to photons or vice-versa.

(a) Antenna (b) Electron gun

(c) Photon amplifier (d) Microwave tube

22. The beam width of the antenna pattern measured at half power points is called:

(a) Half power beam width (b) Full null beam width

(c) Beam width (d) None of the mentioned

23. In which region a transistor acts as an open switch?

(a) cut off region (b) inverted region

(c) active region (d) saturated region

24. The base emitter voltage in a cut off region is_____

(a) greater than 0.7V (b) equal to 0.7V

(c) less than 0.7V (d) cannot be predicted

25. Which of the following helps in reducing the switching time of a transistor?

(a) a resistor connected from base to ground

(b) a resistor connected from emitter to ground

(c) a capacitor connected from base to ground

(d) a capacitor connected from emitter to ground

26. The use of amplifier in a circuit is to _____ for input signal

(a) Provide a phase shift (b) Provide strength

(c) Provide frequency enhancement (d) Make circuit compatible

27. Power amplifier directly amplifies

(a) Voltage of signal (b) Current of the signal

(c) Power of the signal (d) All of the mentioned

28. Transistor in power amplifier is

(a) An active device (b) A passive device

(c) A op-amp (d) A voltage generating device

29. Voltage shunt feedback amplifier forms

(a) A negative feedback (b) A positive feedback

(c) Both positive and negative (d) None of the mentioned

30. The value of feedback resistor and resistor connected in series with the input signal source are equal to 10 kΩ and 3.3 kΩ. Calculate the closed loop voltage gain?

(a) -6.7 (b) -33

(c) -13.3 (d) -3.33

31. Which of the following is not an example for non-sinusoidal oscillator?

(a) Sawtooth Generators
(b) Blocking oscillators
(c) Multivibrator
(d) Crystal oscillators

32. The sinusoidal oscillator is also called _____

(a) LC oscillator
(b) Harmonic oscillator
(c) RC oscillator
(d) Crystal oscillators

33. Which of the following oscillator is not using a feedback network for its oscillation?

(a) LC oscillator
(b) RC oscillator
(c) Crystal oscillator
(d) Relaxation oscillators

34. Relaxation oscillators are also known as _____

(a) Multivibrator
(b) Phase shift oscillators
(c) Blocking oscillators
(d) Saw tooth generator

35. Bridge rectifier is an alternative for

(a) Full wave rectifier
(b) Peak rectifier
(c) Half wave rectifier
(d) None of the mentioned

36. For a half wave or full wave rectifier the Peak Inverse Voltage of the rectifier is always

(a) Greater than the input voltage
(b) Smaller than the input voltage
(c) Equal to the input voltage
(d) Greater than the input voltage for full wave rectifier and smaller for the half wave rectifier

37. Which of the following electrical characteristics is not exhibited by an ideal op-amp?

(a) Infinite voltage gain
(b) Infinite bandwidth
(c) Infinite output resistance
(d) Infinite slew rate

38. An ideal op-amp requires infinite bandwidth because

(a) Signals can be amplified without attenuation
(b) Output common-mode noise voltage is zero
(c) Output voltage occurs simultaneously with input voltage changes
(d) Output can drive infinite number of device

39. Find the output voltage of an ideal op-amp. If V_1 and V_2 are the two input voltages

(a) $V_O = V_1 - V_2$
(b) $V_O = A \times (V_1 - V_2)$
(c) $V_O = A \times (V_1 + V_2)$
(d) $V_O = V_1 \times V_2$

40. Find the input voltage of an ideal op-amp. It's one of the inputs and output voltages are 2V and 12V. (Gain = 3)

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

41. Why is a demultiplexer called a data distributor?

(a) The input will be distributed to one of the outputs
(b) One of the inputs will be selected for the output
(c) The output will be distributed to one of the inputs
(d) Single input gives single output

42. In 1-to-4 demultiplexer, how many select lines are required?

(a) 2 (b) 3

(c) 4 (d) 5

43. How many AND gates are required for a 1-to-8 multiplexer?

(a) 2 (b) 6

(c) 8 (d) 5

44. 3 bits full adder contains _____

(a) 3 combinational inputs (b) 4 combinational inputs

(c) 6 combinational inputs (d) 8 combinational inputs

45. According to Boolean law: A + 1 = ?

(a) 1 (b) A

(c) 0 (d) A'

46. A (A + B) = ?

(a) AB (b) 1

(c) (1 + AB) (d) A

47. Which one of the following statements is not correct?

(a) Root loci can be used for analyzing stability and transient performance

(b) Root loci provide insight into system stability and performance

(c) Shape of the root locus gives idea of type of controller needed to meet design specification

(d) Root locus can be used to handle more than one variable at a time

48. Root locus of s(s+2) + K(s+4) =0 is a circle. What are the coordinates of the center of this circle?

(a) -2,0 (b) -3,0

(c) -4,0 (d) -5,0

49. Consider the following statements:

Nichol's chart gives information about

i. Closed loop frequency response.

ii. The value of the peak magnitude of the closed loop frequency response Mp.

iii. The frequency at which Mp occurs.

Which of the above statements are correct?

(a) ii and iii (b) i and ii

(c) i and iii (d) i, ii and iii

50. For a stable closed loop system, the gain at phase crossover frequency should always be:

(a) < 20 dB (b) < 6 dB

(c) > 6 dB (d) > 0 dB

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 'antenna Gain'? Explain how does antenna radiate electromagnetic energy?

2. What are the difference modes of propagation of electromagnetic waves?

3. How does quarter wavelength section of a transmission line act as impedance transform?

4. A 50 W transmission line is terminated in an impedance of 20-j50. Calculate the reflection co-efficient.

5. Show that for a TE_{19} mode, a frequency of 8 GHz will pass through a wave-guide of dimensions a = 1.5 cm, b = 1 cm if a dielectric with $;_r = 4$ is inserted inside the guide.

6. Calculate the values of R and C for 100 Hz output in a Wein bridge oscillator and explain why it is necessary to have an amplifier section with very high input impedance.

7. Draw the voltage transfer characteristics of OPAMP and explain the shape of the curve.

8. Draw the basic differentiator circuit using an OPAMP and show that the output voltage is differential of the input.

9. Briefly describe the Dynamic Range and Noise Figure specifications of amplifiers.

10. How is the gain of an amplifier affected by introduction of negative feedback?

11. Subtract $(10110.011)_2$ from $(11010.10)_2$ and verify the result by showing equivalent decimal subtraction.

12. Draw a circuit symbol of 3-input and 4-input AND gates. Give respective logic expression. Also draw the truth table for 4-input AND gate.

13. What is noise immunity with reference of logic gates? Compare TTL, CMOS and ECL families on the basis of Noise Immunity.

14. Draw the logic diagram of a half adder using only NAND gates. Show the steps involved therein to arrive at the final configuration starting with the basic half adder logic expressions.

15. What is a clocked J-K flip flop? What improvement does it have over the clocked R-S flip flops?

16. What are the advantages and disadvantages of closed loop control systems?

17. Obtain the pole-zero map of the following transfer function:

$$G(s) = \frac{(s-2)(s+2+j4)(s+2-j4)}{(s-3)(s-4)(s-5)(s+1+j5)(s+1-j5)}$$

18. Expand the following equation of Laplace transform in terms of its partial fractions and obtain its time-domain response.

$$Y(s) = \frac{2s}{(s+1)(s+2)}$$

19. Briefly explain the properties of Transfer Function.

20. Draw the Bode magnitude and phase plot of the following open-loop transfer function and determine gain margin, phase margin and absolute stability.

$$G(s)H(s) = \frac{1}{s^2(s+1)}$$

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