

Date of Examination:	29-04-2022	Time:	2 Hrs
Name of the Post:	Junior Technical Superintendent (ECE)		

Name of the Candidate:											
Application No:											

Candidate's Signature

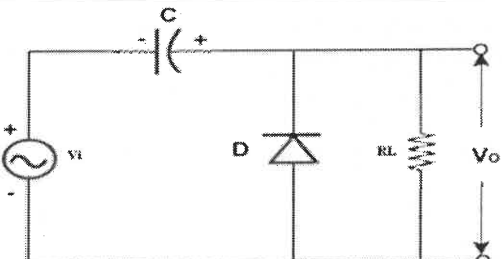
Invigilator's Signature

Instructions to the Candidate:

1. Use of Calculators, Cell Phones and Other Electronic Devices are not permitted inside the examination hall.
2. Candidate should fill the details on both question paper booklet and OMR sheet carefully without any corrections.
3. Candidate should carefully read the instructions given on the question paper booklet and OMR sheet
4. Candidate should mark correct answer only on OMR sheet.
5. **Question paper consists of 75 questions in total. The questions are divided into Part A and Part B. Part A consists of 50 questions carrying one mark each. Part B consists of 25 questions carrying two marks each.**
6. **Wrong answer per each question in Part A carries negative of 0.25 marks. Wrong answer per each question in Part B carries negative of 0.5 mark.**
7. Clarifications on Questions are not permitted.
8. Rough works can be done in the blank space provided at the end of the question paper booklet.
9. No Candidate is allowed to leave the examination hall till the examination is completed.
10. **Candidate should return both question paper booklet and the OMR sheet after completion of examination to the Invigilator**

PART A: (50 x 1 = 50 Marks)

1.	The real part of the complex frequency is called? A) radian frequency B) neper frequency C) sampling frequency D) angular frequency
2.	The value of one decibel is equal to? A) 0.115 N B) 0.125 N C) 0.135 N D) 0.145 N
3.	Inverse Laplace transform changes the _____ domain function to the _____ domain function. A) time, time B) time, frequency C) frequency, time D) frequency, frequency
4.	Determine the current if a 20-coulomb charge passes a point in 0.25 seconds A) 10 A B) 20 A C) 2 A D) 80 A
5.	If source impedance is complex, then maximum power transfer occurs when the load impedance is _____ the source impedance. A) equal to B) negative of C) complex conjugate of D) negative of complex conjugate of
6.	The number of branches incident at the node of a graph is called? A) degree of the node B) order of the node C) status of the node D) number of the node
7.	The value of α in the attenuation band of constant k-low pass filter is? A) $2 \cosh^{-1}(fc/f)$ B) $4 \cosh^{-1}(fc/f)$ C) $4 \cosh^{-1}(f/fc)$ D) $2 \cosh^{-1}(f/fc)$
8.	The expression of the characteristic impedance of a symmetrical T-section is is? A) $Z_{OT} = \sqrt{(Z_1^2/4 - Z_1 Z_2)}$ B) $Z_{OT} = \sqrt{(Z_1^2/4 + Z_1)}$ C) $Z_{OT} = \sqrt{(Z_1^2/4 + Z_2)}$ D) $Z_{OT} = \sqrt{(Z_1^2/4 + Z_1 Z_2)}$
9.	Which of the following device can be used to measure low voltage? A) VTVM B) Moving iron voltmeter C) CRO D) RPS
10.	Which of the following unit is used to express sensitivity of analog voltmeter? A) Ohms B) Voltage C) No unit D) Ohms per volt
11.	Basic building blocks of digital multimeter are _____ A) oscillator, amplifier B) diode, op amp C) rectifier, schmitt trigger D) A/D, attenuator, counter
12.	What is the effect of heat on the resistances in a Wheatstone bridge? A) no effect B) increases the voltage drop across the circuit C) decreases the current flowing through the circuit D) causes a permanent change in the resistance values
13.	Maxwell's equations can be written in A) integral form B) differential form C) logical form D) either in integral or differential form
14.	Which of the following is not an LC oscillator A) Hartley Oscillator B) Colpitts oscillator C) Crystal oscillator D) Clapp oscillator

15.	Low frequency oscillators have a frequency range of A) 20 Hz-20K Hz B) 20 Hz -100KHz C) 1 Hz -20KHz D) 50 Hz -100KHz
16.	In an LC transistor oscillator, the active device is _____ A) LC tank circuit B) Biasing circuit C) Transistor D) RC circuit
17.	A control system in which the control action is somehow dependent on the output is known as A) Closed loop system B) Semi-closed loop system C) Open loop system D) Unstable system
18.	Commercial Maxwell bridges measure A) inductances in the range of 1 to 1000H B) capacitances in the range of 10mF to 1F C) resistances in the range of 0.001 Ω to 1 Ω D) power in the range of 1W to 50MF
19.	Mass action law states that ----- (n_i = intrinsic concentration, n is electron concentration & p is hole concentration) A) $n_i^2 = n * p$ B) $n_i^2 = n / p$ C) $n^2 = n_i * p$ D) $p=n_i$
20.	trans resistance amplifier has A) high input impedance & low output impedance B) high input impedance & high output impedance C) low input impedance & high output impedance D) low input impedance & low output impedance
21.	Which of the following parameters of P-N junction diode increases with temperature. A) Cut in voltage B) Reverse saturation current C) Ideality factor D) Resistance
22.	The breakdown voltage of the P-N junction diode decreases due to the increase in. A) Reverse saturation current B) Reverse leakage current C) Bias voltage D) Barrier voltage
23.	The tunnelling involves _____ A) acceleration of electrons in p side B) movement of electrons from n-side conduction band to p-side valance band C) charge distribution management in both the bands D) positive slope characteristics of diode
24.	 <p>Circuit shown in above figure is ----- circuit A) positive clipper B) negative clamper C) positive clamper D) negative clipper</p>
25.	The stable oscillator is ----- oscillator A) LC oscillator B) clapp oscillator C) crystal oscillator D) RC phase shift oscillator
26.	The main advantage of feedback in amplifier is ----- A) gain stability B) decrease in bandwidth C) increase in output impedance D) none of the above

27.	The crossover distortion occurs in _____ amplifier A) Class A B) Class B C) Class C D) Class AB
28.	BFW 10 Represents _____ A) JFET B) Transistor C) Diode D) UJT
29.	The gain of an amplifier with feedback is known as _____ gain A) Open loop B) closed loop C) Resonant D) Resistance
30.	When a negative voltage feedback is applied to an amplifier, its bandwidth _____ A) Decreases B) increases C) remains the same D) None
31.	The use of coupling capacitor in CE amplifier is A) to block DC B) to allow low frequency C) to shift Q point D) to allow DC
32.	_____ amplifier amplifies Voltage and Current A) Common Base B) Common emitter C) Common Collector D) All
33.	What is the value of current when the gate to source voltage is less than the pinch off voltage? A) 0mA B) 1mA C) 10mA D) 5mA
34.	In BC 107 transistor, C stands for A) Small Signal B) Low power C) large signal D) either a or b
35.	Typical values of h_{ie} and h_{fe} of a transistor BC107B at Q-point (2mA, 5V) are A) 4.5K Ω and 330 B) 6.5K Ω and 630 C) 2.5K Ω and 230 D) 3.5K Ω and 530
36.	In majority of instruments damping is provided by (A) fluid friction B) spring (C) eddy currents D) hysteresis
37.	The function of shunt in an ammeter is to A) by pass the current B) increase the sensitivity of the ammeter C) increase the resistance of ammeter D) decrease the sensitivity of ammeter
38.	In FET, Drain Current (I_D) is ----- A) directly proportional to V_{GS} B) directly proportional to square of the V_{GS} C) inversely proportional to V_{GS} D) inversely proportional to square of the V_{GS}
39.	The ratio of change in drain current (ΔI_D) to the change in gate-source voltage (ΔV_{GS}) is A) output conductance B) trans conductance C) trans resistance D) output resistance
40.	Relation among μ , r_d & g_m is A) $\mu = r_d / g_m$ B) $g_m = r_d / \mu$ C) $\mu = r_d * g_m$ D) $g_m = r_d * \mu$
41.	The decimal equivalent of the octal number $(645)_8$ is _____ A) $(450)_{10}$ B) $(451)_{10}$ C) $(421)_{10}$ D) $(501)_{10}$
42.	The excess-3 code for 597 is given by _____ A) 100011001010 B) 100010100111 C) 010110010111 D) 010110101101
43.	On multiplication of $(10.10)_2$ and $(01.01)_2$ is _____ A) 101.0010 B) 0010.101 C) 011.0010 D) 110.0011

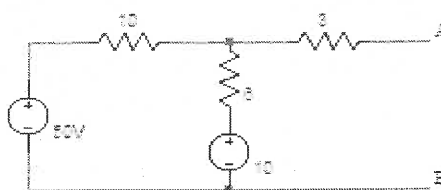
44.	Simplify $Y = AB' + (A' + B)C$. A) $AB' + C$ B) $AB + AC$ C) $A'B + AC'$ D) $AB + A$
45.	The canonical sum of product form of the function $y(A,B) = A + B$ is _____ A) $AB + BB + A'A$ B) $AB + AB' + A'B$ C) $BA + BA' + A'B'$ D) $AB' + A'B + A'B'$
46.	If A, B and C are the inputs of a full adder then the carry is given by _____ A) A AND B OR (A OR B) AND C B) A OR B OR (A AND B) C C) (A AND B) OR (A AND B)C D) A XOR B XOR (A XOR B) AND C
47.	How many inputs will a decimal-to-BCD encoder have? A) 4 B) 8 C) 10 D) 16
48.	In a multiplexer, the selection of a particular input line is controlled by _____ A) Data controller B) Selection lines C) Logic gates D) Both (A) and (b)
49.	How many select lines would be required for an 8- line-to-1-line multiplexer? A) 2 B) 4 C) 8 D) 3
50.	What is the maximum possible range of bit-count specifically in n-bit binary counter consisting of 'n' number of flip-flops? A) 0 to 2^n B) 0 to 2^{n+1} C) 0 to 2^{n-1} D) 0 to $2^{n+1/2}$

Part – B (25 Questions and each carry 2 Marks)

Note: Wrong answer per each question in Part B carries negative of 0.5 marks.

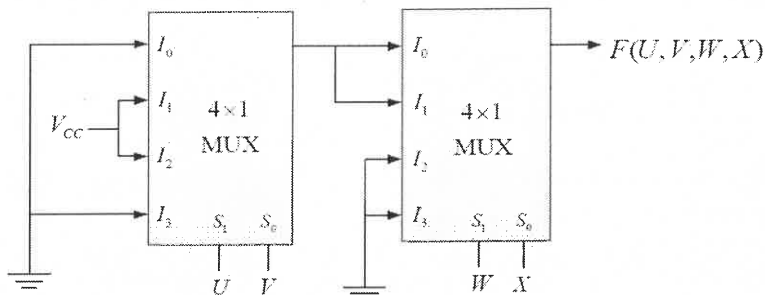
51.	<p>Consider the circuit shown in the following figure</p> <p>The Boolean expression F implemented by the circuit is</p> <p>(A) $\overline{XYZ} + XY + \overline{YZ}$ (B) $\overline{XYZ} + XZ + \overline{YZ}$ (C) $\overline{XYZ} + XY + \overline{YZ}$ (D) $\overline{XYZ} + XY + \overline{YZ}$</p>
52.	The output Y of a 2-bit comparator is logic 1 whenever the 2-bit input A is greater than the 2-bit input B. The number of combinations for which the output is logic 1, is A) 4 B) 6 C) 8 D) 10
53.	<p>For the circuit shown in the following figure, P and Q are the inputs and Y is the output, then what is the logic implemented by the circuit is</p> <p>A) XNOR B) XOR C) NOR D) OR</p>

54. Determine the equivalent thevenin's voltage between terminals A and B in the circuit shown below.



- A) 5 B) 15 C) 25 D) 35

55. A four-variable Boolean function is realized using 4x1 multiplexers as shown below



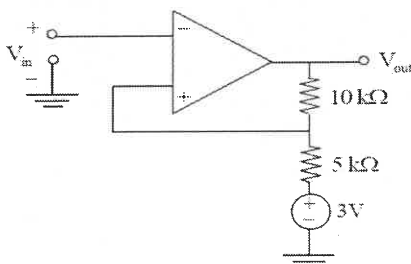
The minimized expression for $F(U, V, W, X)$ is

- (A) $(UV + \bar{U}\bar{V})\bar{W}$ (B) $(UV + \bar{U}\bar{V})(\bar{W}\bar{X} + \bar{W}X)$
 (C) $(U\bar{V} + \bar{U}V)\bar{W}$ (D) $(U\bar{V} + \bar{U}V)(\bar{W}\bar{X} + \bar{W}X)$

56. For a two stage op-amp with a slew rate of $200V/\mu\text{sec}$ and a load capacitance of 1pF , what is the bias current required?

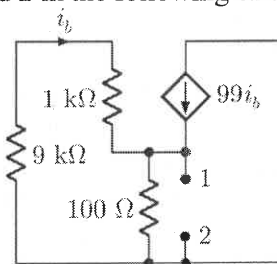
- A) $20\mu\text{A}$ B) $100\mu\text{A}$ C) $200\mu\text{A}$ D) 1mA

57. For the operational amplifier circuit shown below, the output saturation voltages are $\pm 15\text{V}$. The upper and lower threshold voltages for the circuit are _____ and _____ respectively.



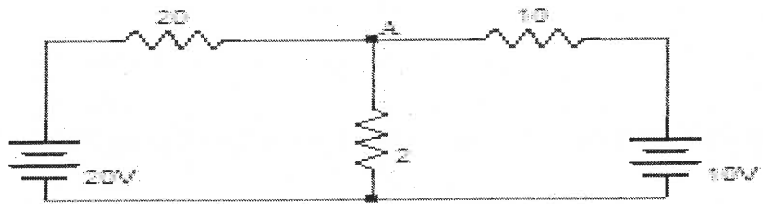
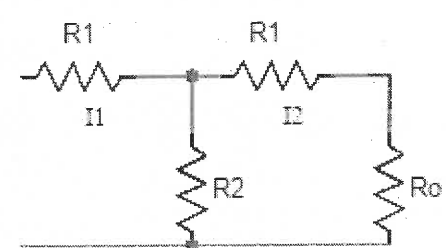
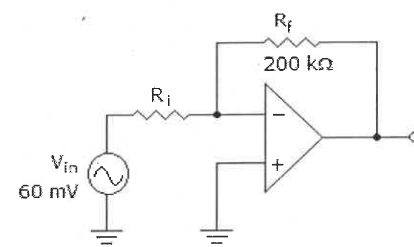
- A) $+5\text{V}$ and -5V B) $+7\text{V}$ and -3V C) $+3\text{V}$ and -7V D) $+3\text{V}$ and -3V

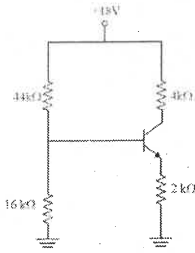
58. The impedance looking into nodes 1 and 2 in the following circuit is



- A) 50Ω B) 100Ω C) $5\text{k}\Omega$ D) $10.1\text{k}\Omega$

59. For a BJT the common base current gain $\alpha = 0.98$ and the collector base junction reverse bias saturation current $I_{CO} = 0.6\mu\text{A}$. This BJT is connected in the common emitter mode and operated in the active region with a base drive current $I_B = 20\mu\text{A}$. The collector current I_C for this mode of operation is
- A) 0.98mA B) 0.99mA C) 1.0mA D) 1.01mA

60.	Using a 10nF capacitor C, find the value of R that yields an output of 100us in the monostable circuit using 555-timer A) 13.3kΩ B) 15kΩ C) 9.1kΩ D) None of the above
61.	An op-amp has a rated voltage of ±10V and slew rate of 1V/us. What is its full power bandwidth A) 2.53kHz B) 49.9kHz C) 1.59kHz D) 15.9kHz
62.	Find the voltage across 2Ω resistor due to 20V source in the circuit shown below.  A) 1 B) 1.5 C) 2 D) 2.5
63.	In the circuit shown below, find the value of I ₁ /I ₂ .  A) (R ₁ -R ₂ +R ₀)/R ₂ B) (R ₁ +R ₂ +R ₀)/R ₂ C) (R ₁ -R ₂ -R ₀)/R ₂ D) (R ₁ +R ₂ -R ₀)/R ₂
64.	The inverse transform of the function k/(s+a) is? A) ke ^{-at} u(t) B) ke ^{at} u(t) C) ke ^{-at} u(t-a) D) ke ^{at} u(t-a)
65.	Differential mode gain = 10000 & common mode gain = 10 then value of CMRR of OPAMP is _____ A) zero B) 10 ⁵ C) 1000 D) 100
66.	If R _f = 200KΩ & R _i = 10KΩ then gain for non-inverting OP-AMP is _____ A) 20 B) 21 C) 22 D) 2000
67.	Consider the circuit shown in below figure. If R _i = 100kΩ then output voltage is _____  A) 120mV B) 60mV C) -120mV D) -121mV
68.	The frequency (in rad/s) for Hartley oscillator, if L _{eq} = 5mH & C = 2μF is _____ A) 10Krad/sec B) 10Mrad/sec C) 100Krad/sec D) 100Mrad/sec
69.	Minimum number of 2 input NAND gates required to implement the function, F = (X̄ + Ȳ)(Z + W) is A) 3 B) 4 C) 5 D) 6

70.	<p>Consider the circuit shown in the below figure. Assume base-to-emitter voltage $V_{BE} = 0.8V$ and common base current gain (α) of the transistor is unity. The value of the collector-to-emitter voltage V_{CE} (in volts) is</p>  <p>A) 6V B) 8V C) 10V D) 4V</p>
71.	<p>The minimum number of NAND gates required to implement the Boolean function $A + AB + ABC$ is equal to</p> <p>A) Zero B) 1 C) 4 D) 7</p>
72.	<p>A stable LTI system has a transfer function $H(S) = \frac{1}{S^2 + S - 6}$ to make this system Causal it needs to be cascaded with another LTI system having T.F. $H_1(S)$. Then $H_1(S)$ is</p> <p>A) $S + 3$ B) $S - 2$ C) $S - 6$ D) $S + 1$</p>
73.	<p>A transistor has an I_C of 100mA and I_B of 0.5mA. What is the value of α_{dc}?</p> <p>A) 0.565 B) 0.754 C) 1.24 D) 0.995</p>
74.	<p>The base current for a BJT remains constant at 5mA, the collector current changes from 0.2mA to 0.3mA and beta was changed from 100 to 110, then calculate the value of S.</p> <p>A) 0.01m B) 1m C) 100m D) 25m</p>
75.	<p>A transistor is connected in CB configuration. The emitter voltage is changed by 200mV, the emitter by 5mA. During this transition the collector base voltage is kept constant. What is the input dynamic resistance?</p> <p>A) 30Ω B) 60Ω C) 40Ω D) 50Ω</p>

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