MIZORAM PUBLIC SERVICE COMMISSION

TECHNICAL COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE (M.E.S.) UNDER PUBLIC HEALTH DEPARTMENT, GOVERNMENT OF MIZORAM, MARCH, 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. In free space, the Poisson equation becomes
(a) Maxwell equation (b) Ampere equation
(c) Laplace equation (d) Steady state equation

2. Maxwell's equation cannot be represented in which of the following form?
(a) Static (b) Differential
(c) Integral (d) Harmonic

3. Standing waves occur due to
(a) Impedance Match (b) Impedance mismatch
(c) Reflection (d) Transmission

4. Given that the reflection coefficient is 0.6. Find the SWR.
(a) 2 (b) 3
(c) 4 (d) 6

5. If the beam width of an antenna in two orthogonal planes are 30° and 60°. Then the directivity of the antenna is
(a) 24 (b) 18
(c) 36 (d) 12

6. If the power input to an antenna is 100 mW and if the radiated power is measured to be 90 mW, then the efficiency of the antenna is
(a) 75% (b) 80%
(c) 90% (d) Insufficient data

7. The phenomenon employed in waveguide operation is
(a) Reflection (b) Refraction
(c) Total internal reflection (d) Absorption

8. The dominant mode in waveguide is the mode which has
(a) Highest frequency (b) Highest wavelength
(c) Lowest phase constant (d) Highest attenuation

9. Ideally, for linear operation a transistor should be biased so that the Q- point is
(a) Near saturation (b) Near cutoff
(c) Where is maximum (d) Halfway between cutoff and saturation

10. The purpose of capacitors in a transistor amplifier is to
(a) Protect the transistor (b) Cool the transistor
(c) Couple or bypass a.c. component (d) Provide biasing

11. An amplifier has a power gain of 100. Its dB gain is
(a) 10 dB (b) 20 dB
(c) 40 dB (d) 100 dB

12. A transistor amplifier has high output impedance because
(a) Emitter is heavily doped (b) Collector has reverse bias
(c) Collector is wider than emitter or base (d) None of these

13. The maximum efficiency of transformer coupled class A power amplifier is
(a) 30% (b) 50%
(c) 80% (d) 45%

14. The output stage of a multistage amplifier is also called
(a) Mixer stage (b) Power stage
(c) Detector stage (d) F stage

15. The value of negative feedback fraction is always
(a) Less than 1 (b) More than 1
(c) Equal to 1 (d) None of these

16. The gain of an amplifier without feedback is 100 dB. If a negative feedback of 3 dB is applied, the gain of the amplifier will become
(a) 5 dB (b) 300 dB
(c) 103 dB (d) 97 dB

17. In a zener voltage regulator, the change in load current produce a change in
(a) Zener current (b) Zener voltage
(c) Zener voltage as well as zener current (d) None of these

18. The maximum efficiency of a half wave rectifier is
(a) 40.6% (b) 81.2%
(c) 50% (d) 25%

19. In a phase shift oscillators the frequency determining elements are
(a) L and C (b) R, L and C
(c) R and C (d) R

20. In an LC oscillator, if the value of L is increased four times, the frequency of oscillations is
(a) Increased 2 times (b) Decreased 4 times
(c) Increased 4 times (d) Decreased 2 times

21. A square wave oscillator has $f_0 = 1kHz$. Assume the resistor value to be 10 kW and find the capacitor value?
(a) 3.9 μF (b) 0.3 μF
(c) 2 μF (d) 0.05 μF

22. Triangular wave form has

(a) Rise time < fall time (b) Rise time = fall time

(c) Rise time ≥ fall time (d) None of these

23. Output of an integrator producing waveforms of unequal rise and fall time are called

(a) Triangular waveform (b) Pulsating waveform

(c) Sawtooth waveform (d) Spiked waveform

24. Which of the following electrical characteristics is not exhibited by an ideal Opamp?

(a) Infinite voltage gain (b) Infinite bandwidth

(c) Infinite output resistance (d) Infinite slew rate

25. Find the output voltage of an ideal Opamp if and are the input voltages

(a) $V_0=V_1-V_2$ (b) $V_0=A*(V_1-V_2)$

(c) $V_0=A*(V_1+V_2)$ (d) $V_0=V_1*V_2$

26. If a system is given unbounded input then the system is

(a) Stable (b) Unstable

(c) Not defined (d) Linear

27. Root locus is used to calculate

(a) Marginal stability (b) Absolute stability

(c) Conditional stability (d) Relative stability

28. Number of roots of characteristic equation is equal to number of

(a) Branches (b) Root

(c) Stem (d) Poles

29. A lag compensator is basically a

(a) High pass filter (b) Band pass filter

(c) Low pass filter (d) Band elimination filter

30. The compensator required to improve the steady state response of a system is:

(a) Lag (b) Lead

(c) Lag-lead (d) None of these

31. The compensator required to improve the transient response of a system is:

(a) Lag (b) Lead

(c) Lag-lead (d) None of these

32. The Nichol's chart can be used to determine

(a) Transient response (b) Time response

(c) Closed- loop frequency response (d) Open - loop frequency response

33. The parameter which is constant along the constant M circle is

(a) Frequency (b) Phase angle

(c) Magnitude (d) Open-loop gain

34. The root locus always starts at the

(a) Open -loop poles (b) Open-loop zeros

(c) Closed-loop poles (d) Closed-loop zeros

35. Which of the following is the best method for determining the stability and transient response?

(a) Root locus (b) Bode plot

(c) Nyquist plot (d) None of these

36. A(A+B) =

(a) AB (b) 1

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

37. The expression foe Absorption Law is given by

(a) $A + AB = A$ (b) $A + AB = B$

(c) $AB + A\overline{A} = A$ (d) None of these

38. Simplify $Y = A\overline{B} + (\overline{A})B)C$

(a) $A\overline{B} + C$ (b) $AB + AC$

(c) $\overline{A}B + A\overline{C}$ (d) $AB + A$

39. The canonical sum of product form of the function $y(A,B)=A+B$ is

(a) $AB + BB + A\overline{A}$ (b) $AB + A\overline{B} + \overline{A}B$

(c) $BA + B\overline{A} + \overline{A}\overline{B}$ (d) None of these

40. Minimize the expression $Y = A\overline{B}C + \overline{A}\overline{B}C + \overline{A}BC + A\overline{B}\overline{C} + \overline{A}\overline{B}\overline{C}$

(a) $AB + C$ (b) $A + BC$

(c) $\overline{A}C + \overline{B}$ (d) $\overline{A}B + \overline{C}$

41. Find the reduced SOP form of the following function $F(\mathrm{A,B,C,D}) = \sum \mathrm{m}(0,1,3,7) + \mathrm{D}(2,5)$

(a) $\overline{A} + \overline{B}$ (b) $\overline{A} + C$

(c) $A + C$ (d) $A + B$

42. A counter has 14 stable states 0000 through 1101. If the input frequency is 50 kHz what will be its output frequency?

(a) 5 kHz (b) 3.57 kHz

(c) 4 kHz (d) 14 kHz

43. The following switching functions are to be implemented using a decoder:

$F_1 = \sum m(1,2,4,8,10,14),\ F_2 = \sum m(5,6.9.11),\ F_3 = \sum m\,2,4,5,6,7,$

The minimum configuration of the decoder will be

(a) 2 to 4 line (b) 3 to 8 line

(c) 4 to 16 line (d) 5 to 32 line

44. Fan-in is defined as

(a) The number of outputs connected to a gate without any degradation in the voltage levels

(b) The number of inputs connected to a gate without any degradation in the voltage levels

(c) The number of outputs connected to a gate with degradation in the voltage levels

(d) The number of inputs connected to a gate with degradation in the voltage levels

45. The only difference between a combinational circuit and a flip flop is that

(a) The flip flop requires previous state (b) The flip flop requires next state

(c) The flip flop requires a clock pulse (d) None of these

46. How many flip flops are required to construct a decade counter?

(a) 4 (b) 5

(c) 8 (d) 10

47. If A and B are the inputs of a half adder, the sum is given by

(a) A AND B (b) A OR B

(c) A XOR B (d) A NAND B

48. What is a multiplexer?

(a) It is a type of decoder which decodes several inputs and gives one output

(b) It is a device which converts many signals into one

(c) It takes one input and gives many output

(d) None of these

49. A latch is an example of

(a) Monostable multivibrator (b) Astable multivibrator

(c) Bistable multivibrator (d) None of these

50. The flip-flop is activated only by

(a) Positive edge trigger (b) Negative edge trigger

(c) Either positive or negative edge trigger (d) None of these

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. State and explain Uniqueness theorem.

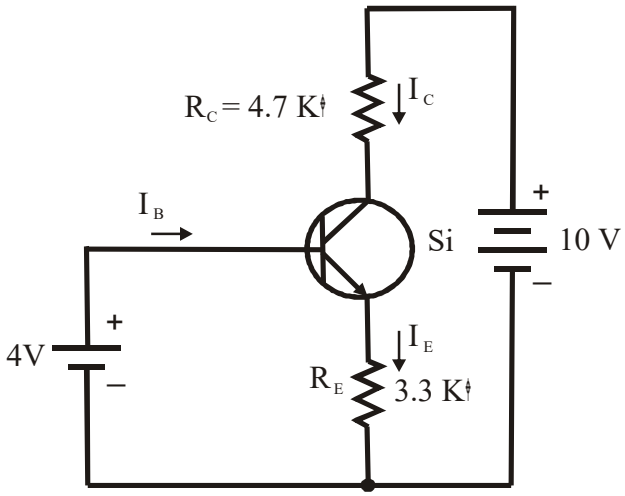
2. Write short notes on Faraday's Law of electromagnetic induction.

3. State Maxwell's equation in integral form.

4. What is transmission coefficient? Derive the relationship between transmission coefficient and reflection coefficient.

5. What is a cavity resonator? Explain the operation of a Cavity resonator.

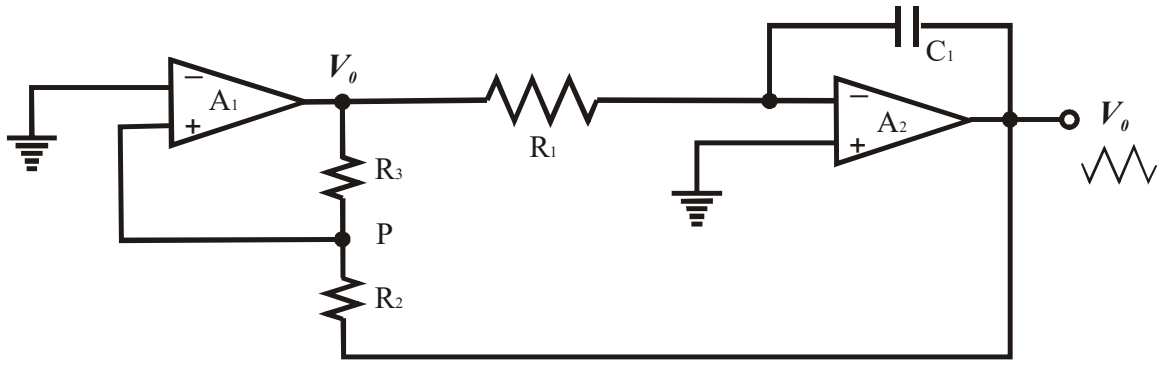
6. In the circuit shown below, $\beta = 100$. Calculate V_E, I_E, I_C and V_C.



7. Discuss different types of power amplifiers in terms of their efficiency and application.

8. A Colpitt's oscillator is to generate a frequency of 800 kHz. The capacitors to be used must have capacitance C_1=*100pF* and C_2=*10pF*. Find the value of inductance.

9. Assume that for the circuit shown below R_1=100 *k*Ω, R_2=10 *k*Ω, R_3=20 *k*Ω, C_1=0.01 μ*F* and V_{sat}=514*V* for the Opamp. Determine



(a) Period
(b) Frequency
(c) Peak value of square wave
(d) Peak value of triangular wave.

10. Draw the block schematic of an Opamp and explain the function of each stage.

11. State and explain Routh's Criterion.

12. Consider G(s)H(s) $= \frac{K(s+1)}{s(s+5)}$. Obtain the nature of its Root Locus.

13. What is Compensation? What are Compensators? What are the various compensation schemes used in practice?

14. Minimize the expression

$Y = \overline{A}\overline{B}C\overline{D} + ABC\overline{D} + A\overline{B}C\overline{D} + A\overline{B}CD + A\overline{B}\overline{C}\overline{D} + AB\overline{C}\overline{D} + \overline{A}\overline{B}CD + \overline{A}\overline{B}\overline{C}D.$

15. Draw and explain 2- input NMOS NAND Gate.

16. Define Half Subtractor and Full Subtractor.

17. Implement the following function using 3:8 Decoder

$F_1(A,B,C) = \sum m(0,1,4,5,7)$

$F_2(A,B,C) = \sum m(2,4,6,7)$

18. Explain the operation of an SR Flip Flop.

19. Design a MOD-5 synchronous counter using JK Flip Flop and Implement it.

20. Convert SR flip flop into JK flip flop.

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