Department of Computer Science and Engineering
University of Dhaka

Fisrt Year Hons' 2013 — Chemistry Incourse 2

Full Marks: 30 — Time 1.5 h

Answer All Question

1. (a) State and explain Hess's law. 2
   (b) Derive the equation to find the effect of temperature on the heat of reaction. 3
   (c) The heat of combustion of propane at 25 °C and constant pressure is 530.6 Kcal/mole; the heat of formation of water is 68.3 and for carbon dioxide is 94.2 Kcal/mole. Calculate the heat of formation of propane at 25 °C and (a) at constant pressue, (b) at constant volume. 3
   (d) Define integral heat of solution. What do you mean by aqueous solution? 2

2. (a) State the Law of Mass Action. Find the expression for Kp of the reaction: 2
   $3H_2 + N_2 \leftrightarrow 2NH_3$
   (b) Derive the relationship between K_p and K_c 3
   (c) With the help of Le Chatelier principle explain the effect of temperature and pressure on the reaction: 3
   $3H_2 + N_2 \leftrightarrow 2NH_3$
   (d) For the reaction: $2SO_3 \leftrightarrow 2SO_2 + O_2$ 2
   At equilibrium and 760 mm Hg total pressure the mole fraction data are: $SO_2 = 0.309$; $SO_3 = 0.338$; $O_2 = 0.353$. Calculate the values of K_p and K_c. Temp = 25 °C

3. (a) Define phase, component and degree of freedom with examples. 3
   (b) Find number of phases, components and degree of freedom for the reaction: 3
   $NH_4Cl(s) \leftrightarrow NH_3(g) + HCl(g)$
   (c) Draw the phase diagram of water. What is triple point? Find number of phases and degrees of freedom at this point. 4

Set C (1st year 2013, CT-2, CSE 1101, Time: 1 hour, Marks: 15)

1. Define Extranet. 1
2. Write down the features of Linux 2
3. Mention the main difference between assembly language and machine language. 1.5
4. How data can be read from an optical disk. 2.5
5. Distinguish between hard disc and flash memory. 2
6. Write a short on the applications of internet. 4
7. Mention the features of high level languages. 2

Department of Computer Science and Engineering
Incourse Exam-1

Course Title: Physics — **Course Code: Phy -1122**

Date: 06. 03. 2013 — **Duration: 50 min.**

Answer all the questions

1. Define electric flux density Φ_E. Write down the four Maxwell's equations of classical electrodynamics. 1+4
2. Find the electric field $\vec{E}$ outside a uniformly charged solid sphere of radius R and total charge q. 5
3. Derive the charge continuity equation given by $\frac{\partial \rho}{\partial t} = -\vec{\nabla}_o \vec{J}$. 5
4. How did Maxwell propose the correction to the Ampere's law? 5

Set D **(1st year 2013, CT-1, CSE 1101, Time: 1hour, Marks: 15)**

1. **Mention the features of 5th generation computers.** **1.5**
2. **Explain working principle of a speaker.** **3**
3. **Mention the function of BIOS.** **1**
4. **Mention the main difference between flatbed scanner and sheet-fed scanner.** **1**
5. **Explain working principle of a ink-jet printer.** **3.5**
6. **Distinguish between SRAM and DRAM.** **3**
7. **What happens when a keyboard of a key is pressed?** **2**

University of Dhaka
Department of Computer Science
First Year 1st Semester 2012-13 First Incourse Examination
Course No. MATH-1124 Calculus Marks: 30

Answer any 5 questions. All questions are of equal value. Time: 1 (One) hour.

1. (a) Define domain and range of a function $f(x)$. Given that $f(x) = -\sqrt{3-2x}$ find $f^{-1}(x)$ and sketch the graphs of f and f^{-1} hence, state the domain and range of f^{-1}.

(b) What do you mean by $\lim_{x \to a} f(x)$ and $f(a)$?

2. (a) Sketch the graphs of (i) $y = 3 - |2x-4|$ (ii) $y = 3 + \sqrt{x+1}$ (iii) $y = |x-3| + 2$ and hence write down the domain and range for each of them.

(b) Find formulas for $f o g$ and $g o f$ then state the domain and range of them where $f(x) = \sqrt{x-3}$ and $g(x) = \sqrt{x^2+3}$.

3. (a) Evaluate the following limits:

(i) $\lim_{x \to 2} \dfrac{x^3 + 3x^2 - 12x + 4}{x^3 - 4x}$ **(ii)** $Lt_{x \to 0} \dfrac{\cos 2x - 1}{\cos x - 1}$

(b) If $f(x) = \begin{cases} 1+x, & x > 0 \\ 1-x, & x \le 0 \end{cases}$ **, does $f'(0)$ exist?**

4. Test the continuity and differentiability of a function $f(x)$ at a point $x = 0$ and $x = \pi/2$ where

$$f(x) = \begin{cases} 1, & x < 0 \\ 1 + \sin x, & 0 \le x < \pi/2 \\ 2 + (x - \pi/2)^2, & x \ge \pi/2 \end{cases}$$

5. Find the derivatives of the functions

(i) $y = \sin^3(\ln 2x^2)$ **(ii)** $y = \dfrac{3at^2}{1+t^3}$, $x = \dfrac{3at}{1+t^3}$ **(iii)** $y = x^{\tan^{-1} x} + (\sin x)^{\log x}$

(iv) $y = \sin^{-1}(3x - 4x^3)$

6. (a) State Leibnitz theorem. If $y = e^{a \sin^{-1} x}$, then show that,

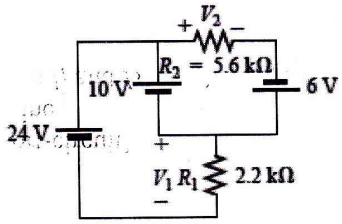
$$(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2 + a^2)y_n = 0.$$

(b) A 5 ft ladder, leaning against a wall, slips in such a way that its base is moving away from the wall at a rate of 2 ft/sec at the instant when the base is 4 ft away from the wall. How fast is the top of the ladder moving down the wall at the instant?

Department of Computer Science & Engineering, Dhaka University
First In-Course Examination
1st Year 1st Semester B.Sc., Session: 2012-2013
EEE – 1121, Electrical Circuit Analysis

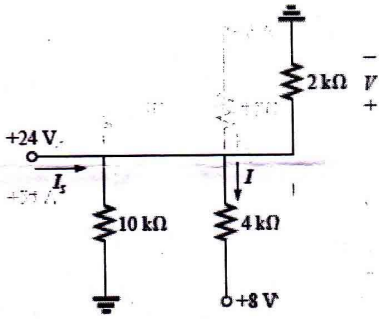
Total Marks: 35 Time: 1 Hour

1. a) State Kirchhoff's voltage law with a suitable figure. 3
   b) Determine the unknown voltages using Kirchhoff's voltage law. 3

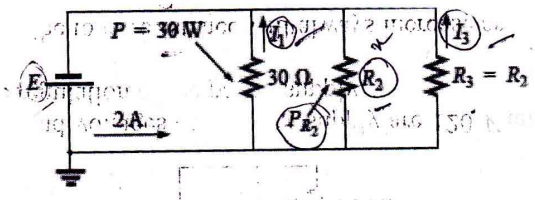


   c) The no-load and full-load voltages of a power supply are 120 V and 100 V respectively. Calculate the voltage regulation of the power supply. 2

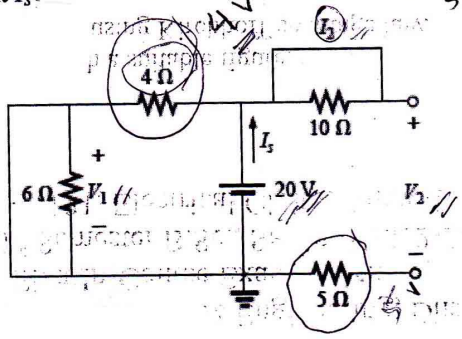
2. a) "For parallel resistors, the total resistance will always increase as additional elements are added in parallel". Do you agree? Give proof in favor of your opinion. 4
   b) For the network below 5
      i) Find the current I
      ii) Determine the voltage V
      iii) Calculate the source current I_s



3. a) What are the rules for dividing current in a parallel circuit? Also find the generic equation. 4
   b) Find the unknown quantities for the circuit using the information provided. 5



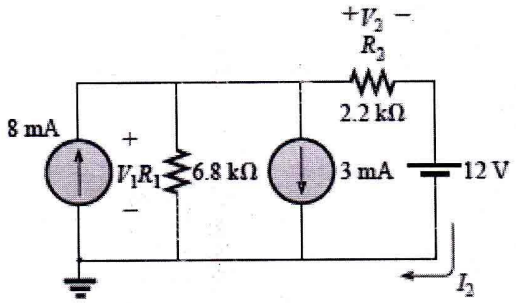
4. a) Define 'Open-circuit' and 'Short-circuit'. 4
   b) For the network below, determine 5
      i) The short-circuit currents I_1 and I_2
      ii) The voltages V_1 and V_2
      iii) The source current I_s



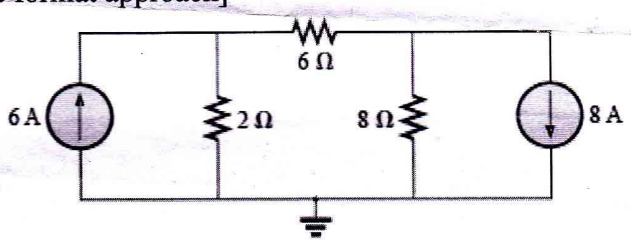
Department of Computer Science & Engineering, Dhaka University
Second In-Course Examination
1st Year 1st Semester B.Sc., Session: 2012-2013
EEE – 1121, Electrical Circuit Analysis

Total Marks: 35 Time: 1 Hour

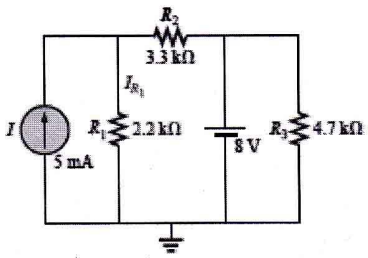
1. a) Draw a practical voltage source and current source and prove that ***source conversions are equivalent only at their external terminals.*** 1+3
   b) Is it possible to connect current sources of different current ratings in series? Why? 2
   c) For the network for the following figure: 4
      i) Convert the voltage source to a current source.
      ii) Reduce the network to a single current source, and determine the voltage V_1.
      iii) Using the results of part (b), determine V_2.
      iv) Calculate the current I_2.



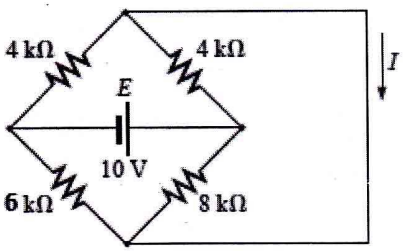
2. a) Briefly describe the concept of supermesh current. 2
   b) i) Using mesh analysis, determine the currents for the following network. 4+4
   ii) Using nodal analysis, determine the nodal voltages as well as currents for the same network. [Hint. Use format approach]



3. a) What are relative advantages of Thevenin's theorem? 2
   b) i) Using superposition, find the current through R_1 for the following network. 4+4
   ii) Find the Thevenin's equivalent circuit for the same external to the R_1 and prove that the same current is passing through R_1.



4. a) What is the limitation of reciprocity theorem? 1
   b) Prove the reciprocity theorem for the following network for the voltage E and current I. 4



Answer any 5 questions. All questions are of equal value. Time: 1 (One) hour.

1. (a) **Differentiate** $\tan^{-1}\dfrac{2x}{1-x^2}$ **with respect to** $\sin^{-1}\dfrac{2x}{1+x^2}$.

(b) **State Mean Value theorem. Verify Mean Value theorem for** $f(x)=3+2x-x^2$ **in the interval [0, 1].**

2. (a) **Let** $f(x)=x^3-3x^2+1$. **Find the intervals where** $f(x)$ **is increasing, decreasing, concave up and concave down.**

(b) **Find the maximum and minimum values of** $1+2\sin x+3\cos^2 x,\quad 0\le x\le \pi/2$.

3. (a) **Find the intervals where the function** $f(x)=xe^{-x}$ **is concave up and concave down.**

(b) **For the function** $f(x)=x^3-3x-1$ **find the absolute maximum and absolute minimum values of** $f(x)$ **in the interval [0, 2].**

4. **Evaluate the following integrals:**

(i) $\displaystyle\int\frac{y}{\sqrt{y+1}}dy$ (ii) $\displaystyle\int\frac{7-6\sin^2\theta}{\sin^2\theta}d\theta$ (iii) $\displaystyle\int x\cos^2 x\,dx$ (iv) $\displaystyle\int\frac{e^x}{e^{2x}+2e^x+5}dx$ (v) $\displaystyle\int\frac{x}{2-6x-x^2}dx$

5. **Compute the value of the following integrals:**

(i) $\displaystyle\int_1^2(3x^2-2)^4 x\,dx$ (ii) $\displaystyle\int_0^1\tan^{-1}x\,dx$ (iii) $\displaystyle\int_0^{\log 2}\frac{e^x}{e^x+1}dx$ (iv) $\displaystyle\int_0^{\pi/2}\cos 2x\cos 3x\,dx$

6. (a) **Find the reduction formula for** $I_n=\displaystyle\int_0^{\pi/2}\sin^n x\,dx$. **Hence, evaluate** $\displaystyle\int\sin^6 x\,dx$.

(b) **Evaluate:** $\displaystyle\underset{n\to\infty}{Lt}\left[\frac{n}{n^2+1^2}+\frac{n}{n^2+2^2}+\cdots+\frac{1}{2n}\right]$.

Department of Computer Science and Engineering
University of Dhaka

First Year First Semester In-course Examination – II
Course: Programming Fundamentals

Full Marks: 30 Duration: 1 Hour

Answer all questions.

1. a) What is a recursive function? What are its properties? 2+2

   b) Can we write a recursive function to print the binary equivalent of a given integer? If you think it is possible then write the recursive function. Justify your answer, otherwise. 6

2. a) What are the distinguishable and similar features between arrays and structures? 3

   b) When will you choose an array or a structure as your data type? 2

3. Suppose, you have a time data type as follows:

```
struct __time
{
    unsigned char hour;       /*0 to 23*/
    unsigned char minute;     /*0 to 59*/
    unsigned char second;     /*0 to 59*/
}
```

and, suppose, you have a function to check whether a given time is a valid (returns 1) or not (returns 0). The valid ranges of the time structure is given as comments with the corresponding fields. The prototype for the function is:

```
int checkValidTime(struct __time *tm);
```

   a) Write the for loops with the `__time` structure that will show all combination of the time of a day. 4

   b) Write the `checkValidTime` function for the given structure. 5

   c) Write a function for the given structure that shows (in the screen) the time of a datetime structure in AM/PM format. 6

Department of Computer Science and Engineering
First Year First Semester B. Sc Final Examination, 2013
MATH – 1124: Calculus - I

Total Marks: 60 **Time: 2.5 Hours**

(Answer any Four (4) of the following Questions)

1. a) Define domain and range of a function f(x) with at least one example. Sketch and determine the domain and range of the following functions (any two): 7
(i) $f(x) = |x| + |x+1|$ (ii) $f(x) = \frac{1}{x^2-4}$ (iii) $f(x) = \sinh x$.

b) What do you mean by $\lim_{x\to a} f(x)$ and $f(a)$? Test the continuity and differentiability of a function $f(x)$ at a point $x = \pi/2$, where 8

$$f(x)\begin{cases} 1, & x<0 \\ 1+\sin x, & 0 \le x < \frac{\pi}{2} \\ 2+\left(x-\frac{\pi}{2}\right)^2, & x \ge \frac{\pi}{2} \end{cases}$$

2. a) Find the differential coefficient $\frac{dy}{dx}$ of the following functions (any tow): 5
(i) $y = \tan\ln\sin(e^{x^2})$ (ii) $y = (2^x + x^2)^{f(x)}$ (iii) $x = \sin^{-1}\frac{2t}{1+t^2}, y = \tan^{-1}\frac{2t}{1-t^2}$

b) State Leibnitz's theorem. If $y = \tan^{-1} x$, then prove that 6
$(1+x^2)y_{n+2} + 2(n+1)xy_{n+1} + n(n+1)y_n = 0$.

c) A man is walking at the rate of 5 miles per hour towards the foot of a building 40 ft. high. At what rate is he approaching the top when he is 30 ft. from the foot of the building? 4

3. a) State Lagrange's Mean value theorem (MVT). Verify this theorem for $f(x) = x^3 - x - 4$ on the interval [-1, 2]. 5

b) Find the local extrema of $f(x) = x^4 - 8x^3 + 22x^2 - 24x + 5$. 5

c) State L'Hospital rule and compute $\lim_{x\to 0}\left(\frac{\tan x}{x}\right)^{\frac{1}{x}}$ 5

4. a) Evaluate the following indefinite Integrals: any two 7
(i) $\int \cos^7 x\, dx$ (ii) $\int \frac{\sin x \cos x}{\cos^4 x + \sin^4 x} dx$ (iii) $\int \frac{dx}{2x^2+x+1}$

b) Evaluate the following definite integrals: 8
(i) $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}} dx$ (ii) $\int_0^4 \frac{x^3}{\sqrt{x^2+9}} dx$

5. a) State Taylor's theorem with remainder. Use Taylor's theorem to expand $f(x) = \frac{1}{x+1}$ in powers of x – 3. 7

b) If $I_n = \int \cos^n x\, dx$, then prove that $I_n = \frac{1}{n}\sin x \cos^{n-1} x + \frac{n-1}{n} I_{n-2}$. Hence evaluate $\int_0^{\frac{\pi}{2}} \cos^6 x\, dx$ 8

6. a) Find the area bounded by the parabolas $y^2 = 4ax$ and $x^2 = 4ay$. 5

b) Find the area of the surface generated by revolving the right hand loop of the lemniscate $r^2 = \cos 2\theta$ about the y-axis. 5

c) Find the length or perimeter of the circle $x^2 + y^2 = a^2$. 5

Department of Computer Science and Engineering
First Year First Semester B.Sc. Final Examination, 2013
CHM – 1123: Chemistry

Total Marks: 60 **Time: 2.5 Hour**

[Answer any Four (4) of the following Questions]

1. a) Define the following terms: 2×3
   i) Mean free path
   ii) Critical pressure
   iii) Molar heat capacity
   b) How and why real gases deviate from ideal behavior? 2
   c) Derive Vander Waal's equation for 'n' moles. 4
   d) What pressure is exerted by a mixture of 2.00 g of H_2 and 8 g of N_2 at 270 K in a 10 litre vessel? 3

2. a) Give a derivation of phase rule. 5
   b) Find number of phases and components in – (i) composite of rubber and cellulose, (ii) mixture of sand, sugar and water, (iii) dissociation of limestone. 3
   c) Draw the phase diagram for ice ⇌ water ⇌ vapour system and explain the features of different curves, points and regions. 5
   d) Why the solidous in the above phase diagram is negatively sloped? 2

3. a) Derive an expression for the work done in an isothermal reversible expansion of an ideal gas and prove that the work done in such a process is the maximum. 4+2
   b) State second law of thermodynamics. What is Carnot cycle? Derive the equation to calculate the efficiency of an engine using Carnot cycle. 1+1+5
   c) The heat of combustion at constant pressure of benzoic acid is -771.4 K. Cal at 25 °C. What is heat of combustion at constant volume? 2

4. a) What is the difference of order and molecularity of a reaction? Explain. 3
   b) How would you distinguish a first order reaction from a second order reaction with the help of half life? 5
   c) In a certain first order reaction half of the material is decomposed in 1000 seconds. How long will it be until only one-third is left? 3
   d) Chemical equilibrium is also known as "dynamic equilibrium", explain. 4

5. a) Define electrophiles and nucleophiles with examples. 3
   b) Given a general scheme of Friedel-Craft alkylation with conditions. What are the disadvantages of this reaction? 4
   c) Grignard reagent is classified as organometallic compound, explain it with its special reaction properties. 4
   d) Electrophilic aromatic substitution is easier compared to nuclephilic aromatic substitution, explain. 4

6. a) Define oxidation-reduction with electronic concept. 3
   b) Oxidation-reduction is a simultaneous process, explain. 4
   c) Balance following equation with electronic concept of oxidation-reduction. 4

$$K_2Cr_2O_7 + Na_2S_2O_3 \xrightarrow{H^+} Cr^{3+} + Na_2S_4O_6 + H_2O$$

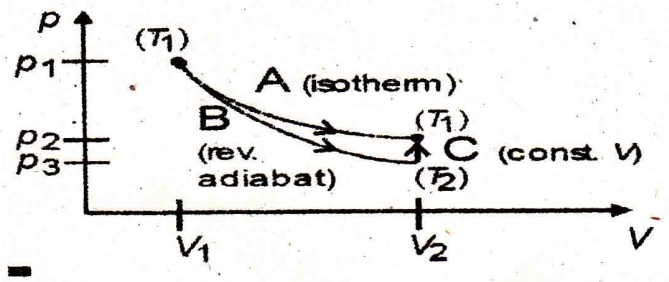
   d) Explain metallic bond and special properties of metal. 4

University of Dhaka
Department of Computer Science and Engineering
First Year First Semester B. Sc. Final Examination, 2013
PHY – 1122: Physics

Total Marks: 60 **Time: 2.5 Hours**

(Answer any Four (4) of the following Questions)

1. a) Define intensive and extensive thermodynamic variables. 2
   b) Define entropy in terms of Boltzmann relation. State third law of thermodynamics. 2+2
   c) Show that for Ideal gas $U = C_v dT$. 4
   d) Calculate $\oint \frac{dq}{T}$ for the path A– B – C and A– C. 5



2. a) Write down the postulates of Bohr model of atom. 4
   b) State Wilson-Sommerfeld quantization rule. Show that the condition for the orbital stability is $L = n\hbar$ using this rule. 3+4
   c) What is De Broglie matter wave? What is the relation between this wave and the wave function Ψ? 2+2

3. a) Write down the postulates of special theory of relativity. 2
   b) Derive the relativistic velocity addition formula using Lorentz transformation. 5
   c) Show that a moving clock ticks slower than a clock at rest. 4
   d) Suppose a train is moving with a uniform velocity $\frac{3}{4}c$ with respect to an observer at S frame of reference. An observer in the moving train measures the speed of light at vacuum c. What will be the velocity of that light in free space for an observer at S. 4

4. a) Distinguish between Fraunhofer and Fresnel diffraction. 4
   b) Explain 'missing order' in Fraunhofer double slit diffraction pattern. 5
   c) Deduce radius of the *m*th order bright ring formed in Newton's ring experiment. 6

5. a) Write down the four Maxwell's equations of classical electrodynamics. 4
   b) Derive the continuity equation given by $\frac{\partial \rho}{\partial t} + \nabla . J = 0$. 4
   c) Find out the expression for electric field E at distance r from a midpoint of a wire of length 2L with charge density λ. 4
   d) Explain the inconsistency in Ampere's law. 3

6. Write Short notes on the following topics: 3×5
   i. Simple harmonic motion
   ii. Defects in solid
   iii. Nicol Prism.

I

University of Dhaka
Department of Computer Science and Engineering
First Year First Semester B. Sc Final Examination, 2013
CSE – 1102: Programming Fundamentals

Total Marks: 60 **Time: 2.5 Hours**

(Answer any Four (4) of the following Questions)

1. a) What do you understand by the term "data type"? Show the simple data types used in "C" language in a tree structure. 4

   b) Suppose, you need to use four data for a circle: (i) name (alphanumeric – maximum of 10 characters), (ii) the radius, (iii) the circumference, and (iv) the area. Then, 2+4

      A. What types of data would you use for these?

      B. Write down the C programming variable definitions for these data.

   c) Write a program in C language that will compute and print the value of pi (π) from a circle as represented in question 1(b). In case of printing the value of π, print 6 digits after the decimal point. 5

2. a) The two basic complex data structures in C are: (i) Array and (ii) Structure. What are their relative advantages and disadvantages? When would you choose arrays and when structures? Why? 6

   b) Suppose, you need to operate on 30 student records where each student record consists of the followings: 6

      i) Roll number, ii) name (of max length 30 characters), iii) date of birth, and iv) age. Write down the data definitions that you will use in programming.

   c) For the data definitions used in question 2(b), write the **scanf** and **printf** statements to take input and show values, respectively. 3

3. a) In C language, what is the difference between "NULL" and "void"? Explain with examples. 3

   b) What would be the value of the variable **val** after execution of the following statement blocks? Briefly describe how the value is assigned. 3+5

```
i) float ifConfusing;
int val;
ifConfusing = 0.19839127;
val = ifConfusing <= 0.19836 ? ifConfusing :
(ifConfusing > 22/7 ? 22/7 - 1 : 22/7 - 2);

ii) unsigned char mayConfuse;
unsigned char val;
mayConfuse = 255;
if ( ++mayConfuse )
    val = mayConfuse & 2;
else
    val = (mayConfuse | 2 ) >> 1;
```

   c) Suppose, you have a function that computes the Ecludian distance of a point (x, y, z) from the origin (0,0,0) and its prototype is: 4

```
double eDistance(float *x, float *y, float *z);
```

   Write the function body.

4. a) What is the differences between while and do-while loop? 3

b) Write a program using conditional operators to determine whether a year entered through the keyboard is a leapyear or not. 4

c) Two numbers are entered through the keyboard. Write a program to find the value of one number raised to the power of another. 4

d) Write a program to print all prime numbers from 1 to 300. 4

5. a) Write the syntax of if-else-if with example. 3

b) Given three points (x1, y1), (x2, y2) and (x3, y3), write a program to check if all the three points fall on one straight line. 5

c) What is Swapping? How can you swap two numbers ***with*** and ***without*** temporary variable? Explain with proper example. 4

d) What are the differences between i++ and ++i. 3

6. a) What are the modes for opening a file in C using **fopen**? 3

b) Suppose, you have to store 100 points in *id*: (*x*, *y*) format in a file, where *id*, *x* and *y* are three parameters of a point indicating the identification number, *x* location and *y* location of the point, respectively. Write a program that will generate the points and store in the file. 7

c) Write a program that will open the file generated by the program in question 6(b) and show the content of the file in the screen. 5

University of Dhaka
Department of Computer Science and Engineering
First Year First Semester B. Sc. Final Examination, 2013
CSE – 1101: Computer Fundamentals

Total Marks: 60 **Time: 2.5 Hours**

(Answer any Four (4) of the following Questions)

1. a) Mention the features of the 4th generation computers. 2.5
   b) Mention the function of BIOS. 1.5
   c) Define microprocessor. What are the three basic tasks performed by a microprocessor? 4
   d) What are the advantages of RISC architecture over CISC architecture? 3
   e) How can we measure the speed of a microprocessor? 1.5
   f) With example define opcode and operand of an instruction. 2.5

2. a) Distinguish between primary memory and secondary memory. 2
   b) Write down the differences between SRAM and DRAM. 3.5
   c) DVD stores more data than CD. Why? 2
   d) Describe the structure and working principle of hard disk and hard disk drive. 6
   e) What are the advantages of flash memory stick? 1.5

3. a) Explain working principle of an optical mouse. 3
   b) Describe working principle of ink-jet printers. 4
   c) Mention types of scanner. 1
   d) Explain working principle of a speaker. 3
   e) Mention the advantages of LCD monitor. 3
   f) What is meant by dot pitch of a color monitor? 1

4. a) Distinguish between assembly language and high level language. 2
   b) What is the role of an operating system in a computer system? 3.5
   c) Write down the features of Linux. 2
   d) What is the main difference between compiler and interpreter? 1.5
   e) Define ASCII code and Unicode. Mention the advantages of Unicode over ASCII code. 3
   f) Define database management system. Mention the operations performed by a DBMS. 3

5. a) What is meant by telecommunication? 1
   b) Distinguish between ring and star topology. 3.5
   c) Mention the functions of a router. 2
   d) Describe the structure and advantages of optical fiber. 3
   e) Define network protocol. Explain HTTP and FTP. 3.5
   f) Mention frequency ranges for wireless transmission. 2

6. a) Define Internet. Discuss about the impact of the Internet. 6
   b) Mention the value of the Internet penetration rate in Bangladesh. 1
   c) It is said that open source software is more secured. Is it correct? Explain. 3
   d) How can we maintain network security? 3
   e) Distinguish between virus and Trojan horse. 2

University of Dhaka
Department of Computer Science and Engineering
First Year First Semester B.Sc. Final Examination, 2013
EEE – 1121: Electrical Circuit Analysis

Total Marks: 60 **Time: 2.5 Hour**

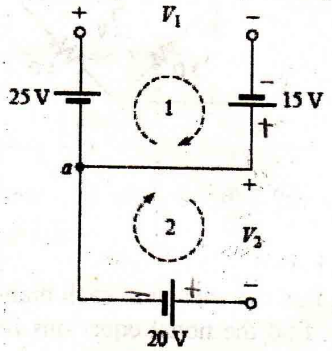
[Answer any Four (4) of the following Questions]

1. a) Define resistance of a material. Briefly describe the temperature effects on the resistance of conductor, semiconductor and insulator. 2+3

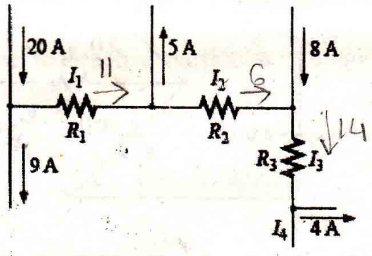
   b) Plot curves of Ohm's law for 5 Ω and 10 Ω resistors in a range of 0 to 30 V. Relate the curves with equations of a straight line and find the slope in both the cases. 3+2

   c) Define efficiency of a system. A 2-hp motor operates at an efficiency of 75%. What is the power input in watts? If the applied voltage is 220 V, what is the input current? 2+3

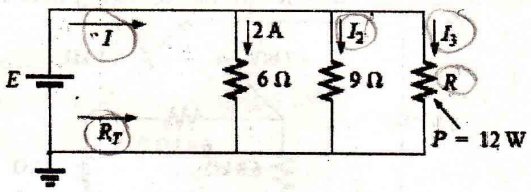
2. a) State Kirchhoff's voltage law with example. Find V_1 and V_2 for the following network. 2+2



   b) State Kirchhoff's current with example. Find the unknown currents and their directions in the following circuit. 2+2



   c) Find the unknown quantities for the following circuit using the provided information. 4

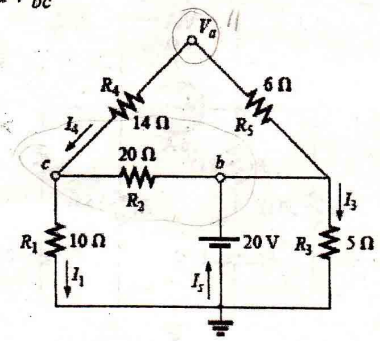


   d) What is the main characteristics regarding voltage and current of an open circuit and a short circuit? Explain with example. 3

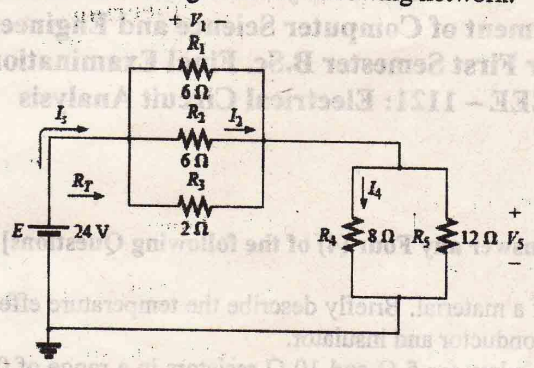
3. a) For the following network: 5

   i) Determine the currents I_S, I_1, I_3, I_4

   ii) Calculate V_a and V_{bc}



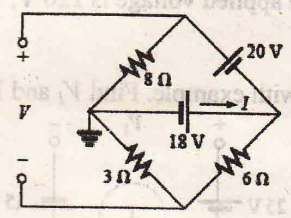
b) Find the indicated currents and voltages for the following network. 5



c) For the network of following figure: 5

i) Determine the current I

ii) Calculate the open-circuit voltage V.

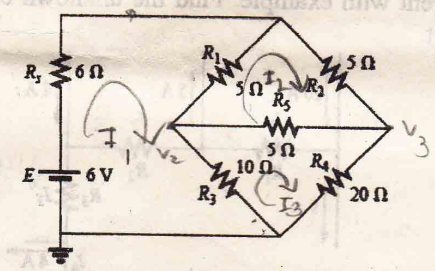


4. a) What is linear bilateral network? What are the differences between voltage source and current source? 1+2

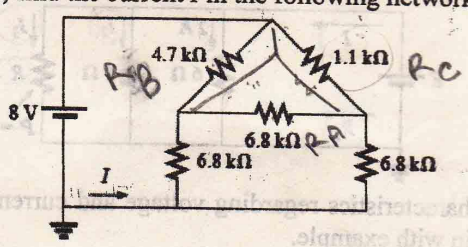
b) Consider the bridge network below: 4+4

i) Using mesh analysis, find the current in each branch.

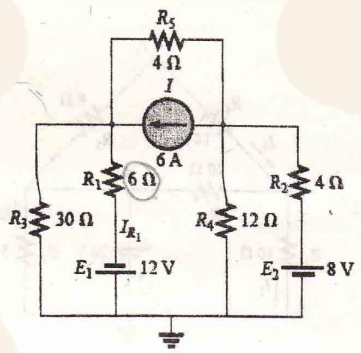
ii) Using nodal analysis, find the nodal equations for the network and also find the current in each branch.



c) Using a Δ–Y conversion, find the current I in the following network. 4

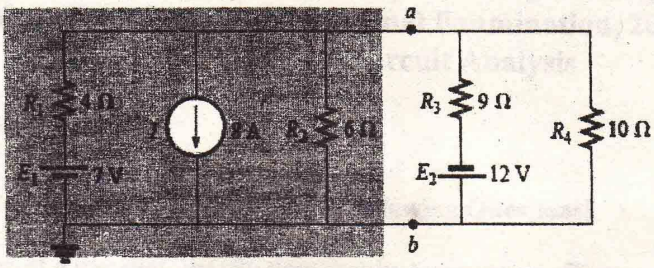


5. a) Using superposition theorem, find the current through R_1 for the following network. 4

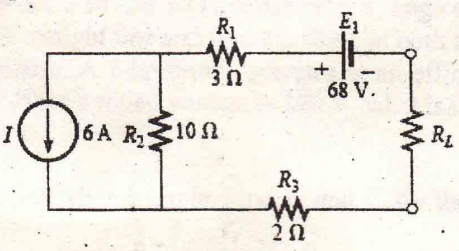


3

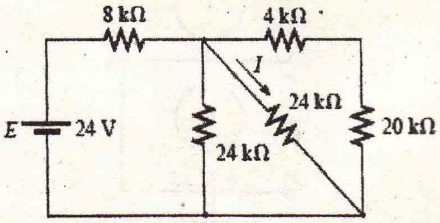
b) Find the Norton equivalent circuit for the portion of the network to the left of a-b in the following figure. 4



c) Find the value of R_L in the following figure for maximum power transfer to R_L, and determine the maximum power. 4

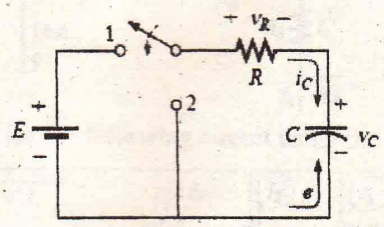


d) For the following network, determine the current I. Explain whether the reciprocity theorem is satisfied or not. 3

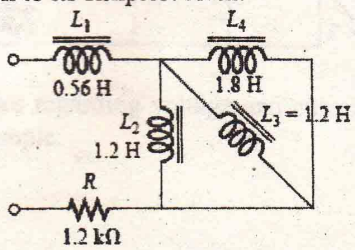
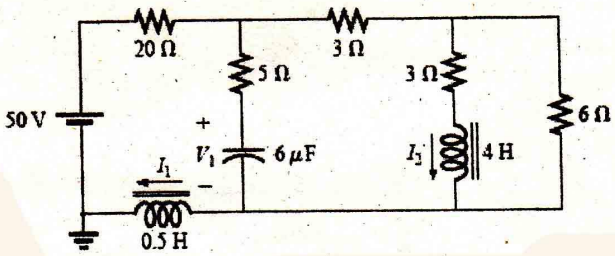


6. a) Define permittivity of the dielectric. Using this definition derive the equation of capacitance. 2+2

b) Derive the equation for time to reach a particular voltage or current during charging phase in a basic capacitive network. 4



c) Reduce the following network to its simplest form. 3



d) Find the voltage V_1 and the current through each inductor in the following circuit. 4