



Rangamati Science and Technology University

Department of Computer Science and Engineering

2nd Year 1st Semester B.Sc. (Engg.) Final Exam-2021

Course Code: CSE-2101; Session: 2019-2020

Course Title: Data Structure

Time: 3 Hours Marks: 60

- NB:
1. Answer any FOUR(4) questions out of SIX(6)questions.
 2. Figures in the right margin indicate marks($15 \times 4 = 60$).
 3. All parts of a question must be answered serially.

1. (a) Define Data Structure operations. Describe different types of Complexity of algorithms. 5
- (b) As per COVID-19 rules, your CSE department is taking online classes. Your professor takes class from *Start_Time(hh:mm-09:00)* to *End_Time(hh:mm-09:45)*. He uses a chrome extension to track when a student joins the class and leaves the class with their *Student ID*. He stores it in a student tracker file and then circulates it in your batch group. Now, your teacher is very strict. He wants to take attendance at a moment when the number of students [40, 34, 14, 24, 43, 10, 33, 40, 19] present in the class is minimum. If there are multiple such times he can choose a time with equal probability and will take the attendance. Now, you know your teacher's Linear Algorithm and Search the time(moment) when your teacher would take the attendance as you have access to the student tracker file.

Note: Each student can join the class at multiple intervals (Nine intervals 5 minutes apart).

- (c) Priyotoma likes stones very much. As she is fond of collecting beautiful stones, every day she finds some of the stones beautiful and put a name then collects it in her bottle. She collected number of stones and the name of those stones as follows:

A, B, C, D, G, I, K, L, M, O, P, Q, R, S, T, U, W, Z.

Now find the stone 'B' through Binary Search and show that how many steps are required to find the desired stone.

2. (a) State floor and ceiling function with example. Write down the major operation of data structures. 5

- (b) Suppose the following numbers are stored in an array A. Now apply the bubble sort to the array A and discuss each pass separately. 5

Array A: 100 15 12 18 0 17

- (c) Yasin is in a relationship with a sweet girl and his girlfriend loves arrays that are sorted in non-increasing order. Today is her birthday. Yasin wants to give her some sorted arrays on her birthday. But the shop has only unsorted arrays. So, Yasin bought T unsorted arrays and is trying to sort them. But he doesn't have much time to sort the arrays manually as he is getting late for the birthday party. So, he asked you to solve the problem because only you know the Selection sort strategies to sort the T arrays in non-increasing order. Help him, or his girlfriend will kill him! 5

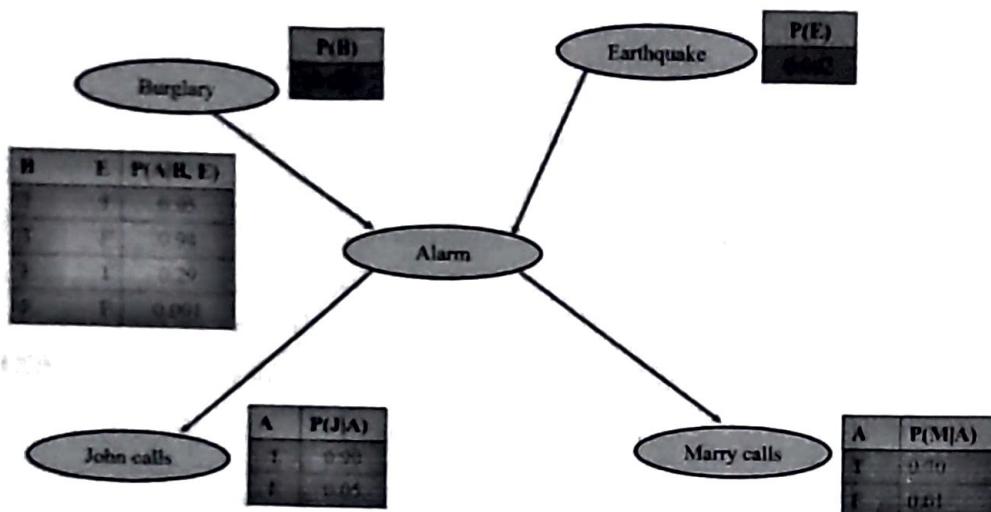
| | | | | | | | |
|---|---|---|---|---|---|---|----|
| T | B | b | P | L | A | X | SS |
|---|---|---|---|---|---|---|----|

3. (a) Explain and draw the schematic diagram of the recursive solution of Tower of Hanoi problem when 5 disks, n=3.



- (b) Consider We installed a burglar alarm at home, which is fairly reliable in detecting burglary but also sometimes responds to minor earthquakes. We have two neighbors, *John* and *Marry*, who promised to call me at work when they hear the alarm. *John* always calls when he hears the alarm, but sometimes confuses telephone ringing with the alarm and calls too. *Marry* likes loud music and sometimes misses the alarm. Given the evidence of who has or has not called, we would like to estimate the probability of a burglary. 5

Now what is the probability that the alarm has sounded but neither a burglary nor earthquake has occurred, and both *John* and *Marry* call?



- (c) Find the table and corresponding graph for the second pattern matching algorithm where the pattern is 5
PT= 'ababab'.
4. (a) Describe logical representation of a circular linked list. Write an algorithm to delete an element from a 5
circular linked list.
- (b) Define stack. Explain the algorithms of basic operations of stack with the help of an illustration. 5
- (c) Write the algorithm to transform infix expressions into postfix expressions. Consider the following 5
arithmetic infix expression Q:
- Q: $((A+B)*D) \uparrow (E-F)$ to transform into its equivalent postfix expression P.
5. (a) What are the differences between binary tree and binary search tree? 5
- (b) Build a Huffman tree with the following nodes and weight arranged in a random order. 5

| Data Item | A | M | C | Y | E | F | G | H |
|-----------|----|---|----|----|---|----|----|---|
| Weight | 23 | 7 | 13 | 22 | 3 | 12 | 30 | 8 |

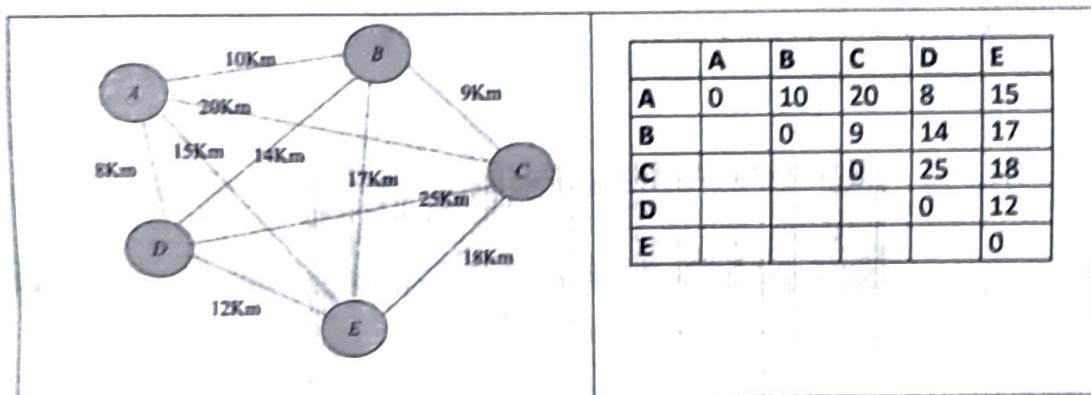
- (c) Consider the following algebraic expression: 5
 $| a + (b - c) | * [(m - n) / (x + y - z)]$
 Convert the expression into preorder and postorder and draw the tree for inorder, preorder and postorder.



- 5 6. (a) Determine percentage of Roulette wheel for six chromosomes with fitness values of 19, 6, 36, 11, 21 and 55. 5



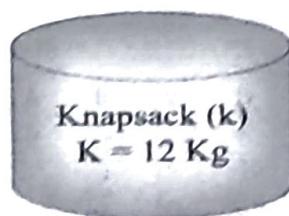
- (b) Consider the TS problem of 5 bits of fig. below. (a) Choose 3 chromosomes and find their fitness values. (b) Apply crossover on Chromosomes A B C D E and A D B E C at single point of 2 (c) apply mutation on chromosome: A B D E C. 5



- (c) Apply the algorithm to determine the population of second generation on the following Knapsack. 5
Consider initial population as four random chromosomes each of 4 bits.

Gene: 0 → absence of item in the knapsack
and 1 → presence of item in the knapsack

| Item | Weight | Value |
|----------|--------|-------|
| A | 5Kg | \$12 |
| B | 3Kg | \$5 |
| C | 7Kg | \$10 |
| D | 2Kg | \$7 |



Rangamati Science and Technology University

Department of Computer Science and Engineering

2nd Year 1st Semester B.Sc.(Engg.) Final Examination, 2021 (Session: 2019-20)
Course Title: Data Structure Lab Course Code: CSE-2102

Time: 3 Hours

Marks: 60

[Answer the following questions. Figures in the right-hand margin indicate full marks.]

- 1.** Write a program to find the ITEM = 85 in sorted 13 element array, where DATA: (11, 22, 30, 33, 40, 44, 55, 60, 66, 77, 80, 88, 99) 10

Use any one process to show the result.

- a) Binary search algorithm

OR

- b) Linear search algorithm

- 2.** An array L contains 8 elements as follows: 77, 33, 44, 11, 88, 22, 66 and 55. Write a program to sorting the data in array L applying the selection sort algorithm. 10

- 3.** An array B contains 7 elements as given: 4, 1, 20, 12, 11, 9 & 5. Write a program to sorting the data in array B applying the Merge sort algorithm. also shown their time complexity 10

- 4.** Viva 20

- 5.** Khata 10





Rangamati Science and Technology University
Department of Computer Science and Engineering
2nd Year 1st Semester B.Sc. (Engg.) Final Exam-2021
Course Code: Math-2103; Session: 2019-2020
Course Title: Numerical Analysis

Time: 3 Hours

Marks: 60

- NB 1. Answer any FOUR (4) questions out of SIX (6) questions.
2. Figures in the right margin indicate marks (15*4=60)
3. All parts of a question must be answered serially.

1. (a) What is the purpose of numerical analysis? List out the types of Errors. Distinguish between Roundoff errors and Truncation errors. 3
- (b) Solve the equation $x = \cos x$ by the Bisection method and by the Newton Raphson method. How many solutions are there? Solve the equation $\sin(x) = \cos x$ by the Bisection method and by the Newton-Raphson method. How many solutions are there? 6
- (c) Gauss Jordan Method to analyze traffic flow: let four roads have been considered, namely road 1 (R1), road 2 (R2), road 3(R3) and road 4 (R4). R1 and R2 can handle a maximum of 800 vehicles whereas road 3 and road 4 can handle a maximum of 2100 vehicles. Following figure shows the traffic flow on the four roads. Here z is a neutrosophic variable, and y_1, y_2 and y_3 , and z are the unknown variables. Form neutrosophic linear equations (NLEs) for all the junctions and applying Gauss Jordan method to find the inverse of the matrix formed from NLEs. Where I is the indeterminacy of the traffic flow. Here falsity considered as zero as we consider traffic flow at the four junctions. 6

Corresponding to the possible traffic flow $z = [200, 250]$ now, find the ranges of the three traffic flows are y_1, y_2 and y_3 .

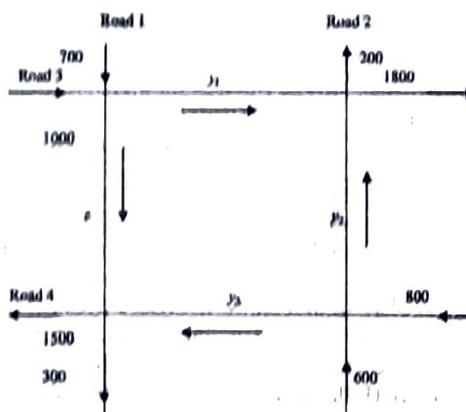
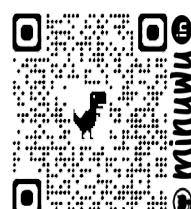


FIGURE 1. The traffic flows of four roads

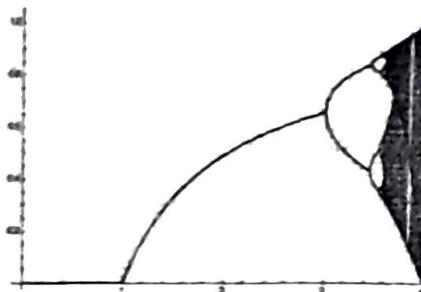
2. (a) What is chopping? If the number $x = 57.46235$ is rounded off to four significant figures, find the absolute error, relative error and the percentage relative error. 5
- (b) Determine the absolute and relative errors involved if $x = 2/3$ is represented in normalised decimal form with 6 digits by (a) round-off (b) truncation. 4



- (c) There are many circumstances where iteration does not lead to a fixed point. The simplest example is that of the quadratic family of maps $f_\mu(x) = \mu \cdot x \cdot (1 - x)$ where $0 \leq \mu \leq 4$ and $0 \leq x \leq 1$. For some values of μ_0 and x_0 the iterates $f_{\mu_0}^n x_0$ will converge to a point. For some choices, the iterates will converge to a periodic set of points. For some, the iterates will not converge at all, but exhibit more random or chaotic behavior. The full range of behavior can be represented by the bifurcation diagram.

6

Now you will cover Sharkovsky's theorem which many see as the fundamental theorem of Chaos Theory with $0 \leq \mu \leq 4$.



3. (a) You are provided with a list of point values for the function $f(x) = x + 10 - e^x$

5

| | | | | | |
|--------|-------|-------|-------|--------|---------|
| x | 0 | 1 | 2 | 3 | 4 |
| $f(x)$ | 9.000 | 8.282 | 4.611 | -7.086 | -40.598 |

Use this data to perform two steps of the bisection method for solving $f(x) = 0$, assuming the initial interval $[0, 4]$. What is the approximation of the root?

- (b) Find the Taylor series for the function $x^4 + x - 2$ centered at $a=1$.

5

- (c) Obtain the solution of the following linear simultaneous equations by the matrix inversion method.

5

$$a_{11}x_1 + a_{12}x_2 + a_{13}x_3 = b_1$$

$$a_{21}x_1 + a_{22}x_2 + a_{23}x_3 = b_2$$

$$a_{31}x_1 + a_{32}x_2 + a_{33}x_3 = b_3$$

4. (a) Using $\frac{1}{1+x} = 1-x + x^2 - x^3 + \dots$ find the Maclaurin series for the function $\frac{1}{2+x}$.

6

- (b) Solve the following equations by Gauss elimination method:

6

$$2x + 4y - 6z = -4$$

$$x + 5y + 3z = 10$$

$$x + 3y + 2z = 5$$

- (c) Why Newton-Raphson is best known method? Illustrate the procedure used in Newton Raphson method.

3

5. (a) Find the root of $f(x) = (x - 4)^2(x + 2) = 0$, using the initial guesses of $x_L = -2.5$ and $x_u = -1.0$, and a pre-specified tolerance of $\epsilon_s = 0.1\%$.

5

- (b) Find a real root of $\cos x - 3x + 5 = 0$. Correct to four decimal places using the method of False Position method.

4

- (c) What are the similarities and differences between the Gauss-Jordan method and the Gauss elimination method?

3

- (d) Find a solution with the method of False Position.

3



- 6.
- (a) Evaluate the integral $\int_0^{\pi} \sin^2 x \, dx$ by first finding the Maclaurin approximation to the integrand with 3 terms. (b) Evaluate the integral exactly and compare. 6
- (b) Use Taylor's series method to solve the equation $dy/dx = 3x + y^2$ to approximate y when $x = 0.1$, given that $y = 1$ when $x = 0$. 4
- (c) Convert the following base-8 numbers to base 10: 3.14 and Convert (1475)₁₀ to base-16. 3
- (d) Why Bisection method is called as the Interval Halving method? 2



RANGAMATI SCIENCE AND TECHNOLOGY UNIVERSITY
Department of Computer Science and Engineering

2nd Year 1st Semester BSc (Engg.) Final Examination-2021

Session: 2019-2020

Course: Engineering Drawing Lab; Code: EEE 2105

Duration: 1 and ½ Hours;

Full Marks: 30

Design a Single_Unit floor plan of a premises using AutoCAD which has one Master_Entry door and includes the following accommodations:

1. An Office room including executive table/chairs, guest chairs and attached washroom. 05
2. A Conference room including necessary cabinet furniture, screen, projector etc. 05
3. A Food Corner including chairs, tables, sink, food cabinet(s), window with other necessary things. 05
4. A Library room including 03 bookshelves with chairs, tables, window(s) to study. 05
5. A furnished Home Theatre TV room with sofa, instruments for watching TV/movies. 05
6. A Kids Playing room including playing instruments like slider, jumper, swinger etc. 05





Rangamati Science and Technology University

Department of Computer Science and Engineering

2nd Year 1st Semester B.Sc. (Engg.) Final Exam-2021

Course Code:EEE-2106; Session: 2019-2020

Course Title:Basic Electronic Devices and Circuits

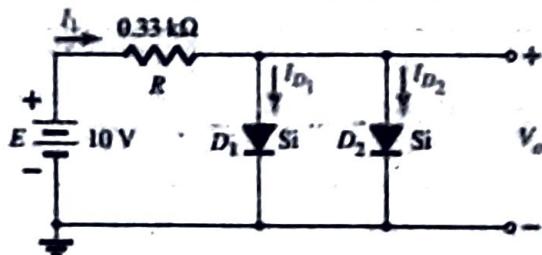
Time: 3 Hours Marks: 60

- NB:** 1 Answer any **FOUR(4)** questions out of **SIX(6)**questions.
2 Figures in the right margin indicate marks($15 \times 4 = 60$).
3 All parts of a question must be answered serially.

1. (a) Differentiate “Intrinsic and Extrinsic semiconductor” with proper example. **04**
 (b) Describe the basic principle of a diode briefly. **05**
 (c) Describe the diode characteristics curve of an ideal diode. **03**
 (d) Illustrate the energy level band diagram of different materials. **03**

2. (a) Describe the diode characteristics curve of an ideal diode. 04

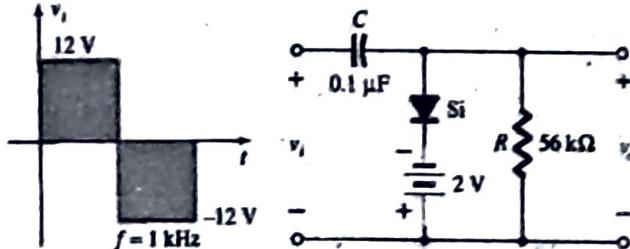
(b) A parallel diode configuration is given in the figure below. Determine the unknown quantities V_o , I_1 , I_{D1} , and I_{D2} from the diode configuration (Si). What will be the change in the solution when the diode is an ideal diode instead of Si? 06



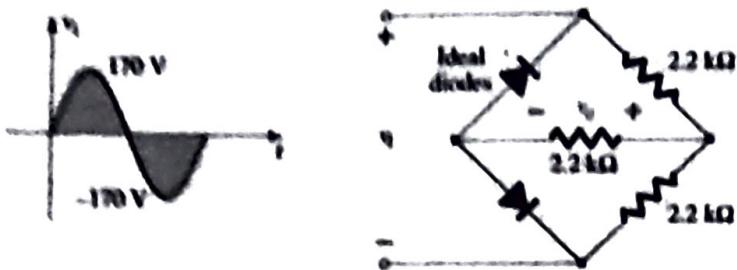
- (c) What happens when forward and reverse bias is applied to PN-junction. **05**

3. (a) Define Clamper circuit. Describe with appropriate circuit diagram. **03**

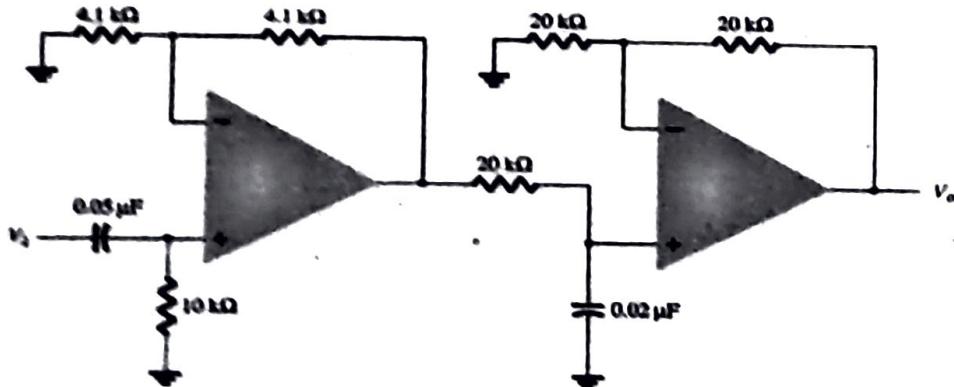
(b) Sketch v_o for the given clamper circuit: **06**



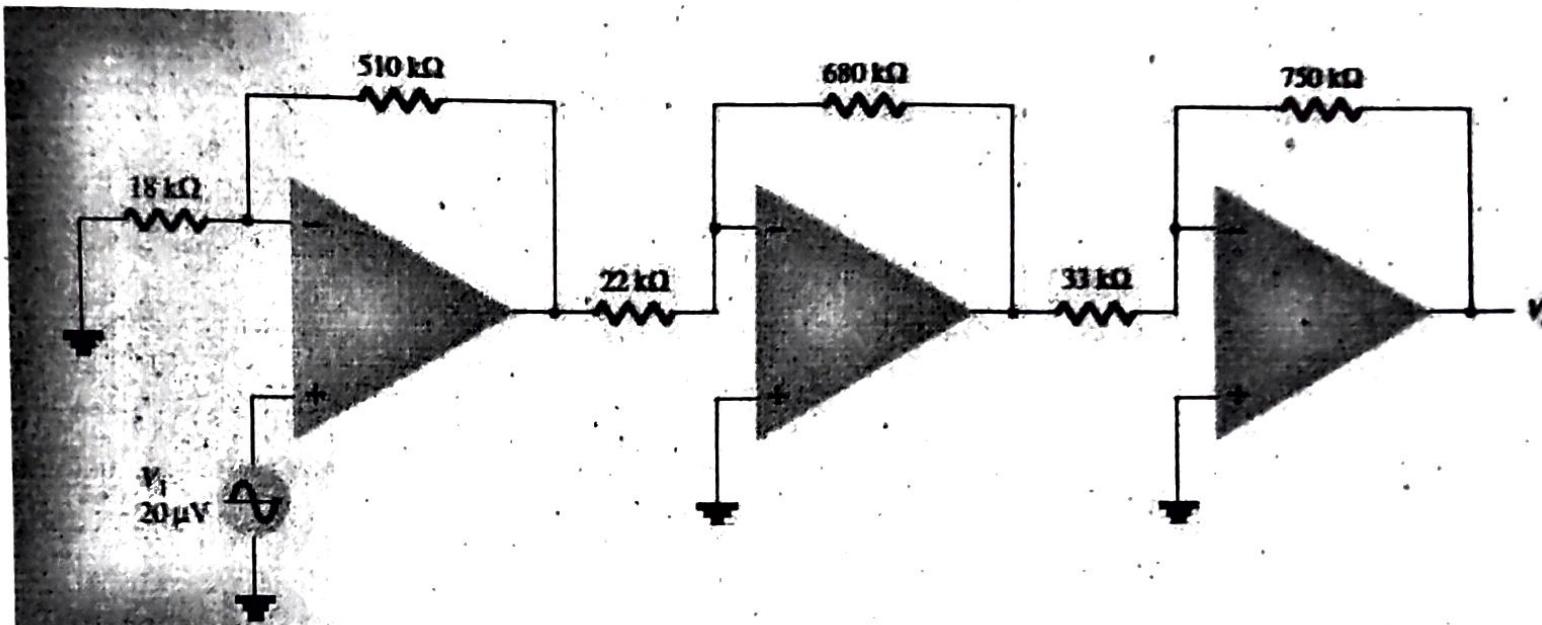
- (c) Determine the output voltage v_o and the dc output voltage v_{dc} for the network given below. [diodes are ideal diodes and $R = 2.2 \text{ k}\Omega$] 06



4. (a) Differentiate FET and BJT. Explain the Common Emitter configuration of a BJT with appropriate configuration and characteristics curve. 05
- (b) Derive the relation between α and β , where α and β have their usual meaning in case of transistor. 03
- (c) Define DC load line with figure. Discuss the importance of biasing the transistor. 04
- (d) For a common-base configured transistor, determine a_{dc} if $I_E=2.8$ mA, $I_C=2.75$ mA and $I_{CBO}=0.1$ μ A. 03
5. (a) Define pinch-off voltage. Illustrate the characteristics curve of an n-channel JFET when V_{GS} is zero volt. 04
- (b) What are the operating conditions of a FET? Prove the operating conditions of FET using Shockley's equation. 03
- (c) Describe the operation of MOSFET as an inverter. 04
- (d) Define "Drain Characteristics of JFET". Sketch the drain characteristics of JFET indicating various regions. 04
6. (a) Draw the frequency response of 1st order High pass, Low pass and Band pass filter. 04
- (b) Calculate the lower and upper cutoff frequencies of the bandpass filter circuit shown in following figure. 06



- (c) A no. of inverting/ non-inverting op-amps are cascaded in the circuit given below. 05
Calculate the output voltage using for the given values of the resistors





Rangamati Science and Technology University

Department of Computer Science and Engineering

2nd Year 1st Semester B.Sc. (Engg.) Final Exam -2021

Course Code: Math-2108; Session: 2019-2020

Course Title: Vector Calculus, Linear Algebra and Complex variable

Time: 3 Hours

Marks: 60

- NB:
1. Answer any FOUR (4) questions out of SIX(6) questions.
 2. Figures in the right margin indicate marks($15 \times 4 = 60$).
 3. All parts of a question must be answered serially.

1. (a) What is directional derivative? Find the directional derivative of $\varphi = 4xz^3 - 3x^2y^2z$ at $(2, -1, 2)$ in the direction $2\mathbf{i} - 3\mathbf{j} + 6\mathbf{k}$. 5
 $\varphi = 4xz^3 - 3x^2y^2z$ at $(2, -1, 2)$ in the direction $2\mathbf{i} - 3\mathbf{j} + 6\mathbf{k}$.
- (b) If $\bar{F} = 4xz\mathbf{i} - y^2\mathbf{j} + yz\mathbf{k}$, evaluate $\iint_S \bar{F} \cdot \hat{n} ds$ where S is the surface of the cube bounded by $x = 0, x=2, y=0, y=2, z=0, z=2$. 5
- (c) Find the volume of the region common to the intersecting cylinders $x^2 + y^2 = 16$ and $x^2 + z^2 = 16$. 5

2. (a) State Green's theorem? Verify Green's theorem in the plane for $\oint_C (xy + y^2) dx + x^2 dy$ where C is the closed curve of the region bounded by $y = x$ and $y = x^2$. 5
 $\oint_C (xy + y^2) dx + x^2 dy$ where C is the closed curve of the region bounded by $y = x$ and $y = x^2$.
- (b) Verify the divergence theorem for $\bar{F} = 4x\mathbf{i} - 2y^2\mathbf{j} + z^2\mathbf{k}$ taken over the region bounded by $x^2 + y^2 = 4, z = 0$ and $z = 3$. 5
- (c) Verify Stokes' theorem for $\bar{F} = xz\mathbf{i} + y\mathbf{j} + x^2y\mathbf{k}$ where S is the surface of the region bounded by $x = 0, y = 0, z = 0, 2x + y + 2z = 8$ which is not included in the xz plane. 5

3. (a) Solve the system of linear equations $x+ay+z=1$
 $x+y+az=1$
 $ax+y+z=1$ 3
 Has (i) a unique if $a \neq 2$ and $a \neq -2$, (ii) more than one solution if $a=2$ and (iii) no solution if $a=-2$.
- (b) Define vector space over field F. Show that $V=\{(a,b): a,b \in \mathbb{R}\}$ is not a vector space over \mathbb{R} with respect to each of the following operations of vector addition in V and scalar multiplication on V:
 (i) $(a,b)+(c,d)=(a+c,b-d)$ and $k(a,b)=(ka,kb)$
 (ii) $(a,b)+(c,d)=(a+c,b+d)$ and $k(a,b)=(a,kb)$
 (iii) $(a,b)+(c,d)=(c,d)$ and $k(a,b)=(ka,kb)$ 4
- (c) Define basis and dimension of a vector space. Find the basis and dimension of the vector space spanned by $(1, 1, -2, 0, -1), (1, 2, 0, -4, 1), (0, 1, 3, -3, 2)$ and $(2, 3, 0, -2, 0)$. 4
- (d) Define rank of a matrix. Find the rank of a matrix $A = \begin{pmatrix} 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 6 \\ 4 & 5 & 6 & 7 \\ 9 & 10 & 11 & 12 \end{pmatrix}$ 4

Define rank of a matrix. Find the rank of a matrix $A =$

$$\begin{pmatrix} 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 6 \\ 4 & 5 & 6 & 7 \\ 9 & 10 & 11 & 12 \end{pmatrix}$$



4. (a) Find the inverse of a matrix $A = \begin{pmatrix} -4 & 2 & 1 \\ 1 & 2 & 3 \\ 5 & 1 & 2 \end{pmatrix}$ 5
- (b) State and proof Cayley Hamilton theorem. 5
- (c) Find the eigen value and eigen vectors of the matrix $A = \begin{pmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{pmatrix}$ 5
5. (a) Discuss about Kernel and Range. Prove that the range is a subspace. 5
- (b) Define absolute value of a complex number. If $z = \frac{-1}{2} + \frac{\sqrt{3}}{2}i$, evaluate $(\bar{z})^4$. 3
- (c) Find the Laurent series around $z = 0$ for $f(z) = 1/z(z - 1)$ in each of the following regions: (i) the region A1 : $0 < |z| < 1$ (ii) the region A2 : $1 < |z| < \infty$. 3
- (d) State the Taylor's theorem. Find the Taylor series for $f(z) = e^z/(1 - z)$ around $z = 0$. Give the radius of convergence. 4
6. (a) Derive the Cauchy- Riemann Equation with necessary conditions. 8
- (b) Prove that $u = e^{-x}(x \sin y - y \cos y)$ is harmonic. Find v such that $f(z) = u+iv$ is analytic using Cauchy- Riemann Equation 7



Rangamati Science and Technology University
Department of Computer Science and Engineering
2nd year 2nd semester B. Sc. (Engg.) Final Exam-2021
Course code: Eco-2109
Course Title: Engineering Economics

Time: 3 Hours

Full Marks: 60

Instructions:

- i. Answer any four questions. All parts of a question must be answered serially.
- ii. The figures in the right margin indicate full marks.
- iii. Keep your answer script clean and free from overwriting.

-
1. a) Define microeconomics and macroeconomics. 4
 - b) What the three problems of economic organization. Discuss how market solve the three economic problems. 6
 - c) Why do we need the IMF? "Smoothing the bumps in the flow of foreign exchange"- describe. 5
 2. a) What is demand its law? Briefly discuss about the various types of demand. 8
 - b) Define market demand. Broadly discuss the factors that determine market demand. 7
 3. a) What do you mean by production function? Define total, average and marginal product with suitable examples. 8
 - b) Elaborately discuss about the law of diminishing marginal utility with suitable curve and example. 7
 4. a) Briefly discuss about the varieties of imperfect competitors. 6
 - b) Discuss on price elasticity of demand, equilibrium, efficiency with suitable examples. 5
 - c) What are three classical theories of international trade? Explain with proper example. 4
 5. a) What do you mean by unemployment? Briefly discuss the ways to measure unemployment of a nation. 8
 - b) Write down the economic and social impacts of unemployment for a nation like Bangladesh. 7
 6. a)What are the benefits and scope of engineering economics? 5



b) Define IRR. How to calculate IRR step-by-step?

5

c) State your observation on the following diagram:

5

