

# Answer Key :ECE

Type: ECE

1) The Eigen values of the matrix  $\begin{bmatrix} -1 & 3 & 5 \\ -3 & -1 & 6 \\ 0 & 0 & 3 \end{bmatrix}$  are

Options:

- 1.3,  $3+5j$ ,  $-6-j$
- 2.  $-6+5j$ ,  $3+j$ ,  $3-j$
- 3.  $3+j$ ,  $3-j$ ,  $5+j$
- 4.3,  $-1+3j$ ,  $-1-3j$

Correct Option: 4

Type: ECE

2) The standard deviation of a uniformly distributed random variable between 0 and 1 is

Options:

- $1.1/\sqrt{12}$
- $2.1/\sqrt{3}$
- $3.5/\sqrt{12}$
- $4.7/\sqrt{12}$

Correct Option: 1

Type: ECE

3) The Newton-Raphson method is used to solve the equation  $f(x) = x^3 - 5x^2 + 6x - 8 = 0$ . Taking initial guess  $x = 5$ , the solution at the end of first iteration is

Options:

- 1.4
- 2.4.3
- 3.3.5
- 4.5.3

Correct Option: 2

Type: ECE

4) The magnitude of the gradient for the function  $f(x,y,z) = x^2 + 3y^2 + z^3$  at the point (1,1,1) is

Options:

- 1.6
- 2.7
- 3.8
- 4.9

Correct Option: 2

Type: ECE

5) The solution of the differential equation  $dy/dx = ky$ ,  $y(0) = c$  is

Options:

- 1.  $x = ce^{-ky}$
- 2.  $x = ke^{cy}$
- 3.  $y = ce^{kx}$
- 4.  $y = ce^{-kx}$

Correct Option: 3

Type: ECE

6) The residues of a complex function  $X(z) = (1-2z)/[z(z-1)(z-2)]$  at its poles are

Options:

- 1.  $1/2$ ,  $-1/2$  and  $1$
- 2.  $1/2$ ,  $1/2$  and  $-1$
- 3.  $1/2$ ,  $1$  and  $-3/2$
- 4.  $1/2$ ,  $-1$  and  $3/2$

Correct Option: 3

Type: ECE

7) The Laplace Transform of  $f(t) = e^{2t} \sin(5t) u(t)$  is

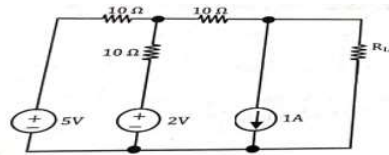
Options:

- 1.  $5/(s^2-4s+29)$
- 2.  $5/(s^2+5)$
- 3.  $(s-2)/(s^2-4s+29)$
- 4.  $5/(s+5)$

**Correct Option: 1**

**Type: ECE**

**8) In the circuit shown, the value of  $R_L$  such that the power transferred to  $R_L$  is maximum is**



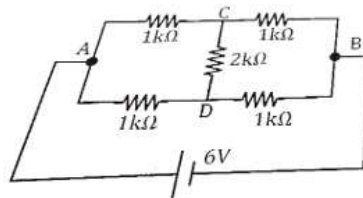
**Options:**

- 1.5  $\Omega$
- 2.10  $\Omega$
- 3.15  $\Omega$
- 4.20  $\Omega$

**Correct Option: 3**

**Type: ECE**

**9) The current through the 2 k $\Omega$  resistance in the circuit shown is**



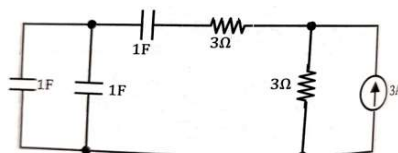
**Options:**

- 1.0 mA
- 2.1 mA
- 3.2 mA
- 4.6 mA

**Correct Option: 1**

**Type: ECE**

**10) The time constant for the given circuit will be**



**Options:**

- 1.1/9 s
- 2.1/4 s
- 3.4 s
- 4.9 s

**Correct Option:** 3

**Type:** ECE

**11) If the unit step response of a network is  $(1 - e^{-\alpha t})$ , then its unit impulse response is**

**Options:**

- 1.  $\alpha e^{-\alpha t}$
- 2.  $\alpha^{-1} e^{-\alpha t}$
- 3.  $(1 - \alpha^{-1}) e^{-\alpha t}$
- 4.  $(1 - \alpha) e^{-\alpha t}$

**Correct Option:** 1

**Type:** ECE

**12) The result of the convolution  $x(-t) * \delta(-t - t_0)$  is**

**Options:**

- 1.  $x(t + t_0)$
- 2.  $x(t - t_0)$
- 3.  $x(-t + t_0)$
- 4.  $x(-t - t_0)$

**Correct Option:** 4

**Type:** ECE

**13) The fundamental period of the discrete-time signal  $x[n] = e^{j(5\pi/6)n}$  is:**

**Options:**

- 1.  $6/5\pi$
- 2.  $12/5$
- 3. 6
- 4. 12

**Correct Option:** 4

**Type: ECE**

**14) The closed-loop transfer function is  $T(s) = 4/(s^2+0.4s+4)$ . The steady state error due to unit step input is \_\_\_\_.**

**Options:**

- 1.0
- 2.1
- 3.10
- 4.0.1

**Correct Option: 1**

**Type: ECE**

**15) The transfer function of a system is given as  $100/(S^2+20S+100)$ . The system is**

**Options:**

- 1.An over damped system
- 2.An underdamped system
- 3.A critically damped system
- 4.An unstable system

**Correct Option: 3**

**Type: ECE**

**16) In a Bode magnitude plot, which one of the following slopes would be exhibited at high frequencies by a 4th order all-pole system?**

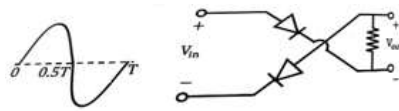
**Options:**

- 1.-80 dB/decade
- 2.-40 dB/decade
- 3.+40 dB/decade
- 4.+80 dB/decade

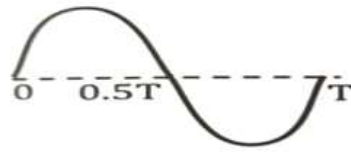
**Correct Option: 1**

**Type: ECE**

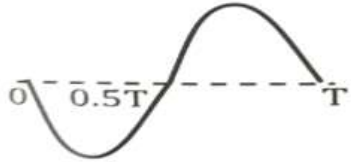
**17) For the circuit with ideal diodes shown in the figure , the shape of output ( $V_{out}$ ) for the given sine wave input ( $V_{in}$ ) will be**



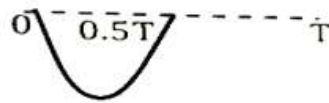
**Options:**



• 1.



• 2.



• 3.



• 4.

**Correct Option: 3**

**Type: ECE**

**18) Which one of the following statement is correct about an ac-coupled common-emitter amplifier in the mid-band region?**

**Options:**

- 1. The device parasitic capacitances behave like open circuits, whereas coupling and bypass capacitances behave like short circuits.
- 2. The device parasitic capacitances, coupling capacitances and bypass capacitances behave like open circuits.
- 3. The device parasitic capacitances, coupling capacitances behave like short circuits.
- 4. The device parasitic capacitances behave like short circuits, whereas coupling and bypass capacitances behave like open circuits.

**Correct Option: 1**

**Type: ECE**

19) The OPAMP circuit shown below represents a

Options:

- 1.High pass filter
- 2.Low pass filter
- 3.Band pass filter
- 4.Band reject filter

Correct Option: 2

Type: ECE

20) The Boolean expression  $Y = \bar{A}\bar{B}\bar{C}D + \bar{A}BC\bar{D} + A\bar{B}\bar{C}D + ABC\bar{D}$  can be minimized to

Options:

- 1.  $Y = \bar{A}\bar{B}\bar{C}D + \bar{A}B\bar{C} + A\bar{C}D$
- 2.  $Y = \bar{A}\bar{B}\bar{C}D + BC\bar{D} + A\bar{B}\bar{C}D$
- 3.  $Y = \bar{A}B\bar{C}\bar{D} + \bar{B}\bar{C}D + A\bar{B}\bar{C}D$
- 4.  $Y = \bar{A}B\bar{C}\bar{D} + \bar{B}\bar{C}D + A\bar{B}\bar{C}\bar{D}$

Correct Option: 4

Type: ECE

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

Options:

- 1.An AND gate
- 2.An OR gate
- 3.A XOR gate
- 4.A NAND gate

Correct Option: 3

Type: ECE

22) A 4 to 1 multiplexer to realize a boolean function  $F(X,Y,Z)$  is shown in the figure below. The inputs Y and Z are connected to the selectors of the MUX (Y is more

significant). The canonical sum-of-product expression for  $F(X,Y,Z)$  is

Options:

- 1.  $\Sigma m(2,3,4,7)$
- 2.  $\Sigma m(1,3,5,7)$
- 3.  $\Sigma m(0,2,4,6)$
- 4.  $\Sigma m(2,3,5,6)$

**Correct Option: 1**

**Type: ECE**

23) A message  $m(t) = \cos 2000\pi t + 4\cos 4000\pi t$  modulates the carrier  $c(t) = \cos 2\pi f_c t$  where at  $f_c = 1$  MHz to produce an AM signal. For demodulating the generated AM signal using an envelope detector, the time constant  $RC$  of the detector circuit should satisfy

Options:

- 1.  $0.5 \text{ ms} < RC < 1 \text{ ms}$
- 2.  $1 \mu\text{s} \ll RC \ll 0.5 \text{ ms}$
- 3.  $RC \ll 1 \mu\text{s}$
- 4.  $RC \gg 0.5 \text{ ms}$

**Correct Option: 2**

**Type: ECE**

24) Consider a random process  $X(t) = \sqrt{2} \sin(2\pi t + \phi)$ , where the random phase  $\phi$  is uniformly distributed in the interval  $[0, 2\pi]$ . The autocorrelation  $E[X(t_1)X(t_2)]$  is

Options:

- 1.  $\cos(2\pi(t_1+t_2))$
- 2.  $\sin(2\pi(t_1-t_2))$
- 3.  $\sin(2\pi(t_1+t_2))$
- 4.  $\cos(2\pi(t_1-t_2))$

**Correct Option: 4**

**Type: ECE**

25) A memoryless source emits  $n$  symbols each with a probability  $p$ . The entropy of the source as a function of  $n$

**Options:**

- 1.Increases as  $\log n$
- 2.Decreases as  $\log(1/n)$
- 3.Increases as  $n$
- 4.Increases as  $n \log n$

**Correct Option:** 1

**Type:** ECE

**26) A sinusoidal signal of 2 kHz frequency is applied to a delta modulator. The sampling rate and step size  $\Delta$  of the delta modulator are 20,000 samples per second and 0.1V respectively. To prevent slope overload, the maximum amplitude of the sinusoidal signal (in Volts) is**

**Options:**

- 1. $1/2\pi$
- 2. $1/\pi$
- 3. $2/\pi$
- 4. $\pi$

**Correct Option:** 1

**Type:** ECE

**27) The Ebers-Moll model of a BJT is valid**

**Options:**

- 1.Only in active mode
- 2.Only in active and saturation modes
- 3.Only in active and cut-off modes
- 4.In active, saturation and cut-off modes

**Correct Option:** 4

**Type:** ECE

**28) An extra high voltage transmission line of the length 300 km can be approximated by a lossless line having propagation constant  $\gamma = 0.00127$  radians per km. Then the percentage ratio of the length to wavelength will be given by**

**Options:**

- 1.24.24%

- 2.12.12%
- 3.19.05%
- 4.6.06%

**Correct Option:** 4

**Type:** ECE

**29) If a right-handed circularly polarized wave is incident normally on a plane perfect conductor, then the reflected wave will be**

**Options:**

- 1.Right-handed circularly polarized
- 2.Left-handed circularly polarized
- 3.Elliptically polarized with tilt  $45^\circ$
- 4.Horizontally polarized

**Correct Option:** 2

**Type:** ECE

**30) Which option is the closest in meaning to the sentence below? She enjoyed herself immensely at the party?**

**Options:**

- 1.She had a terrible time at the party
- 2.She had a horrible time at the party
- 3.She had a terrific time at the party
- 4.She had a terrifying time at the party

**Correct Option:** 3