University of Dhaka

Department of Computer Science and Engineering

1st year Incourse Examination, 2018

CSE - 1103: Electrical Circuits

Full Marks: 30 Duration: 1 hour 30 minutes

Answer five of the following questions. $5 \times 6 = 30$

1. a) A 100 Ω wire-wound resistor is rated at +100 PPM for a temperature range of 0°C to +100°C. Determine its resistance at 50°C. 3

   b) Find the range in which a resistor having the following color band must exist. 3
   1st band: Green, 2nd band: Blue, 3rd Band: Yellow and 4th band: Gold.

2. a) The voltage drop across a transistor network is 12 V. If the total resistance is 5.6 kΩ, what is the current level? What is the power delivered? How much energy is dissipated in 1 h? 3

   b) Determine the values of R_1, R_2, R_3, and R_4 for the voltage divider of Fig. 1. 3

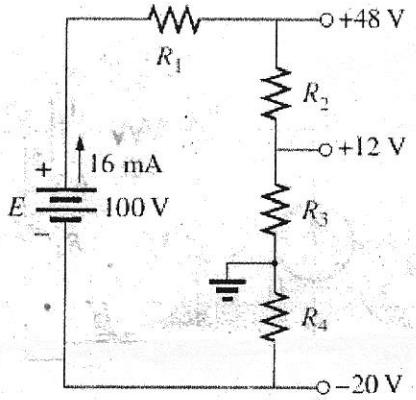


Fig. 1

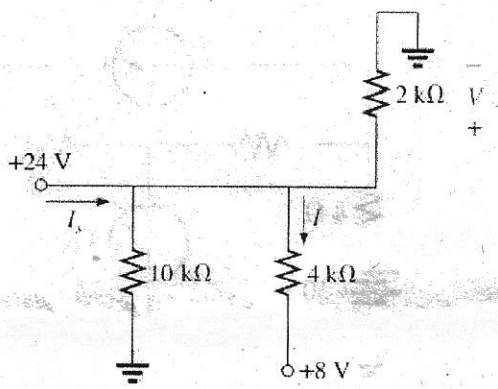


Fig: 2

3. a) For the network in Fig. 2, i) find the current I, ii) Determine the voltage V and iii) calculate the source current I_s. 3

   b) For the network in Fig. 3, determine the voltages V1 and V2 and the current I. 3

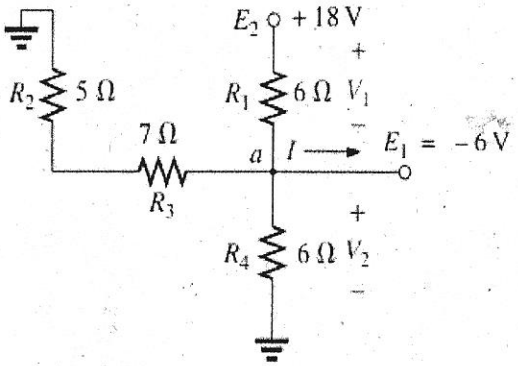


Fig. 3

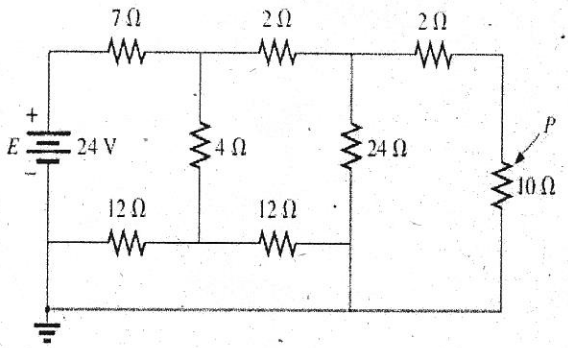


Fig. 4

4 a) Determine the power delivered to the 10Ω load in Fig. 4. 3

   b) For the network in Fig. 5, i) determine the current I and ii) calculate the open-circuit voltage V. 3

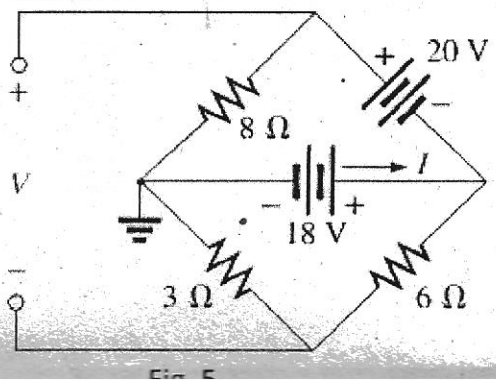


Fig. 5

5. a) Given the voltage divider supply in Fig. 6. 1
   i. Determine the supply voltage E. +
   ii. Find the load resistors R_{L2} and R_{L3} and 2
   iii. Determine the voltage divider resistors R_1, R_2, and R_3. + 3

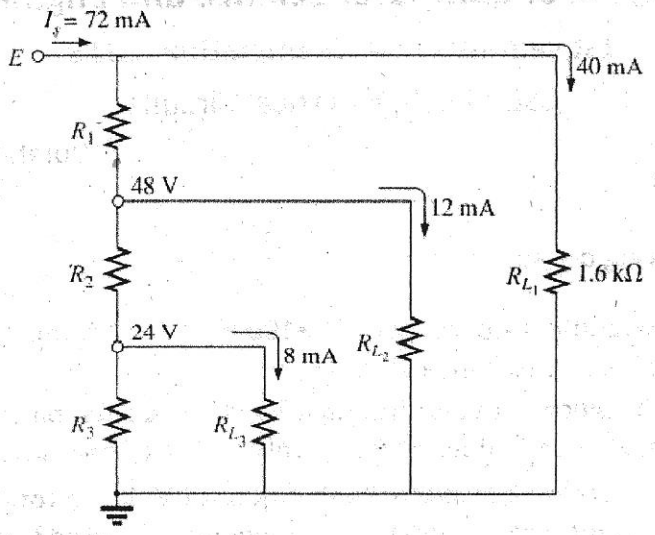


Fig. 6

6. a) Using the supermesh approach, find the current through each element of the networks in Fig. 7. 3

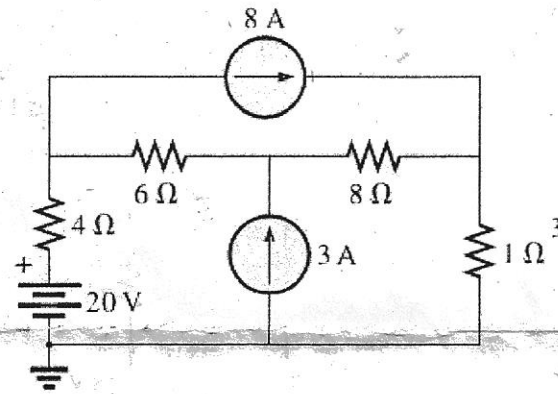


Fig. 7

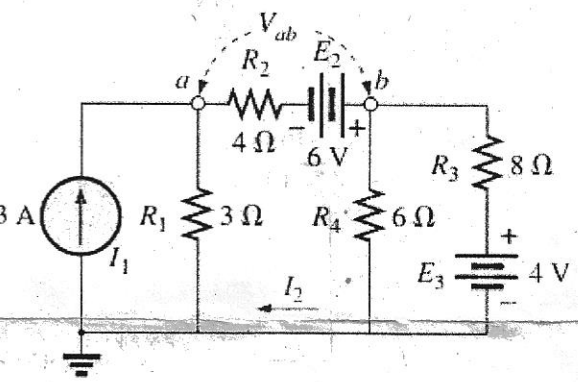


Fig. 8

b) For the networks in Fig. 8, determine the current I_2 using branch-current analysis, and then find the voltage Vab. 3

Incourse Examination

CSE1102: Discrete Mathematics

Duration: 1 hr 30 minutes Full Marks: 30

1. Let *p*, *q*, and *r* be the propositions 5

p :You get an A on the final exam.

q :You do every exercise in this book.

r :You get an A in this class.

Write these propositions using *p*, *q*, and *r* and logical connectives (including negations).

a) You get an A in this class, but you do not do every exercise in this book.

b) You get an A on the final, you do every exercise in this book, and you get an A in this class.

c) To get an A in this class, it is necessary for you to get an A on the final.

d) Getting an A on the final and doing every exercise in this book is sufficient for getting an A in this class.

e) You will get an A in this class if and only if you either do every exercise in this book or you get an A on the final.

2. a) Express "No one has lost more than one thousand dollars playing the lottery." using quantifiers. Then form the negation of the statement so that no negation is to the left of a quantifier. 2

b) Use the rule of inference to show that if $\forall x(P(x) \rightarrow (Q(x) \wedge S(x)))$ and $\forall x(P(x) \wedge R(x))$ are true, then $\forall x(R(x) \wedge S(x))$ is true. 3

3. Prove that if *N* objects are placed into *k* boxes, then there is at least one box containing at least $\lceil N/k \rceil$ objects. 3

4. Show that in a group of 10 people (where any two people are either friends or enemies), there are either three mutual friends or four mutual enemies, and there are either three mutual enemies or four mutual friends. Use this to show that among any group of 20 people (where any two people are either friends or enemies), there are either four mutual friends or four mutual enemies. 5

5. Give an explicit formula for a function from the set of integers to the set of positive integers that is 4

a) one-to-one, but not onto.

b) onto but not one-to-one

c) one-to-one and onto

d) neither one-to-one nor onto

6. Prove that $2^n > n^2$ if n is an integer greater than 4. (Using induction) 4

7. How many positive integers between 50 and 100 4

a) are divisible by 7? Which integers are these?

b) are divisible by 11? Which integers are these?

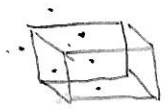
In-course Examination

Physics, CSE-1104

March 08,2018

Answer ALL questions | Time: 1 hour 30 minutes | [Marks 25]

1. Consider an ideal gas undergoing a reversible adiabatic compression or expansion.



   (a) Starting from the first law of thermodynamics, show that
   i. $nC_V dT = nRT(dP/P) - nRdT$ [2]
   ii. $nC_V dT = -nRT(dV/V)$ [2]

   (b) Derive equations: (a) relating T and P **using i. above** and (b) relating T and V **using ii. above**, for the reversible adiabatic process (compression or expansion) of an ideal gas with constant heat capacities. Hence find the relation between (c) P and V for the adiabatic process. [1+1+1]

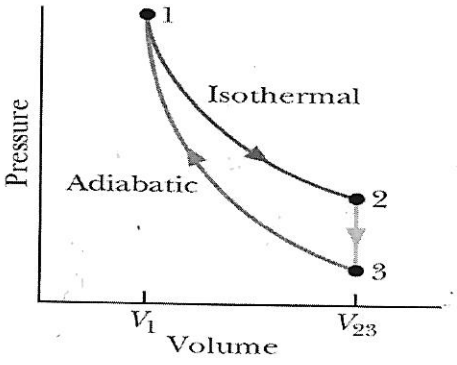
2. n moles of a diatomic ideal gas are taken through the cycle with the molecules rotating but not oscillating, where $V_{23} = 3.00V_1$.

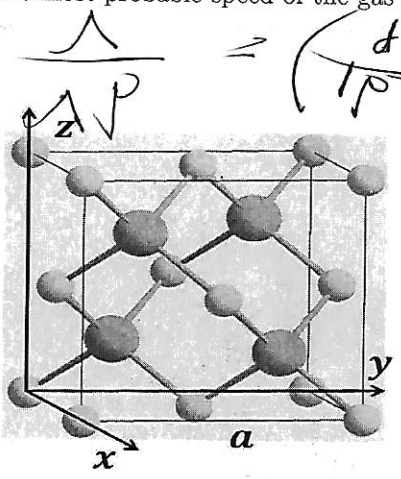
   (a) What are the values of p_2/p_1, p_3/p_1 and T_3/T_1 ? $[\frac{1}{2} \times 3 = 1.5]$

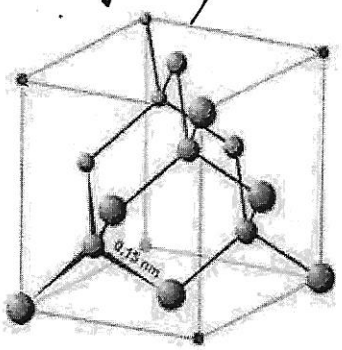
   (b) For path $1 \to 2$, what are (i) W/nRT_1, (ii) Q/nRT_1, (iii) $\Delta E_{int}/nRT_1$ and (iv) $\Delta S/nR$? $[\frac{1}{2} \times 4 = 2]$

   (c) For path $3 \to 1$, what are (i) W/nRT_1, (ii) Q/nRT_1, (iii) $\Delta E_{int}/nRT_1$ and (iv) $\Delta S/nR$? $[\frac{1}{2} \times 4 = 2]$

   (d) Find the average speed, rms speed and the most probable speed of the gas at state 1 in terms of p_1 and V_1. $[\frac{1}{2} \times 3 = 1.5]$







3. Consider the crystal structure of Sphalerite or Zinc Blend (ZnS) as shown in the second figure above. The larger spheres represent S atoms and the smaller ones represent Zn atoms.

   (a) Identify the type of the Bravais lattice. [1]

   (b) Draw the three primitive lattice vectors $\vec{a}_1, \vec{a}_2, \vec{a}_3$ and write them in terms of the Cartesian unit vectors $\hat{x}$, $\hat{y}$ and $\hat{z}$. Taking the length of the side of the cube as a, find the volume of the primitive unit cell. $[1 + 1 = 2]$

   (c) Mark the basis of the crystal and find the position vectors of the atoms in the basis. $[1 + 0.5 + 0.5 = 2]$

   (d) Find the coordination number of the Zn and S atoms. $[0.5 + 0.5 = 1]$

   (e) If Zn and S atoms are replaced by carbon atoms, the above becomes the structure of diamond (c.f. third figure above). Assuming C atoms as hard spheres, find the packing fraction of the diamond structure. [3]

   (f) Find the Miller indices of a plane passing through three C atoms in the middle of the xy-, zx- and zy- planes (as shown in the figure). [2]

Department of Computer Science and Engineering

1st Year 1st Semester B.Sc.(Hons.) Incourse Examination, 2018

CSE 1101: Fundamentals of Computer and Computing

Full Marks: 30 **Time: 1.5 Hours**

(Answer all of the following Questions)

1. a) Discuss structural and operational differences among main memory, magnetic disks and flash drives 3

   b) Compress the following text using a well known text compression technique. 3

   Plain text: betty botter bought some butter

   c) i) Convert the following two's complement representations to its equivalent base 10 form 2

   - 01111
   - 11010

   ii) Encode the following values into the floating point format for storage in a computer. 2

   - $2\frac{3}{4}$
   - $-3\frac{1}{2}$

2. a) Draw the computer architecture diagram with proper labeling 3

   b) Suppose the memory cells from addresses 00 to 05 in the machine described in Appendix A contain the (hexadecimal) bit patterns given in the following table: 5

Address	Contents
00	14
01	02
02	34
03	17
04	C0
05	00

   If we start the machine with its program counter containing 00, what bit pattern is in the memory cell whose address is hexadecimal 17 when the machine halts?

   c) Discuss memory mapped I/O 2

3. a) What does the memory manager of an operating system do when the total main memory space required exceeds the space actually available in the computer? 3

   b) What are the three conditions for deadlock to occur 3

   c) Time slicing and synchronization is the responsibility of the scheduler or the dispatcher? Explain 2

   d) List four activities of a typical operating system. 2

Appendix A (The Machine's Architecture)

The machine has 16 general-purpose registers numbered 0 through F (in hexadecimal). Each register is one byte (eight bits) long. For identifying registers within instructions, each register is assigned the unique four-bit pattern that represents its register number. Thus register 0 is identified by 0000 (hexadecimal 0), and register 4 is identified by 0100 (hexadecimal 4).

There are 256 cells in the machine's main memory. Each cell is assigned a unique address consisting of an integer in the range of 0 to 255. An address can therefore be represented by a pattern of eight bits ranging from 00000000 to 11111111 (or a hexadecimal value in the range of 00 to FF).

Floating-point values are assumed to be stored in an eight-bit format.

The Machine's Language

Each machine instruction is two bytes long. The first 4 bits provide the op-code; the last 12 bits make up the operand field. The table that follows lists the instructions in hexadecimal notation together with a short description of each. The letters R, S, and T are used in place of hexadecimal digits in those fields representing a register identifier that varies depending on the particular application of the instruction. The letters X and Y are used in lieu of hexadecimal digits in variable fields not representing a register.

Op-code	Operand	Description
1	RXY	LOAD the register R with the bit pattern found in the memory cell whose address is XY.
2	RXY	LOAD the register R with the bit pattern XY.
3	RXY	STORE the bit pattern found in register R in the memory cell whose address is XY.
4	0RS	MOVE the bit pattern found in register R to register S.
5	RST	ADD the bit patterns in registers S and T as though they were two's complement representations and leave the result in register R.
6	RST	ADD the bit patterns in registers S and T as though they represented values in floating-point notation and leave the floating-point result in register R.
7	RST	OR the bit patterns in registers S and T and place the result in register R.
8	RST	AND the bit patterns in registers S and T and place the result in register R.
9	RST	EXCLUSIVE OR the bit patterns in registers S and T and place the result in register R.
A	R0X	ROTATE the bit pattern in register R one bit to the right X times. Each time place the bit that started at the low-order end at the high-order end.
B	RXY	JUMP to the instruction located in the memory cell at address XY if the bit pattern in register R is equal to the bit pattern in register number 0. Otherwise, continue with the normal sequence of execution. (The jump is implemented by copying XY into the program counter during the execute phase.)
C	0 0 0	HALT execution.

1st Year 1st Semester In Course Examination, 2018

MATH:1105 Differential and Integral Calculus

Total: 30

Time: 1 Hour 20 Minutes

1. (a) What do you mean by the Even functions and Odd functions. Give an example of each and explain why they are even or odd functions. 2+2+2

   (b) Is $f(x) = x^2$ a decreasing function or an increasing function? Justify your answer. 1+2

   (c) Which type of functions grow faster: polynomial or exponential? 1

2. (a) If : 3

$$f(x) = \begin{cases} \sqrt{x-4} & \text{if } x > 4 \\ 8 - 2x & \text{if } x < 4 \end{cases}$$

determine whether $\lim_{x \to 4} f(x)$ exists.

   (b) What do you mean by the Horizontal Asymptote of a curve? Discuss with an example. 2

   (c) Given the function : 5

$$f(x) = \begin{cases} x + 2, & \text{for } x < 1 \\ ax^2 + b, & \text{for } x \geq 1 \end{cases}$$

   Find the value of a and b such that the function f is continuous and differentiable at $x = 1$.

3. (a) Discuss the relationship between the tangent line to a curve and the first order derivative of the function corresponding to the curve. 2

   (b) If $f(x) = |x^2 - 9|$, then find the value of $f'(3)$ 3

   (c) Find: 3

$$\lim_{x \to +\infty} (\sqrt{x^6 + 5} - x^3)$$

   (d) How horizontal line test can be used to determine whether a function is one-to-one or not? 2