

Metropolitan University, Sylhet
Department of Computer Science and Engineering
Semester Final Examination – 2023
Program: B.Sc. in CSE; Batch: 57(A,B,C,D,E,F,G)
Course: GED-119: Engineering Ethics and Cyber Law

Time: 2 Hours

Marks: 40

Answer any four questions. All parts of each question must be answered sequentially.
Figures in the right margin indicate full marks.

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- ✓ a) Explain Internet Privacy. 4
- b) Explore the potential risks and challenges associated with maintaining privacy on the internet in an increasingly interconnected world. 6
- ✓ a) How does cybercrime impact society across various aspects? 4
- b) What measures can individuals take to minimize the risk of falling victim to cybercrime? 6
- 3 Elaborate on the practices and policies existed in Bangladesh for the prevention of cybercrime. 10
- 4 a) What are the primary objectives of the Right to Information Act? 6
- b) Describe the necessary conditions for the free flow of information. 2
- c) How does the constitution of Bangladesh address the right to information (RTI) and ensure transparency in governance? 2
- ✓ What recommendations and suggestions could be implemented to effectively ensure the right to information for the general public? 10
- ✓ a) Discuss the functions, duties, and objectives of the Bangladesh Telecommunication Regulatory Commission (BTRC). 06
- b) Discuss the following circumstances in accordance with the rules of BTRC 04
- Instances of radio or telecommunication apparatus misuse by an employee.
 - Offenses committed by companies.

Metropolitan University, Sylhet
Department of Computer Science and Engineering
Spring Term Final Examination - 2023
Program: B.Sc. in CSE; Batch: 57th
Course: GEd 115: English Language II

Time: 2 Hours

Marks: 40

Figures in the right-hand margin indicate full marks.

Read the following passage and answer questions 1 and 2:

The aims of the transhumanist movement are summed up by Mark O'Connell in his book *To Be a Machine*, which won the Wellcome Book prize in 2018. "It is their belief that we can and should eradicate ageing as a cause of death; that we can and should use technology to augment our bodies and our minds; that we can and should merge with machines, remaking ourselves, finally, in the image of our own higher ideals."

The idea of technologically enhancing our bodies is not new. But the extent to which transhumanists take the concept is. In the past, we made devices such as wooden legs, hearing aids, spectacles and false teeth. In future, we might use implants to augment our senses so we can detect infrared or ultraviolet radiation directly or boost our cognitive processes by connecting ourselves to memory chips. Ultimately, by merging man and machine, science will produce humans who have vastly increased intelligence, strength, and lifespans; a near embodiment of gods.

Adherents of transhumanism envisage a day when humans will free themselves of all corporeal restraints. Kurzweil and his followers believe this turning point will be reached around the year 2030, when biotechnology will enable a union between humans and genuinely intelligent computers and AI systems. The resulting human-machine mind will become free to roam a universe of its own creation, uploading itself at will on to a "suitably powerful computational substrate". We will become gods. These are remote and, for many people, very fanciful goals.

For their part, transhumanists argue that the costs of enhancement will inevitably plummet and point to the example of the mobile phone, which was once so expensive only the very richest could afford one, but which today is a universal gadget owned by virtually every member of society. Such ubiquity will become a feature of technologies for augmenting men and women, advocates insist.

1. Answer the questions:

1×5=5

- a) What does Mark O'Connell say we can and should do?
- b) What is the difference between the past and the future technologies of physical enhancement?
- c) Why is the year 2030 said to be a turning point in the transhumanist movement?
- d) What do transhumanists predict about the price of physical augmentation?
- e) Who or what will become the near embodiment of gods?

2. Paraphrase the following excerpt from the passage:

06

Adherents of transhumanism envisage a day when humans will free themselves of all corporeal restraints. Kurzweil and his followers believe this turning point will be reached around the year 2030, when biotechnology will enable a union between humans and

genuinely intelligent computers and AI systems. The resulting human-machine mind will become free to roam a universe of its own creation, uploading itself at will on to a "suitably powerful computational substrate."

3. Write ONE example sentence with each of the following phrases:

0.5×10=5

- a) all things considered
- b) easy on the eye
- c) for my part
- d) go hand in hand
- e) it stands to reason
- f) have/be nothing to do with (somebody/something)
- g) spread the word
- h) stand a chance
- i) the best of both worlds
- j) to say the least

4. Fill in the blanks with appropriate phrases from the box:

0.5×10=5

irrespective of, in reality, regardless, compared to, yet, for one thing, either way, in other words, in addition to, consequently

- a) The task was undoubtedly daunting, but he went on to do it ____.
- b) ____ his performance, mine was only mediocre.
- c) You must treat them equally, ____ their gender and backgrounds.
- d) I've made ____ another silly mistake.
- e) You can get there by bus or by taxi. ____ it'll take more than an hour.
- f) I didn't like the house. ____, the rooms were too cramped for comfort.
- g) She didn't pay the membership fee for 3 consecutive months, and ____ lost her membership.
- h) They make it look so easy in the movie, but ____ it's almost impossible.
- i) He took my watch without permission— ____ he stole it.
- j) You'll get two yearly bonuses ____ your salary.

5. Answer any ONE of the following:

07

- a) The IT firm Tech BD has bought some printers from the retailer Asian Multimedia, and these printers have turned out to be faulty. As Admin Officer of Tech BD, write an email to the manager of Asian Multimedia asking for replacement of these printers.
- b) Suppose you are a retailer of bicycles and the name of your shop is Classic Bike Enterprise. Now write a letter to the Manager of CycleLife Ltd., a bicycle wholesaler, for the quotation of 200 pieces of Road Bike. Tell him in your letter that you might place more purchase orders in the future if the bikes are to your liking.

6. Answer any ONE of the following:

12

- a) Some academicians are concerned that AI language models like ChatGPT might be misused by students. Others, however, believe that such language models can be used as an effective tool for study purposes. Discuss both these views and give your opinion.
- b) Do you believe that celebrities should try to establish themselves as role models and have positive influence on common people? Give arguments in support of your answer.

Metropolitan University, Sylhet
Department of Computer Science and Engineering
Spring Term Final Examination – 2023
Program: B.Sc. in CSE; Batch – 57
Course: MAT 123: Differential Equations and Laplace Transforms.

Time: 2 Hours

Marks: 40

Answer any four questions. All parts of each question must be answered sequentially. Figures in the right margin indicate full marks.

1. ✓ Consider the Differential Equation

$$(4x + 3y^2) dx + 2xy dy = 0$$

- (a) Define Integrating Factor with example and show that the equation is not exact. 4
- (b) Find an integrating factor of the form x^n , where n is a positive integer. 3
- (c) Hence solve the equation after multiplying with Integrating Factor. 3

2. ✓ (a) Explain separable and homogeneous differential equations with examples. 2

- (b) Solve the initial-value problem. 4

$$x \sin y dx + (x^2 + 1) \cos y dy = 0, y(1) = \frac{\pi}{2}.$$

- (c) Solve the differential equation. 4

$$(y + \sqrt{x^2 + y^2}) dx - x dy = 0$$

3. ✓ (a) Explain Linear and Bernoulli differential equations with examples. 4

- (b) Evaluate the solution of differential equation. 6

$$dy + (4y - 8y^{-3}) dx = 0.$$

4. (a) Define Partial Differential Equations (PDE), linear and nonlinear PDE with examples. 4

(b) Form a PDE by eliminating arbitrary constant from the following equations. 6

(i) $2z^2 = c(x + 2y)$

(ii) $z = (x - a)^2 + (y - b)^2$

(iii) $z = ax^3 + by^3$

5. (a) Define Lagrange's Equations with example. 1

(b) Solve the following PDEs. 9

(i) $p \tan x + q \tan y = \tan z$

(ii) $\left(\frac{y^2 z}{x}\right)p + xzq = y^2$

(iii) $zp = -x$

6. (a) Define Laplace Transform and Inverse Laplace transform with examples. 4

(b) Evaluate the following Laplace and Inverse Laplace Transforms 6

(i) $\mathcal{L}\{4e^{5t} + 6t^2 - 3\sin 4t + 2\cos 2t\}$

(ii) $\mathcal{L}^{-1}\left\{\frac{2s^2 - 4}{(s+1)(s-2)(s-3)}\right\}$

Metropolitan University, Sylhet
Department of Computer Science and Engineering
Spring Term Final Examination – 2023
Program: B.Sc. in CSE; Batch: 57
Course: CSE 133: Data Structure

Time: 2 Hours

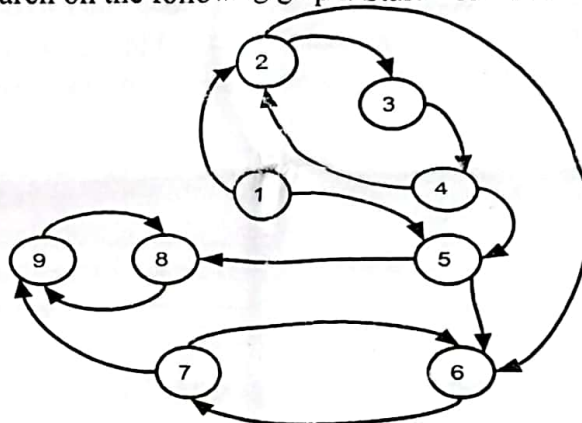
Marks: 40

Answer any **four** questions. All parts of each question must be answered sequentially. Figures in the right margin indicate full marks.

- ✓ a) Let's assume the **in-order** traversal is: 4, 8, 2, 5, 1, 6, 3, 7, 9, 12, 10, 14, 11, 15, 13 5
And the **post-order** traversal is: 8, 4, 5, 2, 6, 7, 3, 1, 12, 9, 14, 10, 15, 13, 11
Construct a binary tree.

- b) Consider the following array: $A = [9, 7, 5, 11, 3, 2, 6, 1, 8]$ 5
Now, Construct a min heap from this array.

- ✓ a) Apply Breadth First Search on the following graph. Start from node 1: 5



- b) I. What is the time complexity of BFS and DFS in terms of the number of vertices (V) and edges (E)?
II. When would you use BFS over DFS and vice versa?
III. Can BFS and DFS be used on both directed and undirected graphs? 5
IV. Which data structures are used for BFS and DFS?
V. When dealing with an undirected graph, which algorithm would be more suitable to determine the shortest distance to all nodes - BFS or DFS?

3. a) Evaluate the following expressions (assume $A=4, B=2, C=3, D=5$) 4
Postfix: $ABC^*+D/$ Prefix: $*-AB/C$

- b) Convert the following infix expression to postfix notation using stack: 6
 $A * (B + C) / D - (E * (F \wedge G))$

- ✓ a) Apply Quick Sort and show all the steps to the following array:
A = [9, 7, 5, 11, 12, 2, 14]

6

- b) Consider the following array: [15, 25, 10, 7, 22, 17, 13, 5, 9, 27, 29, 1]
Apply the following operations

4

- I. Draw a binary search tree from this array
- II. Delete 25 and draw the resultant tree
- III. Insert 25 and draw the resultant tree

- ✓ a) Consider this circular queue, with _ denoting an empty cell.
[YELLOW, _, _, GREEN, GRAY]

5

FRONT is 4, REAR is 0 (assume 0-based indexing)

In this circular queue, run the following operations and show the queue after each operation.

- ENQUEUE RED
- ENQUEUE ORANGE
- DEQUEUE
- ENQUEUE PURPLE
- DEQUEUE

- b) Apply binary search on the following array and show left, mid and right at every step.
Search for value 4:

5

1	4	7	11	15	18	21	24	27	30	33	36	39	42	45	48	51
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6. a) Write the output of the following functions, assuming 0-based indexing.

index(char str[], char str2[]) index("Superfluous", "flu")	substring(char str[], int start, int length) substring("Bhutan", 0, 4);
insert(char str[], char str2[], int pos) insert("Breadth First", "Search", 2)	delete(char str[], int start, int length) delete("Flower garden", 4, 9)
replace(char str[], char original, char replace) replace("Tallahassee", 'a', 'e')	

5

- b)
- I. What is the difference between a linear data structure and a non-linear data structure?
 - II. How does Linked List differ from Array?
 - III. How can you find the middle node of a Linked List?
 - IV. What are the time complexities for insert and delete operations in a singly linked list?
 - V. How can you detect if a linked list has a loop?

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Metropolitan University
Department of Computer Science and Engineering
Spring Term Final Examination – 2023

Program: CSE; Batch: 57
Course: PHY 123: Physics II

Time: 2 Hour

Marks: 40

[Answer any four of the following questions]

- ✓ (a) Draw the intensity distribution curves for single-slit and double-slit diffraction experiments. 2
- (b) Can you determine the wavelength of an X-ray using diffraction grating? Justify your answer. 3
- (c) A physicist named Robert was conducting an optical experiment using a diffraction grating, which is 20 mm long and has 4000 rulings. In his experiment, he used both red light of wavelength 700 nm and blue light of wavelength 430 nm. Which color of light bent more in his experiment? (Hint: Consider $m = 1$.) 5
- ✓ (a) Both prism and diffraction grating can divide white light into spectral lines of different wavelengths. What is the main distinguishing factor between these devices? Explain. 2
- (b) Derive Bragg's law for X-ray diffraction. 4
- (c) Sebastian, a physicist, used a diffraction grating with a length of 10.0 mm and 5000 rulings. He used light with a wavelength of 620 nm and shone it perpendicularly on the grating. What is the largest angle at which Sebastian can observe maxima on a distant viewing screen? 4
- ✓ 3. (a) Derive the Einstein equation for the photoelectric effect. 5
- (b) Mention some of the applications of the photoelectric effect. 2
- (c) How fast must an electron move have a kinetic energy equal to the photon energy of sodium light at wavelength 590 nm? 3
4. (a) Let us assume we are using green light in a photoelectric experiment. First, the intensity of light was very high, and later the intensity of light decreased to very low intensity. How will the kinetic energy of the ejected electrons change with the change in the intensity of the light? Justify your answer. (The wavelength of the green light is 550 nm.) 4
- (b) Assume you are conducting a photoelectric effect experiment. In the experiment, you are using sodium as one of the terminals where a beam of light is incident upon. 3
- i. Draw a graph where the frequency is along the X-axis, and the stopping potential V_{stop} is along the Y-axis.
- ii. Show the cut-off frequency in the graph.
- iii. Also, how can you calculate the work function from that graph?
- (c) Find the maximum kinetic energy of electrons ejected from a certain material if the material's work function is 2.3 eV and the frequency of the incident radiation is 3.0×10^{15} Hz. 3

5. (a) Explain Heisenberg's uncertainty principle. 4
- (b) X-rays having an energy of 250 keV undergo Compton scattering from a target. The scattered rays are detected at 27.0° relative to the incident rays. Find 4
- the Compton shift at this angle, and
 - the energy of the scattered x-ray.
- (c) What is the de Broglie wavelength of an electron with a kinetic energy of 200 eV? 2
6. (a) Find an expression for the radioactive decay of a nucleus. 4
- (b) The half-life of a radioactive isotope is 370 d. How many days would it take for the decay rate of a sample of this isotope to fall to one-sixth of its initial value? 4
- (c) Draw the graph of Geiger and Marsden's experiment. 2

Useful Constants

Planck's Constant, $h = 6.634 \times 10^{-34}$ J-s

The mass of an electron, $m = 9.11 \times 10^{-31}$ kg

Charge of an electron, $e = 1.6 \times 10^{-19}$ C

Speed of light, $c = 3 \times 10^8$ m/s

Metropolitan University
Department of Computer Science and Engineering
 Spring Term Final Examination, Spring 2023
 Program: B.Sc CSE, Batch: 57
 Course: CSE 131: Basic Electronics Engineering

Time: 2 hour

Marks: 40

Answer any four (4) questions. Figures in the right margin indicate full marks.

1. a) Define a Zener diode. 1
- b) Silicon is doped with a group III material at a concentration of $N_d = 10^{15} \text{ cm}^{-3}$. Calculate n_o and p_o . ($n_i = 1.5 \times 10^{10} \text{ cm}^{-3}$) 3
- c) Determine V_D , V_R , and I_D for i) the bias shown in the circuit in Fig-1 3*2
 ii) the circuit if the diode is reversed.

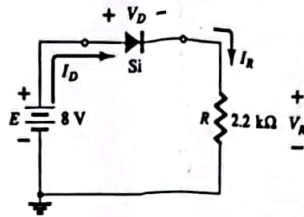


Fig-1

- ✓ a) Determine v_o in the op amp circuits shown in Fig-2.1 and Fig-2.2. 4*2

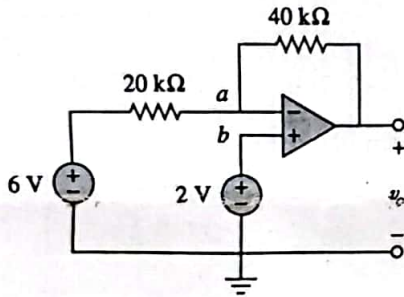


Fig-2.1

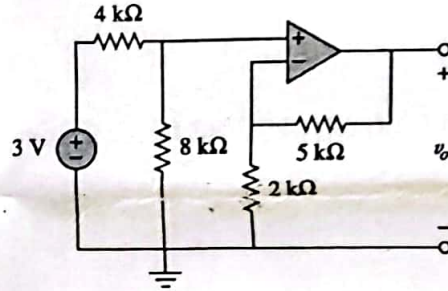


Fig-2.2

- b) Define a differentiator with an appropriate circuit diagram. 2
- ✓ a) Calculate v_o and i_o in the op amp circuit in Fig-3.1. 4

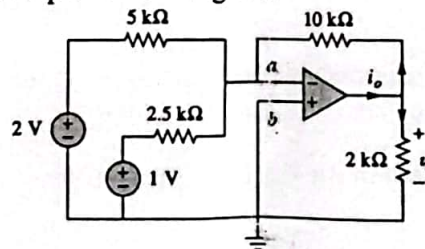


Fig-3.1

- b) Find V_o in the op amp circuit of Fig. 3.2. 6

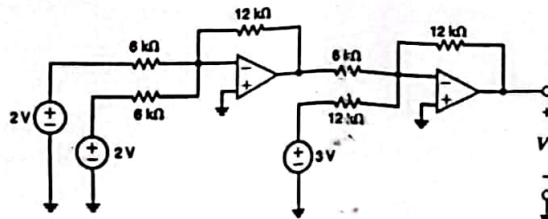


Fig-3.2

4. a) What is field effect? What is its use in a MOSFET? 2

b) A semiconductor substrate is given to you. Design an *n-channel enhancement mode MOSFET (n-MOS)*. The steps to design it needs to contain;
 i) The type of doping you will add to the substrate.
 ii) The other layers that should be added.
 iii) Describe whether the MOSFET will be in *npn* or *pnp* configuration.
 iv) Provide the appropriate voltage connections so that current will flow from source to drain. 2*4

5. a) Calculate the drain current (I_D) and drain-to-source voltage (V_{DS}) for the circuit in Fig-4.1. 5
 Given:

$$\begin{aligned} R_1 &= 30 \text{ k}\Omega \\ R_2 &= 20 \text{ k}\Omega \\ R_D &= 20 \text{ k}\Omega \\ V_{DD} &= 5 \text{ V} \\ V_{TN} &= 1 \text{ V} \\ K_N &= 0.1 \text{ mA/V}^2 \end{aligned}$$

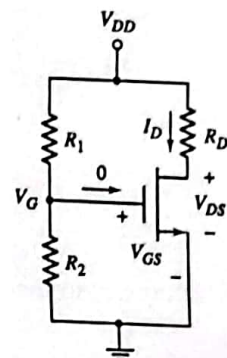


Fig-4.1

b) Find I_B , I_C , I_E , V_C , and V_E for the circuit in Fig-5.2. Given, $\beta = 100$. 5

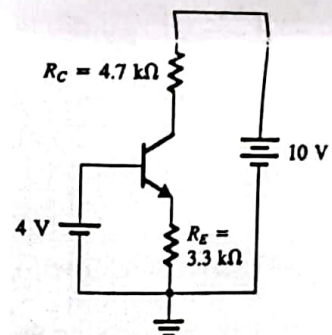


Fig-4.2

6. a) Between BJT and MOSFET, discuss which one is a current controlled device and which one is a voltage controlled device and state your reasoning. 5

b) Find I_B , I_C , and V_{CE} for the circuit in Fig-6. Given, $\beta = 100$. 5

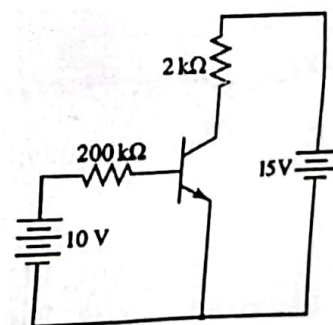


Fig-5