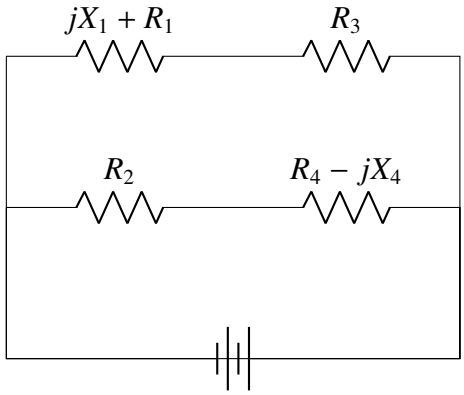
GATE Questions 1

EE24BTECH11012 - Bhavanisankar G S

1) Which one of the following statements regarding the **INT** (interrupt) and the **BRQ** (bus request) 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 insruction cycle.
2) A bridge circuit is shown in the figure below. Which of the seqeuences 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

1) A three phase squirrel cage induction motor has a starting current of seven times the full load current and full load slip of 5% .
   a) If an auto-transformer is used for reduced voltage starting to provide 1.5 per unit starting torque, the auto-transformation ratio (%) should be

      i) 57.77 % ii) 72.56 % iii) 78.25 % iv) 81.33 %

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

      i) 0.607 ii) 0.816 iii) 1.225 iv) 1.616

   c) If a starting torque of 0.5 per unit is required then the per-unit starting current should be

      i) 4.65 ii) 3.75 iii) 3.16 iv) 2.13

2) An indutor designed with 400 turns coil wound on an iron core of 16 cm^2 cross sectional area 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 reductance and leakage inductance.
   a) The current in the inductor is

      i) 18.08 ii) 9.04 iii) 4.56 iv) 2.28

   b) The average force on the core to reduce the air gap will be

i) 832.29 ii) 1666.22 iii) 3332.47 iv) 6664.84

3) Cayley-Hamilton Theorem states that a square matrix satisfies its own characteristic equation. Consider the matrix

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

a) A satisfies the relation

i) $A^2 + 3I + 2A^{-1} = 0$
ii) $A^2 + 2A + 2I = 0$
iii) $(A + I)(A + 2I) = 0$
iv) $expA = 0$

b) A^9 equals

i) 511A + 510I
ii) 309A + 104I
iii) 154A + 155I
iv) $exp9A$

4) A signal is processed by a casual filter with transfer function G(S).

a) For a distortion-free output signal waveform, G(s) must

i) provide zero phase shift for all frequency
ii) provide constant phase shift for all frequency
iii) provide linear phase shift that is proportional to frequency
iv) provide a phase shift that is inversely proportional to frequency

b) $G(z) = \alpha z^{-1} + \beta z^{-3}$ is a low-pass digital filter with a phase charateristics same as that of the above question if

i) $\alpha = \beta$ ii) $\alpha = -\beta$ iii) $\alpha = \beta^{\frac{1}{3}}$ iv) $\alpha = \beta^{\frac{-1}{3}}$

5) The associated figure shows the two types of rotate right instructions R1, R2 available in a microprocessor where Reg is a 8-digit register and C is the carry bit. The rotate left instructions L1 and L2 are similar except that C now links the most significant but of Reg instead of the least significant one.

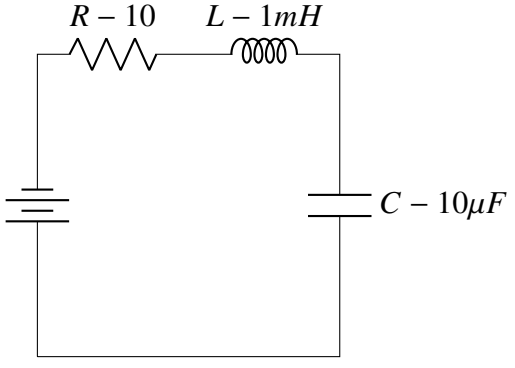
a) Suppose Reg contains the 2's complement number 11010110.If this number is divided by 2 the answer should be

i) 01101011
ii) 10010101
iii) 11101001
iv) 11101011

b) Such a division can be correctly performed by the following set of operations

i) L2, R2, R1
ii) L2, R1, R2
iii) R2, L1, R1
iv) R1, L2, R2

6) Consider the RLC circuit shown in figure.



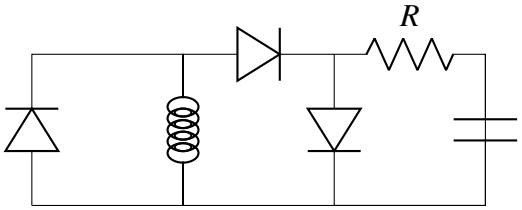
a) For a step-input e_0, the overshoot in the output e_0 will be

i) 0, since the system is not under-damped
ii) 5 %
iii) 16 %
iv) 48 %

b) 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

i) step function
ii) square wave of frequency 50 Hz
iii) square wave of frequency 300 Hz
iv) square wave of frequency 2.0 kHz

7) A 1:1 Pulse Transformer (PT) is used to trigger the SCR in the adjoint figure. The SCR is rated at 1.5 kV, 250A with I_l = 250mA, I_h = 150mA, and I_{Gmax} = 150mA. The SCR is connected tto an inductive load, where L = 150 mH in series with a small resistance and the supply voltage is 200V DC.The forward drops of all transistors/diodes and gate-cathode junction during state are 1.0 V .



a) The resistance R should be

i) 4.7$k\Omega$
ii) 470Ω
iii) 47Ω
iv) 4.7Ω

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

i) 2000$\mu V - s$
ii) 200$\mu V - s$
iii) 20$\mu V - s$
iv) 2.0$\mu V - s$