

POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2023

Programme: BE

Full Marks: 100

Course: Numerical Methods (New)

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Evaluate a real root of the given equation: $f(x) = 3x + \sin x - 2$ 7
 using Fixed point iterative method correct to four decimal places.

OR

Define error. Explain its type with sources of error in Numerical computation.

- b) Calculate the root of the equation: $4x^3 - 2x - 6 = 0$ correct upto 8
 three decimal places using Bisection Method.
2. a) What is interpolation? Find the value of $f(1.2)$ using appropriate 8
 interpolation technique.

x	1	1.4	1.8	2.2
$f(x)$	50	70	100	120

- b) If P is pull required to lift a load W by means of a Pulley, Find the 7
 law of form

$P = mW + C$, (where m and C are constants) using least square method for the following data:

P	12	15	21	25
W	50	70	100	120

OR

Use the suitable method to fit a curve $y = ax^b$ for the following data

x	-2	-1	0	1	2	3	4
y	38	6	0	-5	-41	130	300

3. a) Compute the following using Simpson's 1/3 rule for $n= 8$ with an accuracy to five decimal places.

$$\int_1^5 e^{-x^2} dx$$

b) Evaluate the following using Gaussian three point Integration formula: 8

$$\int_2^4 (x^4 + 1) dx$$

4. a) Solve the following system of Linear equations using partial pivoting method. 7

$$x + y + z = 4, x + 4y + 3z = 8, x + 6y + 2z = 6$$

b) Solve the following system of equations using Gauss Jacobi's method. 8

$$3x + 2y + z = 10, 2x + 3y + 2z = 14, x + 2y + 3z = 14$$

5. a) Find the largest Eigen value and Corresponding Eigen vector of given matrix using power method. 7

$$A = \begin{bmatrix} 2 & 5 & 1 \\ 5 & -2 & 3 \\ 1 & 3 & 10 \end{bmatrix}$$

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b) Solve the following differential equation for $y(0.4)$ using Heun's method. 8

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 3y = 6x ; \text{ with } y(0) = 0 \text{ and } y'(0) = 1 \text{ (take } h=0.2).$$

6. a) Use Euler's method to solve the following equation for $y(1)$ using $t_i \approx 0.25$. 7

$$\frac{dy}{dx} = x + y + xy ; \quad y(0) = 1$$

b) Solve the Poisson equation $\nabla^2 f = -10(x^2 + y^2 + 10)$ over the square with $0 \leq x \leq 3; 0 \leq y \leq 3$ and $f = 0$ on boundary. Use $h = 1$. 8

2×5

7. Write short notes on: (Any two)

a) Initial Value problems and Boundary value problems

b) Algorithm for secant method

c) Schmidt method for one dimensional heat equation

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2024

Programme: BE

Full Marks: 100

Course: Theory of Computation

Pass Marks: 45

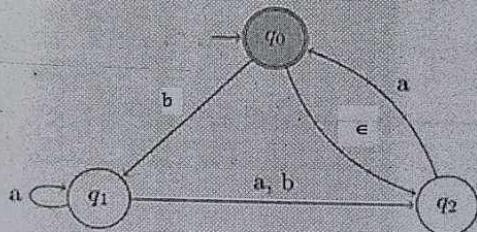
Time : 3 hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) What is function? Explain its types with examples. 7
- b) Differentiate between DFA and NFA? Design a DFA that accepts the language given by $L = \{w \in \{a,b\}^* : w \text{ contains neither 'aa' nor 'bb' as substring}\}$. Hence test your design for abaabb. 8
2. a) Convert the following NFA to its equivalent DFA. 7



- b) Define pumping Lemma for regular language. Show that $L = \{a^n b^{2n} : n > 1\}$ is not regular using pumping lemma for regular language. 8
3. a) What is CFG? Design CFG for language $L = \{a^m b^n : m \geq 1, n \geq 1\}$. Test the grammar for derivation of aaaabbb and also draw equivalent parse tree. 8
 - b) Convert the following grammar into Chomsky Normal form. 7

$S \rightarrow bAD$
 $A \rightarrow aB/bAB$
 $B \rightarrow b$
 $D \rightarrow \epsilon \text{ (Null)}$
4. a) Define PDA with block diagram. Design a PDA which accepts the language $L = \{a^{4n} : n \geq 1\}$ and test for strings aaaaaaaa and aaaaaa. 8

- b) Show that the language $L = \{a^n b^n c^n : n > 0\}$ is not context free using the concept of pumping lemma. 7
5. a) Define Turing machine. Design a Turing machine that accepts the language $L = \{a^n b^n c^n : n \geq 0\}$. 8
- b) How does a Turing machine compute a function of natural numbers? Describe. Show that the function $f(n) = n + 2$ is computable. 7
6. a) State the halting theorem and give the outline of its proof. 7
- b) What are P, NP and NP-Complete problems? Explain with examples. 8
7. Write short notes on: (Any two) 2×5
- a) Simplification of CFG
- b) Recursive and Recursively Enumerable Language
- c) Decision algorithm for CFL

POKHARA UNIVERSITY

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Full Marks: 100

Course: Theory of Computation (New)

Pass Marks: 45

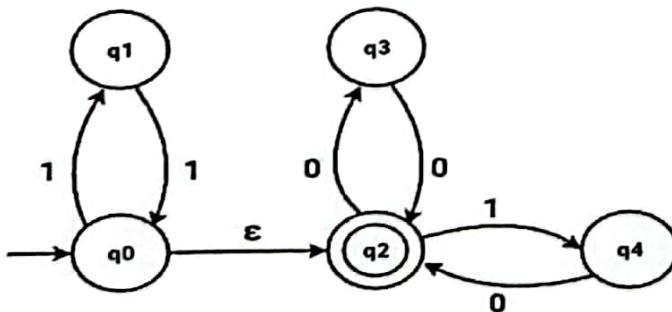
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) State and prove the pigeonhole principle. Prove by mathematical induction that $n^2 - 3n + 4$ is even and true for all positive integers. 7
- b) Define Finite State Automata. Construct a DFA that recognizes. Language L that accepts the set of strings that starts and ends with different symbols over $\Sigma = \{a, b\}$ and test your design with a valid string. 8
2. a) Convert the following NFA to its equivalent DFA. 7



3. a) Describe the decision properties of regular languages. 8
- a) What is CFL? Convert the given Grammar into CNF. 7
 $S \rightarrow ABAB \quad A \rightarrow aA|\epsilon \quad B \rightarrow bB|\epsilon$
- b) Design a PDA for the following language $L = \{a^n b^{2n+1} : n > 0\}$ also 8
check it for aaaaaaaaaaabb and aabbb.

OR

State the rules followed to design a PDA for a given CFG. Design a PDA that accepts $L = \{a^{3n} b^n : n > 0\}$ and check the string aaaaaabb.

4. a) Show that the language $L = \{a^n b^n c^n : n > 0\}$ is not context free using the concept of pumping lemma. 7
- b) PDA is Stronger than FA and for every CFG there is an equivalent PDA. Justify this statement with an example. 8

5. a) Design a TM for $L = \{WW^R : W^R \text{ is reverse of } w \in (a,b)^*\}$ for both even and odd palindrome}. 8
- b) Differentiate between FA, PDA, and TM on the basis of string acceptance. Also, explain why does TM is considered functionally stronger among all of these? 7
- OR
- "Turing machine is believed to be the ultimate calculating mechanism", elaborate with the help of Church-Turing thesis". Also, show that the function $f(n)=n+2$ is Turing computable.
6. a) Elaborate the properties of recursively enumerable and recursive languages. 8
- b) Differentiate the time complexity of a Turing machine and time complexity of a language decision problem. Define the complexity classes P and NP . 7
7. Write short notes on: (Any two) 2×5
- a) Universal Turing Machine
- b) Church-Turing Thesis
- c) Halting Problem

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2024

Programme: BE

Full Marks: 100

Course: Research Fundamentals (New)

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) ✓What are the types of research? Explain each with their characteristics and applications. 7
- b) ✓What are the 6P's of Research? Explain in brief. 8
2. a) ✓What do you mean by research question? Why is it crucial for the research? 8
- b) What is the role of literature review? How do you organize the ✓literature review? Explain. 7

OR

A bank wants to conduct research to evaluate the user experience of its mobile banking application. Suggest two suitable research strategies for this context and explain in brief.

3. a) What are various data-generation methods for research? Explain in brief. 7
- b) ✓What is Quantitative Research? What are the various data analysis techniques for Quantitative Research? 8

OR

What do you mean by the conceptual framework of a research process model? Discuss briefly about data generation methods.

4. a) ✓What do you mean by participant? Explain the rights of the participants. 8
- b) ✓What are the responsibilities of Ethical researcher? 7
5. a) ✓What are the components of Research Proposal? How objectives of a Research are formulated? Explain in detail. 7
- b) ✓Why is Research Proposal needed? Explain the components of the methodology in Research Proposal. 8
6. a) ✓Why do we need Research Report? How Research Findings are presented in Research Report? Explain in detail. 8

b) Discuss the components of a research report and their role in research effectively. 7

7. Write short notes on: (Any two) 2×5

- a) Research objectives
- b) Citation and its types
- c) Plagiarism

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2024

Programme: BE

Full Marks : 100

Course: Numerical Methods (New)

Pass Marks : 45

Time : 3 hrs.

Candidates are required to give their answers in their own words as far as practicable.

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Attempt all the questions.

1. ✓ a) Solve $x \log_{10} x = 1.2$ by Newton-Raphson method correct to four decimal places. 8
- ✓ b) Using Secant Method, find the roots of function $2x - \log_{10} x - 7 = 0$ 7
Correct up to three decimal places.

OR

Find the root of the equation $f(x) = x^2 - 4x - 10$ correct to three decimal places by using False Position method.

2. a) From the following data given in the table below evaluate $f(2.5)$ by using Lagrange method. 8

x	1	2	4	5	7
$f(x)$	1	1.414	1.732	2.00	2.6

- b) From the following table, Estimate the number of student who obtained marks between 50 and 55. 7

Marks	30-40	40-50	50-60	60-70	70-80
No of Students	31	42	51	35	31

3. ✓ a) Compute the Simpson's 1/3 and Simpson's 3/8 rule for $I = \int_0^1 e^{-x^2} dx$ using a regular partition with subinterval n=6. 8
- ✓ b) Use the Romberg integration to find the solution correct upto three decimal places. 7

$$I = \int_0^1 \frac{1}{1+x^2} dx$$

4. $3x + 2y + z = 10$ 8

a) Solve : $2x + 3y + 2z = 14$

$$x + 2y + 3z = 14$$

By Gauss elimination method.

b) Solve the following system of equations using Crout method. 7

$$x + y + z = 4, x + 4y + 3z = 8, x + 6y + 2z = 6$$

OR

Find largest eigen value and corresponding eigen vector of the matrix.

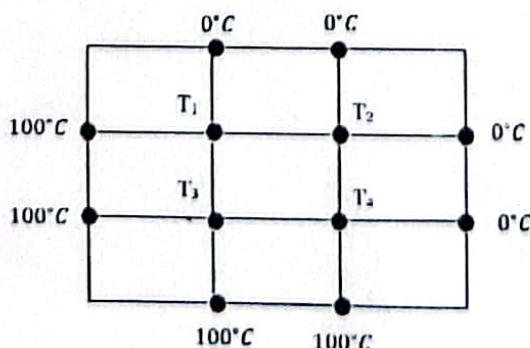
$$\begin{bmatrix} 3 & -1 & 0 \\ -2 & 4 & -3 \\ 0 & -1 & 1 \end{bmatrix}$$

5. a) Solve the following differential equation within $0 \leq x \leq 0.3$ using RK-4TH order Method. 8

$$10 \frac{dy}{dx} = x^2 + y^2, y(0) = 1 \text{ with } h = 0.1$$

b) Apply Euler's method to approximate value of $y(0.3)$ for the differential equation: $\frac{dy}{dx} = y + x, y(0) = 1$. 7

6. a) For square bar of size 15cm×15cm, calculate the steady state temperature at interior point for the grid size of 5cm×5cm. 8



b) Solve the Poisson equation $\nabla^2 f = 2x^2 + y$, over the square domain $1 \leq x \leq 4, 1 \leq y \leq 4$, with $f=0$ on the boundary. Take step size in x and y, $h=k=1$. 7

7. Write short notes on: (Any two) 2×5

- ✓a) Errors in Numerical Method
- ✓b) Ill-conditioned systems
- c) Boundary value problem

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2024

Programme: BE

Full Marks: 100

Course: Advance Programming with Java

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1.
 - a) Define ClassPath? Write a program with custom exception handler that handle arithmetic exception. 7
 - b) Explain the architecture of Java, including the role of the JVM, JRE, and JDK. 8

OR

- Define collection framework in java. Explain the different components of java collection framework.
2.
 - a) What are the implications in Java when defining a variable, method, and class as final? Explain the various access modifiers in Java and their significance. 8
 - b) Define abstraction. Write Java program that override methods (`getUserValue()` and `displayUserDetail()`). Where `getUserValue()` is defined to get user detail(name, address, age) and `displayUserDetail()` to display user detail. 7
 3.
 - a) Pros and Cons of JavaFx. Create GUI application with two buttons "RED" and "Green". When clicking "RED" button change background of "GREEN" button to red and clicking "GREEN" button change background of "RED" button to green. Also, console button clicked message. 8
 - b) Define stage and scene in JavaFX. Explain any two JavaFX layout managers. 7
 4.
 - a) Explain RMI architecture. Develop RMI application where client request to identify given number is Odd or Even. 8
 - b) Write a TCP client server program, where a client sends an integer value and server responds by sending the squared value of that integer. 7

5. a) Differentiate between Statement and PreparedStatement. Consider db_college and tbl_student as database name and table respectively where a tbl_student has columns name, faculty and batch. Write Console application with CREATE, READ, UPDATE and DELETE queries only using Prepared Statement. 8

b) What is a JDBC driver? Explain the different JDBC drive types and configuration 7

OR

Write all steps to connect Java Application with any Database. Insert student detail (roll, name, address, age) into table "student_tbl"

6. a) Describe the life cycle of a servlet. Explain the use of doGet() and doPost() methods of the Servlet with an example. 7

b) Create a Servlet application to showcase the concept of session and cookies 8

7. Write short notes on: (Any two) 2×5

- a) Design patterns
- b) Over view of ORM
- c) RMI vs. CORBA

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2024

Programme: BE

Full Marks: 100

Course: Computer Architecture (New)

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) What do you mean by addressing modes? Explain different addressing modes with suitable examples and diagrams. 7
- b) Evaluate $X = (M \cdot N) + (P \cdot Q)$ using three, two, one and zero address instructions. 8

OR

Differentiate between computer architecture and computer organization. Briefly explain the future trends in computer.

2. a) Write the structure of VHDL programming and write code for full adder using component. 8
- b) Registers in CPU perform two major roles. What are the various register involved to fulfill the roles? 7
3. a) Define control memory. Explain the working of microprogrammed control unit. Differentiate between Horizontal and Vertical microprogrammed control unit. 8

OR

Why microinstruction sequencing is important? Explain variable address field sequencing techniques with necessary block diagram.

- b) Perform unsigned binary multiplication of $17 \cdot 4$ using Booth's algorithm. 7
4. a) What are the pipelining hazards? How can they be removed? 8
- b) What is mapping in memory? What are the various mapping techniques? Explain in detail. 7
5. a) Briefly explain the various memory storage devices of memory organization. 8
- b) DMA overcomes the drawback of programmed I/O and interrupt driven I/O. How can you clarify the statement? 7
6. a) How can you achieve Parallelism in Uniprocessor System? Explain about Flynn's Classification of Parallel Processors. 8

- b) What are the common hardware-related and software-related performance issues that can arise in multi core systems and how do they impact computational efficiency? 7
7. Write short notes on: (Any two) 2×5
- a) Floating point arithmetic
 - b) Register Windowing
 - c) GPU and TPU

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2024

Programme: BE

Full Marks: 100

Course: Applied Mathematics

Pass Marks: 45

Time : 3 hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Define analyticity of a function $f(z)$. Show that the necessary condition for the function $f(z) = u(x, y) + iv(x, y)$ to be analytic on a domain D is $u_x = v_y$ and $u_y = -v_x$ at each point (x, y) of D . 7
 b) State and prove Cauchy integral formula. Evaluate the integral 8

$$\oint_C \frac{e^{5z}}{(z+i)^4} dz, \text{ where } C: |z| = 2.$$

OR

State Cauchy's residue theorem and using it, evaluate:

$$\oint_C \frac{2z}{(z+1)(z-1)^3(z+3)} dz \text{ where } C: |z|=2 \text{ counter clockwise.}$$

2. a) Find the expansion of $\frac{7z-2}{z(z+1)(z-2)}$ in the region given by 7
 i. $0 < |z+1| < 1$.
 ii. $1 < |z+1| < 3$.

- b) Define bilinear transformation. Find the bilinear transformation which maps the points $z = 0, -1, i$ onto the points $w = i, 0, \infty$.
 Also, find the image of the unit circle $|z| = 1$. 8

3. a) State and prove first shifting theorem on Z-transform. Find 7
 Z-transform of $e^{\frac{in\pi}{2}}$ and then find $Z(\cos \frac{n\pi}{2})$ and $Z(\sin \frac{n\pi}{2})$.

- b) Solve the difference equation $y_{n+2} - 7y_{n+1} + 12y_n = 2n$,
 $y_0 = 0, y_1 = 0$ by using Z-transform. 8

4. a) Show that $Z[nf(t)] = -z \frac{d}{dz} [F(z)]$ where $F(z) = Z[f(t)]$. 7

$$\text{Find } Z^{-1} \left[\frac{z}{(z+1)^2(z-1)} \right].$$

- b) Find the solution of one dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ with initial velocity $g(x)$, initial deflection $f(x)$ and boundary condition $u(0, L) = 0 = u(L, t)$. 8

5. a) Express the Laplacian $\nabla^2 u = \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$ in polar coordinates. 7

OR

Derive two-dimensional heat equation completely with necessary assumptions.

- b) Find the temperature in a laterally insulated bar of length L whose ends are kept at temperature 0, assuming that the initial temperature 8

$$\text{is } f(x) = \begin{cases} x & \text{if } 0 < x < \frac{L}{2} \\ L-x & \text{if } \frac{L}{2} < x < L \end{cases}.$$

6. a) Find the Fourier cosine transform of $f(x) = e^{-mx}$ for $m > 0$, and 7
then show that $\int_0^\infty \frac{\cos kx}{1+x^2} dx = \frac{\pi}{2} e^{-k}$.

b) Show that $\int_0^\infty \frac{\cos wx + w \sin wx}{1+w^2} dw = \begin{cases} 0 & \text{if } x < 0 \\ \frac{\pi}{2} & \text{if } x = 0 \\ \pi e^{-x} & \text{if } x > 0 \end{cases}$. 8

7. Attempt all the questions: 4×2.5

- a) Check analyticity of $f(z) = z^2$.
 b) Find $Z(a^n)$.
 c) Find the solution of the partial differential equation $u_{xx} + 9u = 0$.
 d) Define linear partial differential equation with suitable example.