EC GATE 2010 Answer Keys

1	C	**2**	C	**3**	D	**4**	A	**5**	D	**6**	B	**7**	A
8	B	**9**	A	**10**	A	**11**	D	**12**	D	**13**	B	**14**	A
15	C	**16**	D	**17**	B	**18**	B	**19**	A	**20**	C	**21**	B
22	C	**23**	D	**24**	C	**25**	C	**26**	A	**27**	D	**28**	C
29	C	**30**	B	**31**	D	**32**	A	**33**	A	**34**	A	**35**	B
36	C	**37**	D	**38**	B	**39**	D	**40**	C	**41**	B	**42**	C
43	C	**44**	D	**45**	D	**46**	A	**47**	B	**48**	B	**49**	A
50	D	**51**	C	**52**	C	**53**	A	**54**	B	**55**	D	**56**	B
57	A	**58**	D	**59**	C	**60**	D	**61**	C	**62**	C	**63**	D
64	B	**65**	B										

Explanations:-

1. For a real skew symmetric matrix the non-zero eigen values are all pure imaginary and thus occurs in complex conjugate pair.

2. Since given waveform is even, thus it will have only cosine terms. Function f(t) has more negative value then positive, so it will have negative DC Component.

3. $$\frac{d^2x}{dx^2} - \frac{n(x)}{L^2} = 0$$

$$\left(S^2 - \frac{1}{L^2}\right)n(x) = 0,\ n(x) = Ae^{\frac{-x}{2}} + Be^{\frac{x}{2}}$$

$$n(\infty) = 0 \therefore B = 0,\ n(0) = k \therefore B = k$$

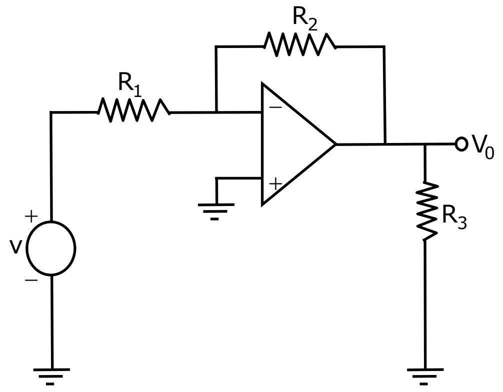
4. $$\begin{bmatrix} \frac{1}{0.5} + \frac{1}{0.5} & \frac{-1}{0.5} \\ \frac{-1}{0.5} & \frac{1}{0.5} + \frac{1}{0.5} \end{bmatrix} = \begin{bmatrix} 4 & -2 \\ -2 & 4 \end{bmatrix}$$

5. Bandwidth $= \frac{1}{RC}, \frac{1}{Z_i} = \frac{1}{R} + \frac{1}{X_L} + \frac{1}{X_C}$ Thus it is maximum at resonance.

9. Given circuit after removing C_E will behave as current-series feedback. Overall voltage gain will decrease as feedback signal comes into picture and since it is current-series feedback, input impedance increases.

10. By rearranging

$$\frac{V_0}{V_i} = -\frac{R_2}{R_1}$$



11. $\overline{A+B} = \overline{A}\,.\,\overline{B}$

$\overline{A\cdot B} = \overline{A}+\overline{B}$

$A\oplus B = A\overline{B}+\overline{A}B$

$A\odot\overline{B} = A\overline{B}+\overline{A}B$

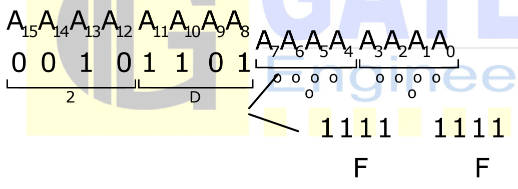
$A\odot\overline{B} = AB+\overline{A}\,\overline{B}$

$\overline{A}\oplus B = \overline{A}\,\overline{B}+AB$

12. $B = \overline{A}$

$F = A\odot B\odot C = A\odot\overline{A}\odot C = C$ so, $F = 1$ when $C = 1$

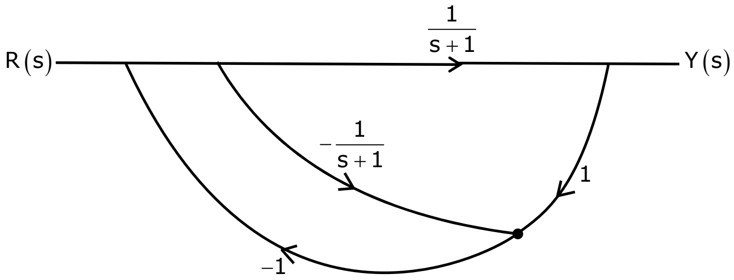
13.



14. $X(z) = 5z^2 + 4z^{-1} + 3 = \left\{5, 0, \underset{\uparrow}{3}, 4\right\}$

15. $h_1(n) \to$ delay by 1, $h_2(n) \to$ delay by 2, $h_1(n) * h_2(n) \to$ delay by 3

17. Construct a signal flow graph



$$\frac{y(s)}{R(s)} = \frac{\frac{1}{s+1}[1-0]}{1-\left[\frac{1}{s+1}-\frac{1}{s+1}\right]} = \frac{1}{s+1}$$

18. $|y(t)| = |M(\omega)||x(t)|$

$1 = \frac{wp}{\sqrt{\omega^2+p^2}}$

$\omega^2+p^2 = \omega^2 p^2,\ 4+p^2 = 4p^2$

$3p^2 = 4,\ p = \frac{2}{\sqrt{3}}$

19. $= \frac{20R}{R+Cs+LCRs^2} = \frac{20}{2+20j} \simeq -j$

20. $\left.\begin{array}{l}(A)\to DSB\\ (D)\to SSB\end{array}\right\} m = \frac{V_m}{V_c} = \frac{V_m}{0} = \infty$

$(B) \to m = \frac{2}{1} = 2$

(C) is without over modulation

21. Power $= \frac{Ac^2}{2} = \frac{6^2}{2} = \frac{36}{2} = 18$

22. $S_{11} \ne S_{22} \ne 0$ lossy $[S]^1 = [S]$ Reciprocal

23. Distribution less $\frac{R}{L} = \frac{G}{C}$

$\alpha = \sqrt{RG}$ and $Z_0 = \sqrt{RG} \to G = \frac{0.1}{2500}$

$\alpha = \sqrt{\frac{0.1\times 0.1}{2500}} = 0.002NP/m$

24. $h(t) = s(T-t)$

25. $P_{AV} = \frac{E^2}{2\eta} = \frac{1}{2\times 120\pi\times\sqrt{\frac{u_r}{\varepsilon_r}}} = \frac{1}{2\times 120\pi\times\sqrt{\frac{1}{4}}} = \frac{1}{120\pi}$

26. $y = \frac{1}{x}\ln x,\ \frac{dy}{dx} = \frac{1}{x^2} - \frac{\ln x}{x^2} = 0, \quad x = e(\max)$

27. 4 heads & 0 tail or 3 head & 1 tail $P = {}^4C_0\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right)^0 + {}^4C_3\left(\frac{1}{2}\right)^3\left(\frac{1}{2}\right)^1 = \frac{5}{16}$

28. $\int_C A.d\ell = \int_C \left(xy\ \hat{a}_x + x^2\ \hat{a}_y\right)\left(\hat{a}_x dx + \hat{a}y\ dy\right)$

$$= \int_C (xy\ dx + x^2 dy) = \int_{1/\sqrt{3}}^{2/\sqrt{3}} x\ dx + \int_{1/\sqrt{3}}^{1/\sqrt{3}} 3x\ dx + \int_1^3 \frac{4}{3} dy + \int_3^1 \frac{1}{3} dy = 1$$

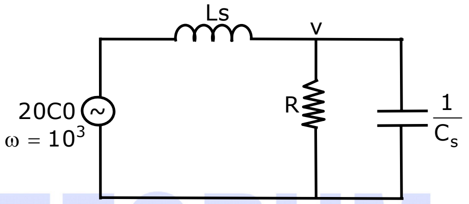
29. $z \times (z)\Big|_{z=0} = \frac{1}{2},\ \ (z-1)\times(z)\Big|_{z=1} = 1,\ \ (z-2)\times(z)\Big|_{z=2} = \frac{-3}{2}$

31. $1 = \frac{s(3s+1)}{s^3 + 4s^2 + (k-3)s}\Bigg|_{s\to 0} = \frac{3s+1}{s^2 + 4s + (k-3)} = \frac{1}{k-3}\ \ k = 4$

32. $i(f) = 0.5,\ i(i) = 0.75$

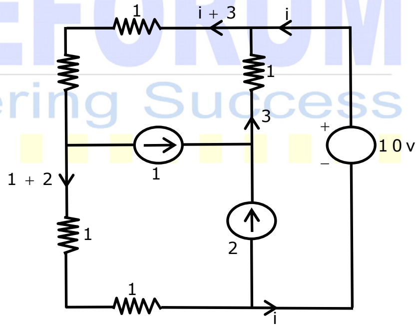
$$i(t) = V_f + \left(i_i - i_j\right)e^{-1/\pi} = 0.5 - 0.125e^{-1000t}$$

33. $V = \dfrac{\dfrac{20}{Ls}}{\left[\dfrac{1}{Ls} + \dfrac{1}{R} + C_s\right]}$



$$= \frac{20R}{R + Cs + LCRs^2} = \frac{20}{2 + 20j} \simeq -j$$

34.

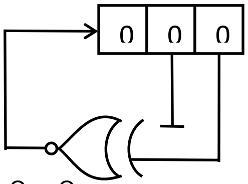


KVL → $10 = 2(i+3) + 2(i+2)$

$10 = 10 + 4i \Rightarrow i = 0$

∴ Power = 0

37.



Q_A	Q_B	Q_C
0	0	0
1	1	0
0	1	1
1	0	1
0	1	0
0	0	1
0	0	1

38. When $V_i = -10$ $V_0 = 5$ Only B option matches

39.

CD
AB

0	0	1	1
0	1	1	0
1	0	0	0
1	1	0	0

$$F = \Sigma m(2,3,5,7,8,9,12)$$

40. A → 0100 0101

B → 0100 0101

Carry flag → 0

RAR will A → 0010 0010

XRA B 0110 0111

$\underline{6\ \ 7}$

41. $y(s) = \dfrac{2(s+2)}{(s+1)(s+3)} \times \dfrac{1}{s+2} = \dfrac{2}{(s+1)(s+3)},\ \ y(t) = \left(e^{-t} - e^{-3t}\right)u(t)$

42. S1 true, S2 False (meter stable nor causal) S3 True

43. $f_s = 2f_m$

$$= 2\left[\frac{500}{2} + \frac{700}{2}\right] = 1200\text{Mz}$$

44. $E(s) = \dfrac{sR(s)}{1 + [G(s) + G_c(s)]H(s)}$

$$= \left.\frac{1}{1 + [G(s) + G_C(s)]}\right|_{s\to 0}$$

so, $G_C(s)\big|_{s\to 0}$ should be maximum for low error $= \infty\ G_C(s)\big|_{s\to 0}$

46.

$$\begin{array}{l|l} y < 0 & y > 0 \\ \eta_1 = 120\pi & \eta_2 = 40\pi \end{array}$$

$$\rho = \frac{[40 - 120]\pi}{[40 + 120]\pi} = \frac{-1}{2}$$

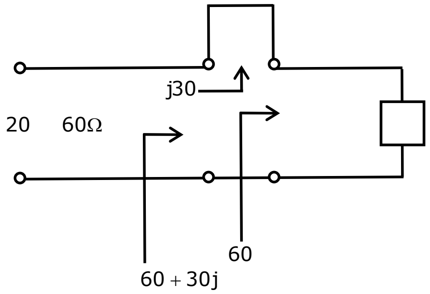
$\therefore\ \rho = -\text{Ve}\ \vec{E}$ will change direction & M will not change its direction,

Direction of $\vec{M}$ for incident field is in x, so direction of $\vec{M}$ in the reflected field is also is in x.

$$|M_C| = \frac{|E_i\rho|}{\eta} = \frac{24 \times \frac{1}{2}}{120\pi} = \frac{1}{10\pi}$$

47. $|\rho| = \left|\frac{60+30j-60}{60+30j+60}\right| = \left|\frac{30j}{120+300}\right| = \frac{1}{\sqrt{17}}$

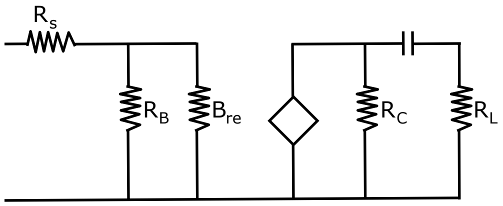
$\text{USWR} = \frac{1+|\rho|}{1-|\rho|} = 1.64$



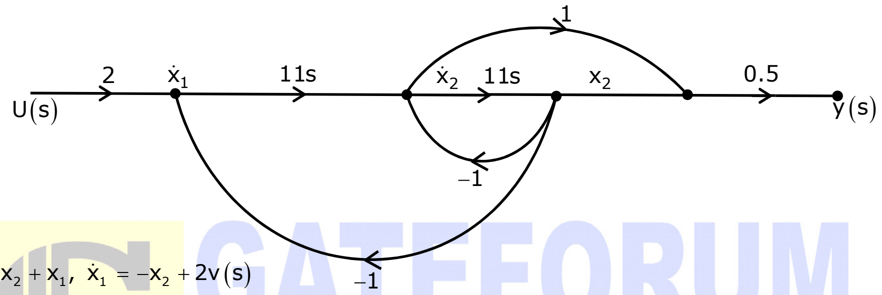
48. $Z_s = R_s + (R_B \,||\, Br_e)$

$r_c = 2.475$

$= 1.258\text{kV}$



50. Let us take two state variable as shown x_1 and x_2



$\dot{x}_2 = -x_2 + x_1,\ \dot{x}_1 = -x_2 + 2v(s)$

$$\Rightarrow \begin{bmatrix}\dot{x}_2\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}-1 & 1\\ -1 & 0\end{bmatrix}\begin{bmatrix}x_2\\ x_1\end{bmatrix} + \begin{bmatrix}0\\ 2\end{bmatrix}U(s)$$

$$y(s) = 0.5x_1 + 0.5x_2 \quad = [0.5 \quad 0.5]\begin{bmatrix}x_2\\ x_1\end{bmatrix}$$

54. $\left.\begin{aligned} S_n(f) &= \frac{N_0}{2} \\ R(\tau) &= \frac{N_0}{2}\delta(\tau)\end{aligned}\right] \rightarrow$ exist in fourier transform pair

$R(0) = \frac{N_0}{2}$, Power $= 2\ \frac{N_0}{2}\ \times 1\times10^{-16} = 2\times10^{-14}$

Variance $= \frac{2}{d^2}$ which is equal to power power since mean is zero $\Rightarrow \alpha = 10^7$

55. Probability of error

$$= \int_{a/2}^{\infty} 0.5\,\alpha e^{-\alpha|n|} = 0.5\,e^{-\alpha\times a/2} = 0.5\,e^{-10^7\times10^{-6}} = 0.5\,e^{-10}$$

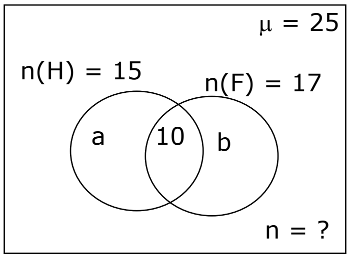
56. Circuitous means round about or not direct. Therefore the closest in meaning will be indirect

57. A worker who is inactive or not working is termed as unemployed, similarly land which is inactive or not in use is called Fallow.

58. The clue in this sentence is 'If we manage to ______our natural resources' and 'better planet'. This implies that the blank should be filled by a word which means 'preserve' or 'keep for long time'. Therefore the word 'conserve' is the right answer.

59. The key words in the statement are 'casual remarks' and 'lack of seriousness'. The blank should be filled with a word meaning 'showed' or 'revealed'. Hence, 'betrayed' is the correct answer.

60. Representing the given information in the Venn diagrams, we have



Let the number of people who play only hockey = a

The number of people who play only football = b

Now, a = n(H) − 10 = 15 − 10 = 5

b = n(F) − 10 = 17− 10 = 7

Clearly, a + b + 10 + n = 25

$\Rightarrow$ n = 25 − 7 - 5 -10 $\Rightarrow$ n = 3

∴ The number of people who do not play neither Hockey nor Football is 3

61. Among the answer choices, the three options B, C and D can be inferred from the passage. But the main essence of the passage is that chemical agents are being used my military establishments in warfare which is not desirable. Therefore option C is the statement which best sums up the meaning of the passage.

62. Given,

137 + 276 = 435

Adding units digits i.e. 7 + 6 = 13, but given as 5, which is 13 − 8 and also 1 is carry forwarded to the tens digit.

i.e., +1

7 6
3 7

05

Here, 7 + 3 + 1 = 11 i.e., 11 − 8 = 3 and 1 is carry forwarded to hundred digits

+1 +1
1 7 6
2 3 7
----
3 5

Now, the sum of digits in hundred's place is 1 + 1 + 2 = 4 i.e.,

1	7	6
2	3	7

4	3	5

Using the same logic, we have

	+1		
+1	7	3	1
	6	7	2

1	6	2	3

Units digits sum 1+2 = 3 Tens digits sum = 3 + 7 = 10 i.e., 10 -2 and + 1 carry forward Hundreds digits sum = 1 + 7 + 6 = 14 i.e., 14 – 8 = 6 and one carry forward

63. Given,

5 skilled workers can build a wall in 20 days i.e., 1 skilled worker can the wall build in 100 days☐

$\therefore$ The capacity of each skilled worker is $\frac{1}{100}$

8 semi-skilled workers can build a wall in 25 days

i.e., 1 semi-skilled worker can build a wall in 200 days

$\therefore$ the capacity of each semi-skilled worker is $\frac{1}{200}$

Similarly, The capacity of 1 unskilled worker is $\frac{1}{300}$.

Now, The capacity of 2 skilled+6 semi-skilled+5 unskilled workers is $2\left(\frac{1}{100}\right) + 6\left(\frac{1}{200}\right) + \frac{5}{300} =$

$\frac{2}{100} + \frac{3}{100} + \frac{5}{100} = \frac{20}{300} = \frac{1}{15}$

$\therefore$ The required numbers of days is 15

64. The given digits are 2,2,3,3,3,4,4,4,4 we have to find the numbers that are greater than 300

$\therefore$ The first digit can be 3 or 4 but not 2.

Now, let us fix the first, second and third digits as 3, 2, 2, then the fourth place can be filled in 3 ways.

i.e.,

3	2	2	2 or 3 or 4	3 ways

$\therefore$ The number of ways is 3 similarly, we fix first third and fourth place as 3,2 and 2 respectively (4) so the second place can be filled in 3 ways again

i.e.,

3	2 or 3 or 4	2	2

The number of ways is 3.

Now, we fix first, second and fourth, previous cases and we obtain the same result.

∴ The number of ways is 3 so, the total number of ways is 9 similarly this can done by fixing the numbers as 3 and 4 (instead of 2) and thereby we obtain the a ways each

The number of numbers starting with 3 is 27

Similarly by taking 4 as the first digit we get 27 numbers

∴ The number of numbers that are greater than 3000 is 27 + 27 = 54

But, 3222, 4222, is not possible as there are only two 2's, 3333 is not possible as there are only three 3's

∴ The total number of numbers that are greater than 3000 is 54 – 3 = 51.

65.

i) H + G > I + S

ii) |G - S| = 1

Meaning G & S will be next to each other in the order. So the option A is ruled out.

G not oldest

S not youngest

iii) No twins.

Going by the options, we will try to solve the equation,

Taking an example with youngest aged 1, we can try to solve the equation,

and correct the age (started with ages 4,3,2,1) to suit condition (i) and (ii) which gives 5,4,3,1

S	I +4	Generalizing, we can take their ages in terms of I's age,
G	I + 3	In this case, H + G > I + S
H	I + 2	Since 2I + 5 > 2I + 4
I	I	

I	In this order, G is always less than I and H is always less than S.
	So G<I and
G	H<S
S	Implies G+H < I + S, all values are positive
H	Defies condition i) Hence incorrect.

I	In this order H< I, G<S
H	Hence H +G < I + S
S	Defies Condition i)
G	Hence incorrect.