GATE 2007 EE

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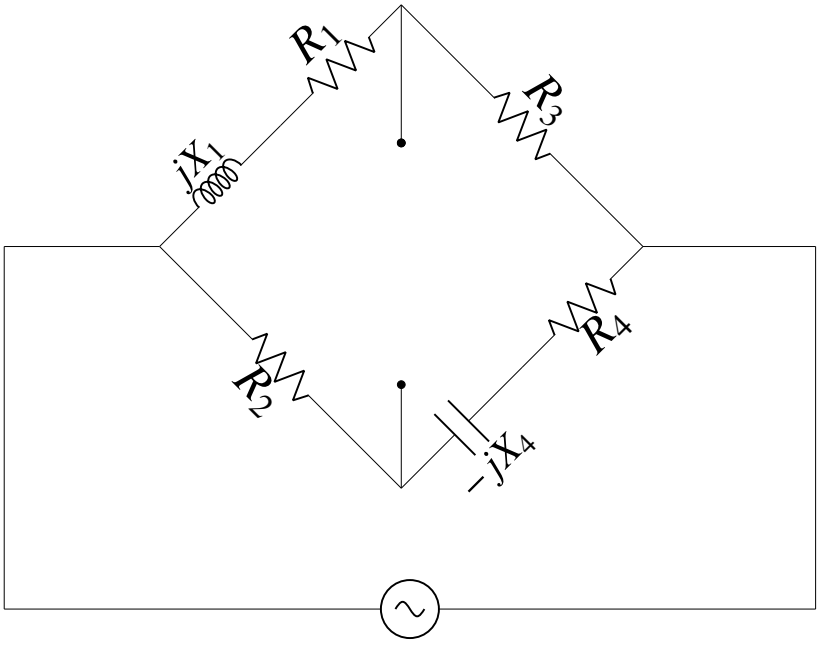
EE24BTECH11026

69. Which one of the following statements regarding the INT (*interrupt*) and the BRQ (*busrequest*) pins in a CPU is true?
    a) The BRQ pin is sampled after every instruction cycle ,but the INT is sampled after every machine cycle
    b) Both INT and BRQ are sampled after every machine cycle
    c) The INT pin is sampled after every instruction cycle,but the BRQ is sampled after every machine cycle
    d) Both INT and BRQ are sampled after every instruction cycle
70. A bridge circuit is shown in the figure below .Which one of the sequences given below is most suitable for balancing the bridge?



    a) First adjust R_4, and then adjust R_1
    b) First adjust R_2, and then adjust R_3
    c) First adjust R_2, and then adjust R_4
    d) First adjust R_4, and then adjust R_2

I. Common Data Questions

Common Data for Questions 71, 72, 73 :
A three phase squirrel cage induction motor has a starting current of seven times the full load current and full load slip of 5%

71. If an autotransformer is used for reduced voltage starting to provide 1.5 per unit starting torque,the autotransformer ratio (%) should be

a) 57.77% b) 72.56% c) 78.25% d) 81.33%

72. If a star-delta starter is used to star this induction motor,the per unit starting torque will be

a) 0.607 b) 0.816 c) 1.225 d) 1.616

73. If a starting torque of 0.5 per unit is required then the per unit starting current should be

a) 4.65 b) 3.75 c) 3.16 d) 2.13

Common Data for Questions 74, 75 :
A 1 : 1 Pulse Transformer (PT) is used to trigger the SCR in the below figure. The SCR is rated at 1.5 kV, 250 A with $I_L = 250mA, I_H = 150mA, and I_G max = 150mA, I_G min = 100mA$. The SCR is connected to an inductive load, where $L = 150mH$ in series with a small resistance and the supply voltage is 200 V dc. The forward drops of all transistors/diodes and gate-cathode junction during ON state are 1.0 V

74. The resistance R should be

a) 4.7 kΩ b) 470 Ω c) 47 Ω d) 4.7 Ω

75. The minimum approximate volt-second rating of pulse transformer suitable for triggering the SCR should be : (volt-second rating is the maximum of product of the voltage and the width of the pulse that may applied)

a) 2000 μV-s b) 200 μV-s c) 20 μV-s d) 2.0 μV-s

II. Linked Answer Questions:Q.76 to Q.85 carry two marks each.

Statement for Linked Answer Questions 76&77 :
An inductor designed with 400 turns coil wound on an iron core of $16cm^2$ cross-sectional area and with a cut of an air gap length of 1 mm. The coil is connected to a 230 V, 50 Hz AC supply. Neglect coil resistance, core loss, iron reluctance and leakage inductance. ($\mu_0 = 4\pi \times 10^{-7}$ H/m)

76. The current in the inductor is

a) 18.08 A b) 9.04 A c) 4.56 A d) 2.28 A

77. The average force on the core to reduce the air gap will be

a) 829 N b) 1666.22 N c) 3332.47 N d) 6664.84 N

Statement for Linked Answer Questions 78 & 79:
Cayley-Hamilton Theorem states that a square matrix satisfies its own characteristic equation. Consider a matrix

$$\begin{pmatrix} -3 & 2 \\ -1 & 0 \end{pmatrix} \tag{1}$$

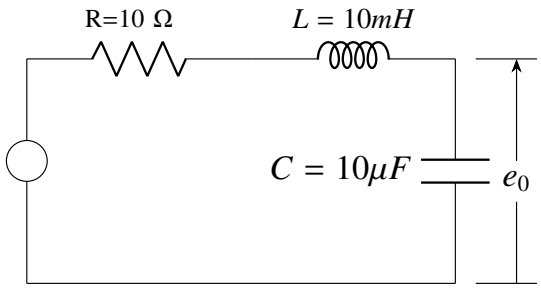
78. A satisfies the relation

a) $A^3 + 3A + 2I = 0$ b) $A^2 + 2A + 2I = 0$ c) $(A + I)(A + 2I) = 0$ d) $\exp(A) = 0$

79. A^9 equals

a) $511A + 510I$ b) $309A + 104I$ c) $154A + 155I$ d) $\exp(9A)$

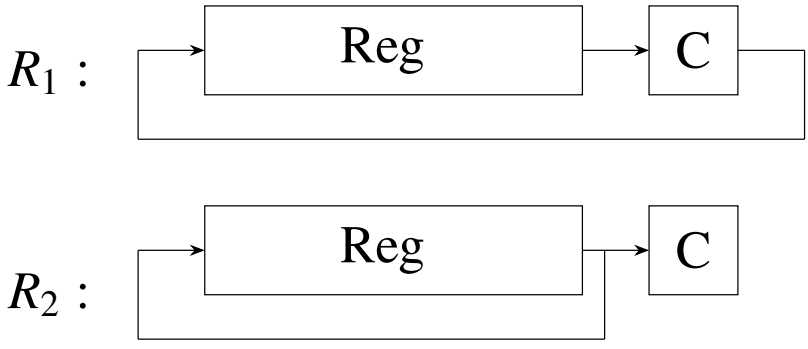
Consider the R-L-C circuit shown in figure.



80. For a step-input e_i, the overshoot in the output e_o will be
    a) 0, since the system is not under-damped
    b) 5%
    c) 16%
    d) 48%
81. If the above step response is to be observed on a non-storage CRO, then it would be best to have the e_i as

    a) Step function c) Square wave of 300 Hz d) Square wave of 2.0 KHz
    b) Square wave of 50 Hz

Statement for Linked Answer Questions 82 & 83:
The associated figure shows the two types of rotate right instructions R1, R2 available in a microprocessor where *Reg* is an 8-bit register and *C* is the carry bit. The rotate left instructions L1 and L2 are similar except that *C* now links the most significant bit of *Reg* instead of the least significant one.



82. Suppose *Reg* contains the 2's complement number 11010110. If this number is divided by 2 the answer should be
    a) 01101011
    b) 10010101
    c) 11110001
    d) 11101011
83. Such a division can be correctly performed by the following set of operations
    (A) L2, L2, R1
    (B) L2, R1, R2
    (C) R2, L1, R1

(D) R1, L2, R2

Statement for Linked Answer Questions 84 & 85:

84. A signal is processed by a causal filter with transfer function $G(s)$. For a distortion-free output signal waveform, $G(s)$ must
    a) provide zero phase shift for all frequency
    b) provide constant phase shift for all frequency
    c) provide linear phase shift that is proportional to frequency
    d) provide a phase shift that is inversely proportional to frequency
85. $G(z) = \alpha z^2 + \beta z^5$ is a low-pass digital filter with a phase characteristic same as that of the above question if
    a) $\alpha = \beta$
    b) $\alpha = -\beta$
    c) $\alpha = \beta^{1/3}$
    d) $\alpha = \beta^{-(1/3)}$