University of Dhaka

Department of Computer Science and Engineering

1st Year 1st Semester B.Sc. Final Examination 2019

CSE 1101: Fundamentals of Computers and Computing (Credits: 02)

Duration: 2.5 hours **Total Marks: 70**

(Answer any five of the following seven questions)

1. A) Differentiate between compiler-based language and interpreter-based language with corresponding examples. [3]

B) A C program contains the following declarations and initial assignments: [4]

```
int i =8;
int j =5;
float x=0.005;
double y = -0.01;
char c= 'c', d='D';
```

Now, evaluate the following expression to find out the value of the expression assuming that the final result will be stored in a variable whose data type is double.

$$(i-3*j)\%(c+2*d)/(x-y)$$

Note that, the ASCII value of 'A' is 65 and 'a' is 97.

2) Find out the type of errors and write their corresponding definitions for each of the following code snippets. [5]

	Erroneous Code	Error Type	Definition of the Error Type

1.	`#include<stdio.h>`
	`void main() {`
	`int x = 10;`
	`int y = 15;`
	`printf("%d", (x, y))}`		

2.	`#include<stdio.h>`
	`void main() {`
	`int a, b, c;`
	`a + b = c;}`		

3.	`#include<stdio.h>`
	`void Main(){`
	`int a = 10;`
	`printf("%d", a); }`		

4.	`#include<stdio.h>`
	`void main() {`
	`int n = 9, div = 0;`
	`div = n/0;`
	`printf("resut = %d", div);}`		

5.	`int main() {`
	`int i = 0;`
	`for(i = 0; i < 3; i++);{`
	`printf("loop ");`
	`continue;}`
	`getchar();`
	`return 0;}`		

D) Differentiate between ***return*** and ***break*** statements with suitable example(s). [2]

2 A) Write a program to find out first ***n*** perfect number where ***n*** is the input from the user. In number theory, a perfect number is a positive integer that is equal to the sum of its proper positive divisors. that is, the sum of its positive divisors excluding the number itself. For example, 6 has positive divisors of 1, 2, 3 and 6. 6 is a perfect number since summation of 1 ,2 and 3 produce 6. [6]

B) Draw the flowchart to solve the following problem for any input ***n***. For **n** = 5, the following output is produced. [5]

```
1 2 3 2 1
1       1
1       1
1       1
1 2 3 2 1
```

C) What are the basic data types in C? Explain each of them with examples. Also, mention their minimum and maximum possible values. [3]

3 A) How it is possible for computers to run multiple programs at a time, where we know that CPU can only execute one program at a time? [3]

B) We want to store the records (Name, Roll and CGPA) of each student of CSEDU. Which one is more desirable in terms of efficiency and storage: Files or Databases? Justify your answer. [3]

C) Distinguish between working principle of an Inkjet and a Laser printer. [4]

D) What do you know about the operation of Virtual Machine and Cloud architecture? [2+2]

4 A) Write down two functions/responsibilities of each layer of the OSI (Open Source Interconnection) 7-layer model. [7]

B) Modify the HTML document below so that the word "Rover" is linked to the document whose URL is http://animals.org/pets/dogs and add an image after the line 'My dog's name is Rover' named as Rover.jpg. [4]

.html.

```
<html>
<head>
<title>Example</title>
</head>
<body>
<h1> My Pet Dog</h1>
<p>My dog's name is Rover.</p>
</body>
</html>
```

C) Differentiate between spyware, phishing attack and denial of service attack [3]

5 A) Compare between Star, Ring and Mesh network topologies. Suppose you want to redesign the network structure of CSEDU, which topology will you use? Justify your answer. [5]

B) When we access a webpage, we give a name instead of an IP address. How this name is translated to the machine-readable IP address? [4]

C) Internet has no leader or head office, how do you think it is managed worldwide and how we enjoy uninterrupted service? [3]

D) Define LAN and WAN. [2]

6 A) Here are some instructions in English. Translate each of them into the machine language of the given Appendix. [4]

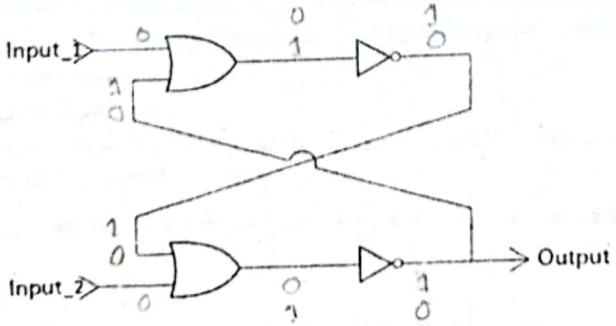
a. LOAD register number 3 with the hexadecimal value 56.
b. ROTATE register number 5 three bits to the right.
c. AND the contents of register A with the contents of register 5 and leave the result in register 0.

Appendix

Op-code	Operand	Description
1	RXY	LOAD the register R with the bit pattern found in the memory cell whose address is XY. *Example:* 14A3 would cause the contents of the memory cell located at address A3 to be placed in register 4.
2	RXY	LOAD the register R with the bit pattern XY. *Example:* 20A3 would cause the value A3 to be placed in register 0.
8	RST	AND the bit patterns in registers S and T and place the result in register R. *Example:* 8045 would cause the result of ANDing the contents of registers 4 and 5 to be placed in register 0.
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. *Example:* A403 would cause the contents of register 4 to be rotated 3 bits to the right in a circular fashion.

B) Describe the process of providing the output of the following Flip-Flop circuit for the following given input combinations, where considering the input combinations to be appeared in given sequence- [5]

Input_1	Input_2
1	0
0	0
0	1
0	0



C) As more RAM increases the performance of the system, why do we need the cache memory? What is the Virtual Memory? [5]

7. A) If a text contains "abfabafcecaecbedba" symbols, represent the text in Huffman code. For the Huffman representation of the code perform the step by step simulation like frequency counting, generating Huffman tree and others. [5]

B) The following message was compressed using LZW compression with a dictionary whose first, second, and third entries are x, y, and space, respectively. What is the decompressed message? [4]
22123113431213536

C) What characteristic of the human eye does JPEG's baseline standard exploit? [2]

D) Which of the following activities require real-time processing? [3]
a. Printing mailing labels
b. Playing a computer game
c. Displaying numbers on a smartphone screen as they are dialed
d. Executing a program that predicts the state of next year's economy
e. Playing an MP3 recording

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1st Year B. Sc. 1st Semester Final Examination, 2019

CSE 1102: Discrete Mathematics (3 credit)

Total Marks: 70 **Time: 3 Hours**

(Answer any Five (5) of the following Questions)

1. a) Five persons A, B, C, D and E are in a compartment in a train. A, C, E are men and B, D are women. The train passes through a tunnel and when it emerges, it is found that E is murdered. An enquiry is held. A, B, C and D are made the following statements. 5
A: I am innocent; B was talking to E when the train was passing through the tunnel.
B: I am innocent; I was not talking to E when the train was passing through the tunnel.
C: I am innocent; D committed the murder.
D: I am innocent; one of the men committed the murder.
Four of these eight statements are true and four false. Assuming that only one person committed the murder, who did it?

b) Translate these specifications into English where F (p) is "Printer p is out of service," B(p) is "Printer p is busy," L(j) is "Print job j is lost," and Q(j) is "Print job j is queued." 2

i. $\exists p(F(p) \wedge B(p)) \rightarrow \exists j L(j)$
ii. $\forall p B(p) \rightarrow \exists j Q(j)$

c) Express each of these statements using predicates, quantifiers, logical connectives, and mathematical operators where the domain consists of all integers. 4

i. The product of two negative integers is positive.
ii. The average of two positive integers is positive.
iii. The difference of two negative integers is not necessarily negative.
iv. The absolute value of the sum of two integers does not exceed the sum of the absolute values of these integers

d) Use rules of inference to show that if $\forall x(P(x) \vee Q(x))$ and $\forall x((\neg P(x) \wedge Q(x)) \rightarrow R(x))$ are true, then $\forall x(\neg R(x) \rightarrow P(x))$ is also true, where the domains of all quantifiers are the same. 3

2. a) Find two sets A and B such that $B \in A$ and $B \subseteq A$. 2

b) Suppose that $A \times B = \emptyset$, where A and B are sets. What can you conclude? 2

c) For the following sub-problems, fill in the blanks with appropriate relationship chosen from the list $\{\in, \supseteq, \subseteq, =, \text{none}\}$. You should choose the relationship which must be true, not just one which can be true. 3

i. $\overline{B - A}$ _____ $(A - B)$
ii. $A \cup (\bar{B} \cap C)$ _____ $(A \cup C) \cap (A \cup \bar{B})$

d) Draw the Venn diagram for $(A \cap B^c) \cup (A \cap D^c)$. 2

e) Consider these functions from the set of students in a discrete mathematics class. Under what conditions is the function one-to-one if it assigns to a student his or her 3

i. student identification number
ii. final grade in the class

f) Consider two sets A and B of bit string. What is the bit string corresponding to the symmetric difference of two sets? 2

3. a) Let $P(n)$ be the statement that $1 + \frac{1}{4} + \frac{1}{9} + \cdots + \frac{1}{n^2} < 2 - \frac{1}{n}$, where n is an integer greater than 1. 6

i. What is the statement P (2)?
ii. Show that P (2) is true, completing the basis step of the proof.
iii. What is the inductive hypothesis?
iv. What do you need to prove in the inductive step?
v. Complete the inductive step.
vi. Explain why these steps show that this inequality is true whenever n is an integer greater than 1.

b) Use by a proof of contradiction to prove that sum of an irrational number and a rational number is irrational. 3

c) Prove that $\forall_n \geq 2, n^3 - n$ is divisible by 6. 3

d) What is wrong with this proof. 2

Theorem: "If n is not positive, then n^2 is not positive."

"Proof:" Suppose that n is not positive. Because the conditional statement "If n is positive, then n^2 is positive" is true, we can conclude that n^2 is not positive.

a) A dollar is defective if some digit appears more than once in 6-digits serial number. How common are nondefective dollars? 2

b) Show that if five integers are selected from the first eight positive integers, there must be a pair of these integers with a sum equal to 9. 3

c) One hundred tickets, numbered 1, 2, 3,..., 100, are sold to 100 different people for a drawing. Four different prizes are awarded, including a grand prize. How many ways are there to award the prizes if 4

i. the people holding tickets 19, 47, 73, and 97 all win prizes?
ii. none of the people holding tickets 19, 47, 73, and 97 wins a prize?
iii. the grand prize winner is a person holding ticket 19, 47, 73, or 97?
iv. the people holding tickets 19 and 47 win prizes, but the people holding tickets 73 and 97 do not win prizes?

d) Find a recurrence relation and give initial conditions for the number of bit strings of length n that do not have two consecutive 0's. How many such bit strings are there of length five? 5

5: a) Suppose that R1 and R2 are symmetric relations on a set A. Is R1∪R2 also symmetric? Is R1∩R2 also symmetric? Explain. 3

b) Find the smallest relation containing the relation {(1,2), (1, 4), (3, 3),(4, 1)} that is both reflexive and symmetric? 2

c) Determine where the relation represented by the following zero-one matrix is an asymmetric relation. 3

$$\begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \end{bmatrix}$$

d) Let R be the relation on the set of people consisting of pairs (a, b), where a is a parent of b. Let S be the relation on the set of people consisting of pairs (a, b), where a and b are siblings (brothers or sisters). What are $S \circ R$ and $R \circ S$? 3

e) Determine whether the relation represented by the following zero-one matrix is an equivalence relation. 3

$$\begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix}$$

6. a) Prove or disprove that if $a|bc$, where a, b and c are positive integers and $a \neq 0$, then $a|b$ or $a|c$. 3

b) Express the greatest common divisor of 9 and 11 as the linear combination of 9 and 11. 3

c) Prove that there are infinitely many primes. 3

d) What are the solutions of linear congruence $34x \equiv 77 (mod\ 89)$ using modular inverse? 3

e) Use Ferrmat's little theorem to compute $3^{302} mod\ 5$. 2

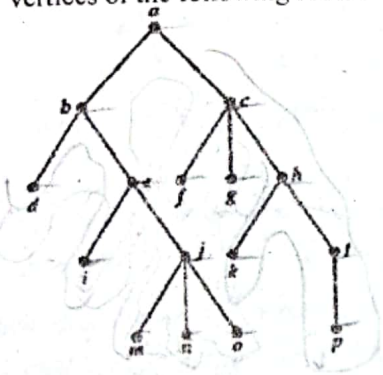
a) Draw a graph with the following adjacency matrix. 3

$$\begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

b) Can a simple graph exist with 15 vertices each of degree five? Justify your answer. 1

c) For which value of m and n does the complete bipartite graph $K_{m,n}$ have an 4
i) Euler circuit?
ii) Euler Path?

d) Determine the order in which i) preorder, ii) inorder, and iii) postorder traversal of the vertices of the following rooted tree. 6



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1st Year 1st Semester B.Sc. Final Examination, 2019
EEE-1103: Electrical Circuits (Credits: 3)

Total Marks: 70 Time: 3 Hours

Answer any 5 (five) of the following questions

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1. (a) The resistance of a copper wire is 1 Ω at 4 °C. At what temperature (°C) will it be 1.1 Ω? Temperature coefficient of Copper at 20 °C is 0.00393. [2]

(b) A resistor contains three color bands on its body. The bands are Grey, Blue and Orange. Find the probable range of resistance of the resistor. [2]

(c) How much energy (in kilowatt-hours) is required to light a 60 W bulb continuously for 1 year (365 days)? [2]

(d) What is the output in horsepower of a motor with an efficiency of 80% and an input current of 8 A at 120 V? [2]

(e) Show that, the voltage across a resistor in a series circuit is equal to the value of that resistor times the total applied voltage divided by the total resistance of the series configuration. [3]

(f) Determine the values of R_1, R_2, R_3, and R_4 for the voltage divider of Fig. 1(f) if the source current is 16 mA. [3]

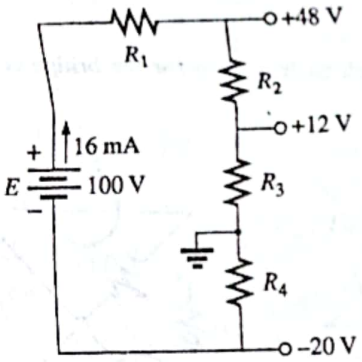

Fig. 1(f)

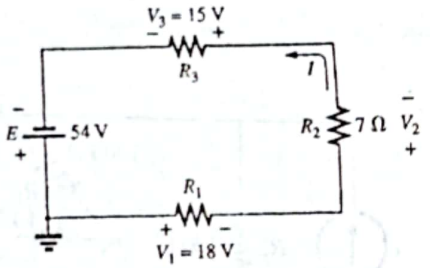

Fig. 2(b)

2. (a) State voltage divider rule. "The total resistance of parallel resistors will always drop as new resistors are added in parallel, irrespective of their value" - explain. [2+2=4]

(b) For the series circuit in Fig. 2(b): [4]

i. Determine V_2 using Kirchhoff's voltage law.

ii. Determine current I_2.

iii. Find R_1 and R_3.

(c) For the network in Fig. 2(c), determine the voltages: [4]

i. V_a, V_b, V_c, V_d

ii. $V_{ab}, V_{cb}, V_{ad}, V_{ca}$

(d) Using Kirchhoff's voltage law, find the unknown voltages for the configurations in Fig. 2(d). [2]

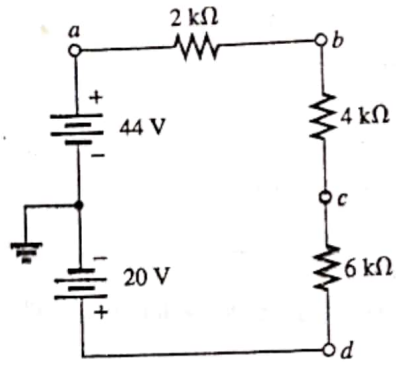

Fig. 2(c)

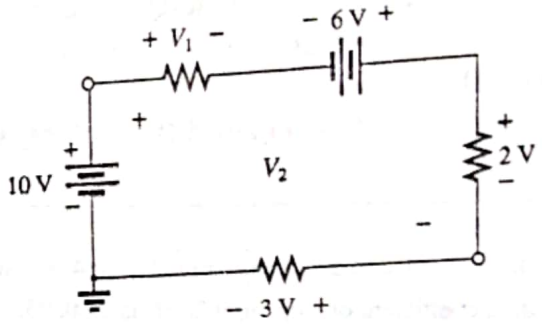

Fig. 2(d)

3. (a) Prove that, the bridge network in Fig. 3(a) is balanced when $R_1/R_3 = R_2/R_4$. [4]

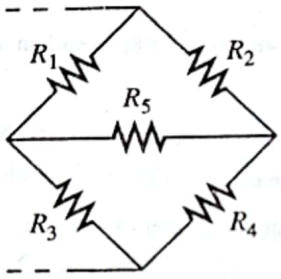

Fig. 3(a)

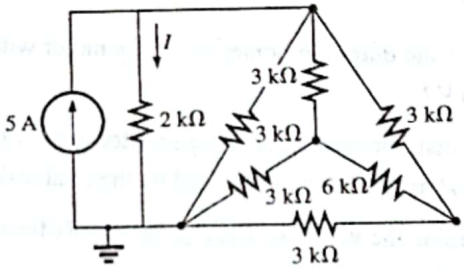

Fig. 3(b)

(b) Determine the current I for the network in Fig. 3(b). [3]

(c) Write the nodal equations and find currents through each resistor for the bridge configuration in Fig. 3(c). Use the format approach. [4]

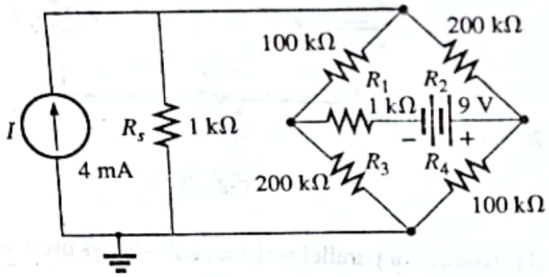

Fig. 3(c)

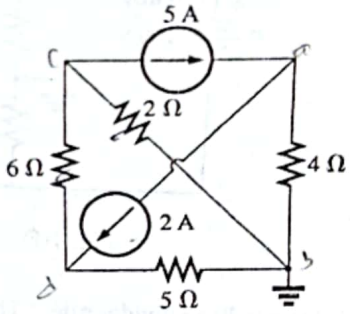

Fig. 3(d)

(d) Find the voltage across each current source in Fig. 3(d). [3]

4. (a) Derive equations to convert the Δ-configuration in Fig. 4(a) to Y-configuration. [3]

(b) Using the supermesh approach, find the current through the network in Fig.4(b). [4]

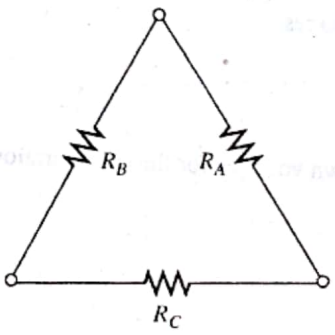

Fig. 4(a)

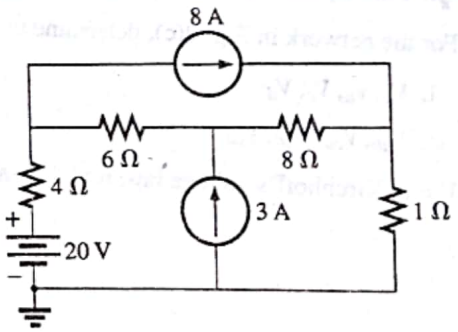

Fig. 4(b)

(c) Using the principle of superposition, find the current I_2 through the 12 kΩ resistor in Fig. 4(c). [4]

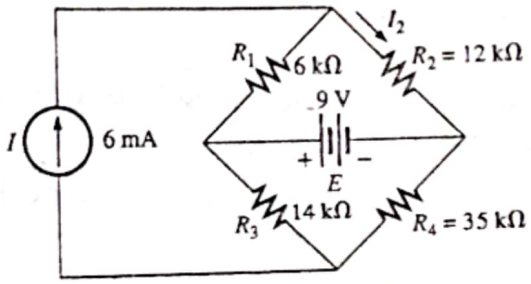

Fig. 4(c)

(d) Demonstrate that the superposition theorem is not applicable to power levels. [3]

5. (a) For the network in Fig. 5(a):

i. Find the Thévenin equivalent circuit for the network external to the resistor R. [3]

ii. Using Superposition theorem, find the current through and voltage across the resistor R. [3]

iii. Using Millman's theorem, find the current through and voltage across the resistor R. [3]

iv. Find the maximum power to R. [1]

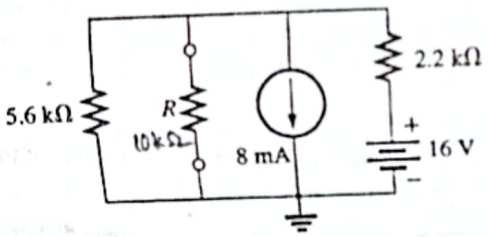

Fig. 5(a)

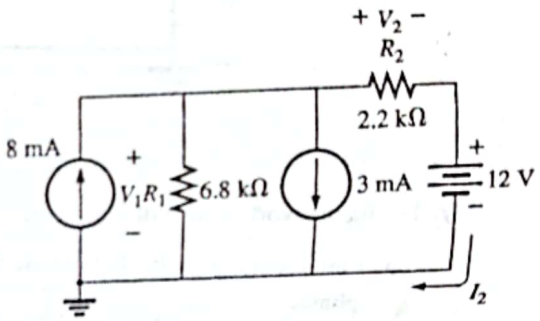

Fig. 5(b)

[4]

(b) For the network in Fig. 5(b):

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 (ii), determine V_2.

iv. Calculate the current I_2.

6. (a) Describe how the capacitance of a capacitor can be improved by applying dielectric materials. [3]

(b) Show that, $C = \epsilon_0 \epsilon_r \frac{A}{d}$, where the symbol represents their corresponding values and units of measurements. [3]

(c) For the network in Fig. 6(c), composed of standard values:

i. Write the mathematical expressions for the voltages υ_C, υ_{R_1} and the current i_C after the switch is thrown into position 1. [3]

ii. Find the values of υ_C and i_C when the switch is moved to position 2 at $t = 100\ ms$. [2]

iii. Write the mathematical expressions for the voltages υ_C, υ_{R_2} and the current i_C if the switch is moved to position 3 at $t = 200\ ms$. [3]

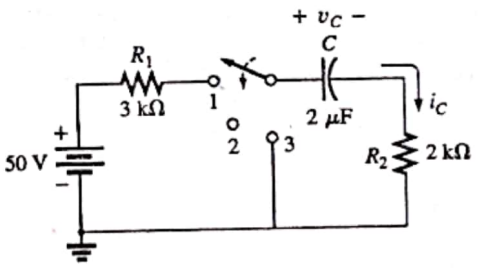

Fig. 6(c)

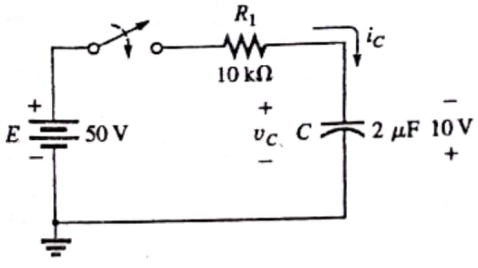

Fig. 7(a)

7. (a) Define leakage current of a capacitor. The capacitor in Fig. 7(a) is initially charged to 10 V with the polarity shown. [1 + 3 = 4]

   i. Write the expression for the voltage v_C after the switch is closed.

   ii. Write the expression for the current i_C after the switch is closed.

(b) If the energy stored by a 6 μF capacitor is 1200 J, then find the charge Q on each plates of the capacitor. [2]

(c) Show that, the inductance of an inductor with a ferromagnetic core is μ_r times the inductance obtained with an air core. [2]

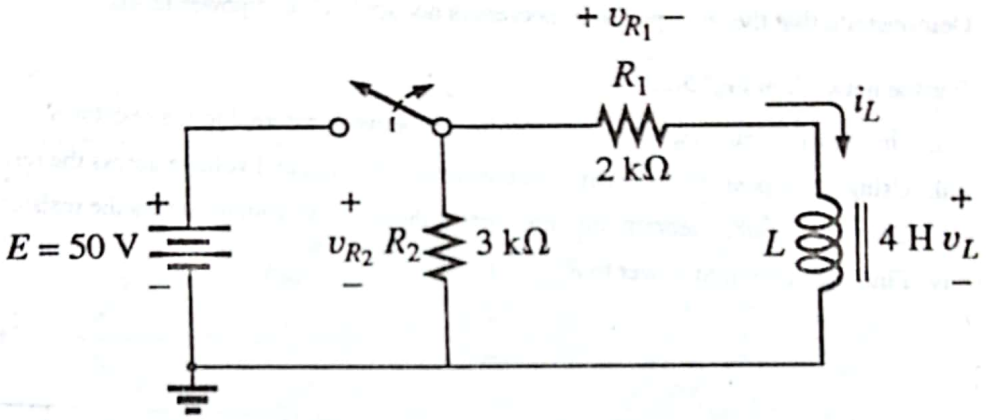

Fig. 7(d)

(d) For the network shown in Fig. 7(d):

   i. Find the mathematical expressions for i_L, v_L, v_{R_1} and v_{R_2} for five time constants of the storage phase. [3]

   ii. Find the mathematical expressions for i_L, v_L, v_{R_1} and v_{R_2} if the switch is opened after five time constants of the storage phase. [3]

University of Dhaka

Department of Computer Science and Engineering

1st Year 1st Semester B.Sc. Final Examination – 2019

PHY-1104: Physics (3 Credits)

Time: 3.00 Hours | Total Marks: 70

[Answer any 5 of the following 7 Questions]

1. a. State and explain the zeroth law of thermodynamics. [1+1]

   b. Explain the concept of internal energy as derived from the first law of thermodynamics. [2]

   c. Show that for an ideal gas, $C_p - C_v = R$. [4]

   d. How much work is required to compress 5.00 mol of a triatomic gas at 20°C and 1.00 atm to one-tenth of the original volume i) by an isothermal process? ii) by an adiabatic process? iii) what is the final pressure in each of these two cases? [2+2+2]

2. a. Explain the concepts of reversible and Irreversible processes. [2]

   b. Show that the entropy remains constant in a reversible process. What happens in case the process is an irreversible one? [4+4]

   c. Suppose that 1.00 kg of water at 0°C is mixed with an equal mass of water at 100°C. After equilibrium is reached, the mixture has a uniform temperature of 50°C. What is the change in entropy of the system? [4]

3. a. Give examples by drawing figures of Bravais and non-bravais lattices. [1+1]

   b. Define primitive unit cell, non primitive unit cell, packing fraction and coordination number. [4]

   c. Consider a cubic lattice with the edges of the conventional unit cell along the x, y and z-axis, and the length of an edge equal to a.

      i. Draw all the members of the family of planes belonging to (1 0 0). How many planes will be in this family? Write the Miller Indices of all of them. [2+1+1]

      ii. Find the planar density of atoms in the (1 0 0) and (1 1 1) planes. [1+1]

      iii. Find the packing fraction of FCC lattice. [2]

4. a. Explain with example the reciprocal lattice vectors in three dimensions. Show that the reciprocal lattice of face centered cubic is a scaled body centered cubic lattice in the reciprocal space. [2+4]

   b. Define Wigner-Seitz unit cell. Draw the Wigner-Seitz unit cells of centered rectangular lattice in 2D. [2+1]

   c. Show that the interplanar spacing in simple cubic crystal is given by: [5]

$$d_{hkl} = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$$

   Where a is the lattice parameter.

5. a. Show that for simple harmonic oscillator, the sum of the kinetic energy and the potential energy is a constant. Draw the plots of the Kinetic and potential energies with respect to time within one period of oscillation. [2+2]

   b. Set up the differential equation of motion of a damped harmonic oscillator damping force proportional to the velocity and restoring force proportional to the displacement. Solve the equation for the underdamped, critically damped and overdamped cases. [2+ 2×3 = 8]

   c. Two vibrations at right angles to one another are described by the equations: [2]

$$x = 4\cos(\omega t), \qquad y = 4\cos(\omega t + \pi/2)$$

   Construct the Lissajous figure of the combined motion indicating the sense of motion.

a. Define diffraction of waves. Distinguish between Fraunhofer and Fresnel types of diffraction. [2 + 2]

b. In multiple-slit diffraction setup, prove that the intensity distribution on a screen when the diffracted light is focused by a converging lens is given by: [6]

$$I = I_0 \frac{\sin^2\beta}{\beta^2} \frac{\sin^2 N\gamma}{\sin^2\gamma}$$

Where, $\beta = \pi a \sin\theta/\lambda$ and $\gamma = \pi d \sin\theta/\lambda$, in which a is the width of each slit, d is the separation of the slits and θ is the angle of diffraction.

c. Find the condition for principal maxima in *N*-slit diffraction. [2]

d. In a double slit diffraction pattern, the width of the slit is $a = 0.0088cm$ and the slit separation is $d = 0.035cm$. The wavelength of light used is $\lambda = 6.328 \times 10^{-5}\ cm$. Find the first missing order. [2]

a. What are coherent sources? How are they realised in practice? [2 + 2]

b. How Newton's rings are formed? How can you determine the wavelength of light with their uses? [2+4]

c. In a double slit experiment, we can measure the wavelength of the light if we know the distances between the slits and the angular separation of the fringes. If the separation between the slits is 0.5mm and the first order maximum of the interference pattern is at an angle of 0.059° from the center of the pattern, what is the wavelength and the color of the light used? [4]

University of Dhaka
Department of Computer Science and Engineering
1st Year B. Sc. 1st Semester Final Examination, 2019

MATH-1105: Differential and Integral Calculus (3 credit)

Total Marks: 70 **Time: 3 Hours**

(Answer any Five (5) of the following Questions)

1. a) Sketch the graph of the following functions and find its domain and range. 4
i) $f(x) = 1 - 2^x$, ii) $f(x) = \sqrt{-x}$

b) Define limit of a function. Evaluate the following. 5

i) $\lim_{x\to\infty} \frac{3x+5}{6x-8}$ ii) $\lim_{x\to\infty} \frac{5x^3 - 2x^2 + 1}{1-3x}$

c) What is $\varepsilon - \partial$ limit? Use $\varepsilon - \partial$ definition to prove 5

$$\lim_{x\to 1} \frac{2x^2 + 2x - 4}{x - 1} = 6$$

2. a) Test the continuity and differentiability of a function $f(x)$ at a point $x = \pi/2$ where 8

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

b) Suppose that $g(x) = 3x^2 - 2x + 3$. Find the average rate of change of g from 0 to 1. 6

3. a) Find the differential coefficient $\frac{dy}{dx}$ of the function $x = \sin^{-1}\frac{2t}{1+t^2}$, $y = \tan^{-1}\frac{2t}{1-t^2}$ 3

b) Find $\frac{dy}{dx}$ of the following functions (any two). 6

i. $y = \sin\left[2\tan^{-1}\left[\frac{1-x}{1+x}\right]\right]$
ii. $y = x^x + x^{1/x}$
iii. $x = \cos(t), y = e^t \sin(t)$

c) The equation of motion of a moving object is $s(t) = 2t^3 - 5t^2 + 3t + 4, 0 \le t \le 10$, where t is the time in seconds and $s(t)$ is measured in meters. Calculate the velocity and the acceleration at $t = 3$. 5

4. a) Let $f(x) = x^4 - 2x^2$. Find the intervals on which the function $f(x)$ is increasing, decreasing, concave up and concave down. Also, find the local extrema of $f(x)$. 8

b) Show that $f(x) = \sin x(1 + \cos x)$ has a relative maxima at $x = \frac{\pi}{3}$. 3

c) State L' Hospital's rule. Apply this rule to evaluate 3

$$\lim_{x\to 0}\left(\frac{1}{x} - \frac{1}{\sin x}\right)$$

5. a) Evaluate the following integrals. 8

i) $\int \frac{dx}{x^2\sqrt{4x^2-9}}$ ii) $\int \left(\frac{10}{y^{\frac{3}{4}}} - \sqrt[3]{y} + \frac{4}{\sqrt{y}}\right)$

iii) $\int_0^{\ln 3} e^x (1 + e^x)^{\frac{1}{2}} dx$ iv) $\int_0^{\frac{\pi}{8}} \sin^5 2x \cos 2x dx$

b) Define improper integral. Evaluate 6

i) $\int_0^\infty (1 - x)e^{-x} dx$ ii) $\int_{-\infty}^\infty \frac{1}{1+x^2} dx$

6. a) Find the length of the perimeter of the cardioids $r = a(1 + \cos\theta)$. 7

b) Find the area of the region enclosed by $x = y^2$ and $y = x - 2$ integrating with respect to y. 7

7. a) Find the volume V of the solid that is obtained when the region under the curve $y = \sin^2 x$ over the interval $[0, \pi]$ is revolved about the x-axis. 4

b) Find the volume of the solid generated when the region between the graphs of the equations $f(x) = \frac{1}{2} + x^2$ and $g(x) = x$ over the interval $[0, 2]$ is revolved about the x-axis. 5

c) Use cylindrical shells to find the volume of the solid generated when the region R in the first quadrant enclosed between $y = x$ and $y = x^2$ is revolved about the y-axis. 5