Assignment 14

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27. In the circuit shown below, the knee current of the ideal Zener diode is 10 mA. To maintain 5 V across R_L, the minimum value of RL in â¦ and the minimum power rating of the Zener diode in mW respectively are

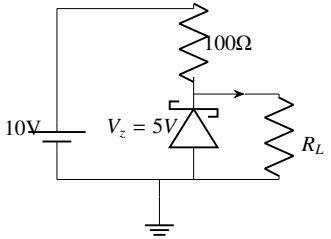

Fig. 0.1: 1

(A) 125 and 125
(B) 125 and 250
(C) 250 and 125
(D) 250 and 250

28. The open-loop transfer function of a dc motor is given as frac$\frac{\omega(s)}{V_a(s)} = \frac{10}{1+10s}$. When connected in feedback as shown below, the approximate value of K_a that will reduce the time constant of the closed loop system by one hundred times as compared to that of the open-loop system is

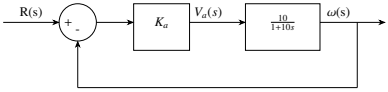

Fig. 0.2: 2

(A) 1
(B) 5
(C) 10
(D) 100

29. In the circuit shown below, if the source voltage $V_S = 100\angle 53.13°V$ then the Thevenin's equivalent voltage in Volts as seen by the load resistance R_L is

(A) $100\angle 90°$
(B) $800\angle 0°$
(C) $800\angle 90°$
(D) $100\angle 60°$

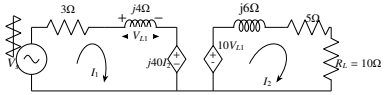

Fig. 0.3: 3

30. Three capacitors $C_1, C_2,$ andC_3, whose values are $10\mu F, 5\mu F,$ and$2\mu F$ respectively, have breakdown voltages of 10V, 5V, and 2V respectively. For the interconnection shown, the maximum safe voltage in Volts that can be applied across the combination and the corresponding total charge in μC stored in the effective capacitance across the terminals are respectively

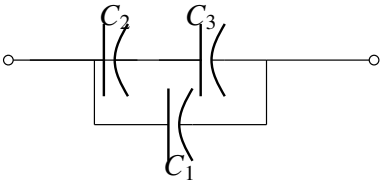

Fig. 0.4: 4

(A) 2.8 and 36
(B) 7 and 119
(C) 1.8 and 32
(D) 7 and 80

31. A voltage $1000 sin\omega t$ Volts is applied across YZ. Assuming ideal diodes, the voltage measured across WX in Volts is

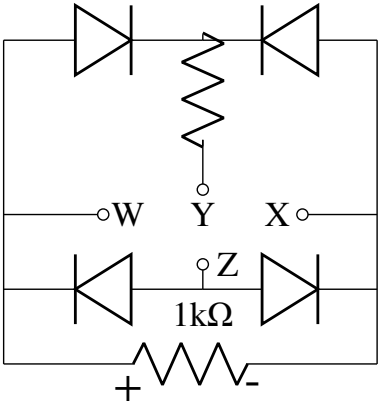

Fig. 0.5: 5

(A) $sin\omega t$

(B) $\frac{sin\omega t+|sin\omega t|}{2}$
(C) $\frac{sin\omega t-|sin\omega t|}{2}$
(D) 0 for all t

32. The separately excited dc motor in the figure below has a rated armature current of 20 A and a rated armature voltage of 150 V. An ideal chopper switching at 5 kHz is used to control the armature voltage. If L_a= 0.1 mH, R_a = 1Ω , neglecting armature reaction, the duty ratio of the chopper to obtain 50% of the rated torque at the rated speed and the rated field current is

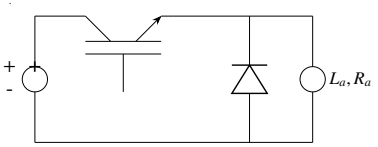

Fig. 0.6: 6

(A) 0.4
(B) 0.5
(C) 0.6
(D) 0.7

33. For a power system network with n nodes, $Z_3$3 of its bus impedance matrix is j0.5 per unit. The voltage at node 3 is $1.3\angle -10°$ per unit. If a capacitor having reactance of -j3.5 per unit is now added to the network between node 3 and the reference node, the current drawn by the capacitor per unit is

(A) $0.325\angle -100°$
(B) $0.325\angle 80°$
(C) $0.371\angle -100°$
(D) $0.433\angle 80°$

34. A dielectric slab with $500mm \times 500mm$ cross-section is 0.4 m long. The slab is subjected to a uniform electric field of $\mathbf{E} = 6a_x + 8a_y \frac{kV}{mm}$. The relative permittivity of the dielectric material is equal to 2. The value of constant $\epsilon_0$is 8.85×10^{-12}. The energy stored in the dielectric in Joules is

(A) 8.85×10^{-11}
(B) 8.85×10^{-5}
(C) 88.5
(D) 885

35. A matrix has eigenvalues -1 and -2. The corresponding eigenvectors are $\begin{bmatrix} 1 \\ -1 \end{bmatrix}$ and $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$ respectively. The matrix is

(A) $\begin{bmatrix} 1 & 1 \\ -1 & -2 \end{bmatrix}$
(B) $\begin{bmatrix} 1 & 2 \\ -2 & -4 \end{bmatrix}$

(C) $\begin{bmatrix} -1 & 0 \\ 0 & -2 \end{bmatrix}$

(D) $\begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$

36. $\int \frac{z^2-4}{z^2+4}$ evaluated anticlockwise around the circle $|z - i| = 2$, where $i = \sqrt{-1}$ is

(A) -4π

(B) 0

(C) $2 + \pi$

(D) $2 + 2i$

37. The clock frequency applied to the digital circuit shown in the figure below is 1 kHz. If the initial state of the output Q of the flip-flop is '0', then the frequency of the output waveform Q in kHz is

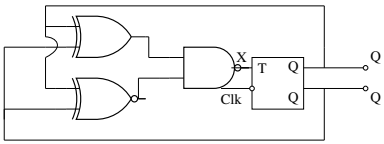

Fig. 0.7: 7

(A) 0.25

(B) 0.5

(C) 1

(D) 2

38. In the circuit shown below, Q_1 has negligible collector-to-emitter saturation voltage and the diode drops negligible voltage across it under forward bias. If V_{cc} is +5 V, X and Y are digital signals with 0 V as logic 0 and V_{cc} as logic 1, then the Boolean expression for Z is

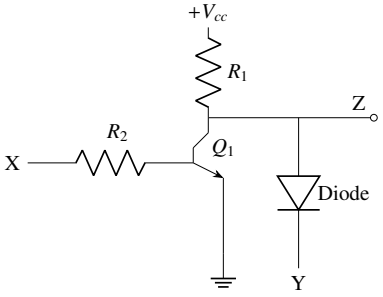

Fig. 0.8: 8

(A) XY

(B) $\bar{X}Y$

(C) $\bar{Y}X$

(D) $X\bar{Y}$

39. In the circuit shown below the op-amps are ideal. Then V_{out} in Volts is

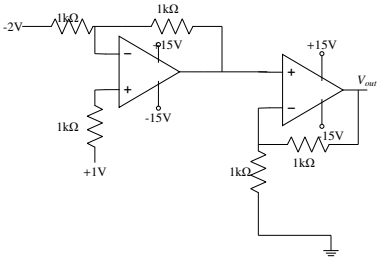

Fig. 0.9: 9

(A) 4
(B) 6
(C) 8
(D) 10