

National Academy of Science and Technology

(Affiliated to Pokhara University)

Dhangadhi, Kailali

Pre-University Examination

Semester: IV_Spring

Level: Bachelor

Program: B.E. Computer

Course: Computer Architecture

Year : 2025

F.M. : 100

P. M. : 45

Time : 3 Hrs.

Candidates are required to give their answer 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 basics of designing computer architecture? 7
 - b) Define RTL. Write in RTL for the following statements: 8
 - i. Add R1 and R2 and transfer to R3 when I is true.
 - ii. Logical shift R3 through right and transfer it to R3.
 - iii. R3 and R4 are XORed and transferred to R5.
2.
 - a) Explain about design principles for modern systems. 8
 - b) Perform -6×-7 using Booth's algorithm. 7
3.
 - a) What is the basic architecture of microprogrammed control unit? Explain. 7
 - b) How are microinstructions sequenced? 8
4.
 - a) Instruction pipelining increases system performance without increasing processor number, explain how? What are pipelining hazards and how can these be removed? 8
 - b) Divide 13 by 4 using restoring algorithm. 7
5.
 - a) Differentiate between programmed I/O and interrupt driven I/O. How DMA is better than programmed I/O and interrupt driven I/O? 7
 - b) What is associative memory? Explain. 8
6.
 - a) Explain Flynn's Classification. 8
 - b) Explain different types of hardware and software performance issues in multicore computers. 7
7. Write short notes on any two: 2×5
 - a) RISC
 - b) VHDL code for full adder
 - c) Multithreaded Architecture

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Pre-University Examination

Level: Bachelor

Semester: IV_Spring

Year : 2025

Program: B.E. Computer

F.M. : 100

Course: Advanced Programming with Java

P. M. : 45

Time : 3 Hrs.

Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks.

Attempt all the questions.

- 1 a) Define class and object. Write down the code to create an Employee class having three private properties, two constructor one for default value and another for parameterized value. Two more methods to set and display values. Create another class having main method and create two objects one for default and another for parameterized constructor and call necessary methods. (8)
- b) Define exception handling. Explain with code example how do you handle user defined exception. (7)
- 2 a) Differentiate between abstract class and interface. How you achieve multiple inheritance in java. Explain with code example. (8)
- (b) Define event handling. Explain the source and listener with different classes. (7)
- 3 a) Wrote down the JavaFx code to take two number as input field and three button (+, -, x) and perform respective function when user clicks on the respective button. (8)
- b) Define Swing. Explain different swing controls used in GUI app development with code example. (7)
- 4 a) Define UDP. Write down the UPD client server program when client enter a number the server will return the square of that number. (8)
- b) Explain RMI with architectural diagram in details. Also write simple hello world distributed application. (7)

OR

Write down distributed RMI client server program to show profit or loss and percentage in the client. The cp and sp are passed from client and profit loss is calculated by the server. (7)

- 5 a) Differentiate between Statement and Prepared Statement. Write down the code example to select all record and individual record of student from `tbl_students` and assume at least 4 columns on your own. (8)

OR

Why do we need database programming? Write down the steps to connect to database with code example. (8)

- b) Define Servlet. Explain servlet life cycle diagram in details with simple example. (7)

- 6 a) Write a program to design a JSP form having name, email and password and store to database using servlet. (8)

- b) Define multithreading with diagram. Write a program to illustrate an example of synchronized block and method in multi-threading. (7)

OR

Why do we need design pattern? Explain Singleton and factory pattern in details with code example. (7)

7. Write short notes (on any two) (2x5 = 10)
- a) Spring Boot and Hibernate
 - b) Session and Cookies
 - c) Transaction Management

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Pre University Examinations

Level: Bachelor

Semester: IV_Spring

Year : 2025

Program: B.E. Computer

F.M. : 100

Course: Research Fundamentals

P.M. : 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 do you mean by research? Mention the aims and objectives of research. 8
b) What are the specific features of research? Elaborate in detail. 7
2. a) What do you understand by plagiarism? Explain about the types of plagiarism. 8
b) What do you mean by literature review? Elaborate the sources of literature with examples. 7
3. a) What do you mean by research strategy? Indicate the difference between case study and action research. 8
b) What do you understand by data collection? Distinguish between focus group discussion and documents. 7
4. a) What is triangulation in research? Mention the types of triangulation in a research project. 8
b) What do you mean by research question? Write about the characteristics of research question. 7
5. a) How do you define research ethics? Mention the responsibilities of an ethical researcher in the research process. 8
b) What are rights of participants in research process? Explain. 7
6. a) What is research proposal? Explain about the components of research proposal. 8
b) What do you understand by report? Mention the significance of a Research Report. 7
7. Write short note on (any two) $5*2=10$
i. Basic and applied research
ii. Products of research
iii. Observation and interview

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Pre University Examinations

Level: Bachelor

Semester: IV_Spring

Year : 2025

Program: B.E. Computer

F.M. : 100

Course: Numerical Methods

P.M. : 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) Find a real root of the equation $x^3 - 2x - 5 = 0$ with an accuracy of at least 0.0001 using Newton's method. [7]
b) Write a difference between secant method and false position method.
Using secant method find a root of the equation $3x + \sin x - e^x = 0$, correct to three decimal places. [1+7]

2. a) From the following table, find the number of students who obtain marks between 40 and 45 using suitable interpolation formula. [7]

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

- b) The pressure and volume of a gas are related by the equation $PV^\alpha = \beta$, α and β being constants. Fit this equation to the following data. [8]

P	0.5	1.0	1.5	2.0	2.5
V	1.62	1.00	0.75	0.62	0.52

3. a) Evaluate the integral $\int_0^{\pi/2} \frac{\cos x}{\sqrt{1+\sin x}} dx$ using Gaussian quadrature formula with $n = 2$ and $n = 3$. [8]

- b) Solve the following system of linear equations using Gauss-Seidel method: [7]

$$x + 10y + 4z = 6; \quad 9x + 2y - 4z = 6; \quad 2x - 4y + 10z = -15.$$

4. a) Solve the following system of equations using factorization method. [8]

$$2x + y + z = 4; \quad 4x + 2y + 3z = 4; \quad x - y + z = 0.$$

b) Using power method, find the dominant eigen value and corresponding eigen vector of the matrix: [7]

$$\begin{pmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{pmatrix}$$

5. a) Using Runge-Kutta method of order four, solve $\frac{dy}{dx} = y + \sin x$,
with $y(0) = 1$ in the interval $0 \leq x \leq 1$. Take $h = 0.5$. [7]

b) Solve the initial value problem

$$y'' + 3y' + 2y = e^{2t}, y(0) = 1 \text{ and } y'(0) = 1 \text{ in the interval } [0,1]$$

using RK-2 method with $h=0.5$ [8]

6. a) Solve the equation $f_{xx} + f_{yy} = 4x^2y^2$ over the square domain $0 \leq x \leq 3$ and $0 \leq y \leq 3$ with $f = 50$ on the boundary and mesh length $h = 1$ using Gauss-Seidel method correct to two decimal places. [8]

b) Find the dy/dx at $x=1$ using the data: [7]

x	1	1.2	1.4	1.6	1.8
y	9	9.5	10.2	11.0	12.2

7. Attempt (Any two) $[2 \times 5 = 10]$

i) Using Euler's method solve the equation $y' = x^2 + y$, $y(0) = 1$, in the interval $0 \leq x \leq 1$ with $h = 0.25$.

ii) If $x = 1.3506217$ is rounded off to five decimal places, calculate the absolute and relative errors.

iii) Write short notes on ill conditioned system with an example.

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Pre University Examinations

Level: Bachelor

Semester: IV_Spring

Year : 2025

Program: B.E. Computer

F.M. : 100

Course: Applied Mathematics

P.M. : 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) Show that the function $u = \sin x \cosh y$ is harmonic and find its harmonic Conjugate [8]

b) Evaluate: $f(z) = \frac{z^4}{(z+1)(z-i)^2}$: where c is $9x^2 + 4y^2 = 36$ [7]

2.a) Find the Taylor's and Laurent's series which represents the function

$$f(z) = \frac{z^2 - 1}{(z+2)(z+3)}$$

in the regions:

i) $|z| < 2$ ii) $2 < |z| < 3$ iii) $|z| > 3$. [7]

b) State Cauchy's residue theorem. Using residue theorem, evaluate the integral. Calculate the residue of the function $f(z)$ at each of its singular points, where

$$f(z) = \frac{z+2}{(z-2)^2(z^2+1)}$$

3.a) Define Z-transform of a function $f(n)$. Find the Z-transform of

$e^{in\pi/2}$ and hence find $Z[\cos(\frac{n\pi}{2})]$ and $Z[\sin(\frac{n\pi}{2})]$ [8]

b) Using Z-transform, solve the difference equation

$$y_{n+2} - 4y_{n+1} + 4y_n = 2^n, y_0 = 0, y_1 = 1.$$

4.a) Show that: $\int_0^\infty \frac{(1-\cos \pi w)}{w} \sin xw dw = \begin{cases} \frac{\pi}{2} & \text{if } 0 < x < \pi \\ 0 & \text{if } x > \pi \end{cases}$ [7]

b) Find the Fourier sine transform of the function

$$f(x) = \begin{cases} x^2 & \text{for } 0 < x < 1 \\ 0 & \text{for } x > 1 \end{cases}$$

[8]

OR

Find the Fourier cosine transform of $f(x) = e^{-mx}$ for $m > 0$ and then

$$\text{Show that } \int_0^\infty \frac{\cos kx}{1+x^2} dx = \frac{\pi}{2} e^{-k}.$$

5.a) A tightly stretched string of length 100 cm is drawn aside at its midpoint perpendicular to the equilibrium position so that its initial position is given by

$$f(x) = \begin{cases} x & \text{if } 0 < x < 50 \\ 100 - x & \text{if } 50 < x < 100 \end{cases} \quad [7]$$

b) Derive one dimensional heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ [8]

6.a) Express the Laplacian $\nabla^2 u = \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$ in polar co-ordinates. [8]

b) Find the solution of one dimensional wave equation with the appropriate initial and boundary conditions. [7]

OR

Solve $u_{xx} + u_{yy} = 0$ using separation of variables method.

7. Solve:

i) Express $f(z) = \cosh z$ in the form $f(z) = u + iv$. [4x2.5 = 10]

ii) Show that the function $u = \cos x \cosh y$ is a solution of two dimensional Laplace equation.

iii) Show that Fourier cosine transforms satisfy linearity property.

iv) Find $Z(e^n)$

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Pre University Examinations

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Year : 2025

Program: B.E. Computer

F.M. : 100

Course: Theory of Computation

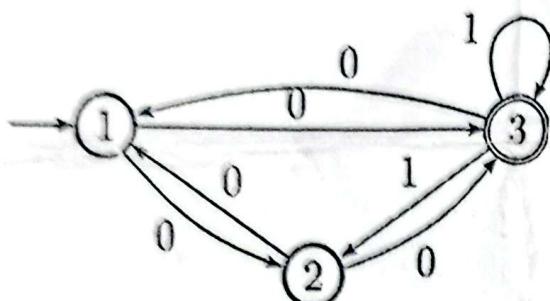
P.M. : 45

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 Chomsky hierarchy? Prove the formula $1+2+\dots+n=n(n+1)/2$ using mathematical induction. 8
b) Convert the following NFA to DFA 7



2. a) State and proof pumping lemma for regular language. 9
b) Construct a regular expression for: all strings over {a, b} containing even number of b's. 6
3. a) Construct a PDA to accept strings of the form $\{a^n b^n \mid n \geq 1\}$. 7
b) What is context free language? Show that the CFL are closed under union. 8

OR

State and explain the steps of pumping lemma for CFL to prove a language is not CFL with suitable example.

4. a) Consider the following grammar: 7
- $S \rightarrow bB \mid Aa$
 $A \rightarrow b \mid bS \mid aAA$
 $B \rightarrow a \mid aS \mid Bbb$
- Find the left most and right most derivation. Also construct derivation tree for each.

- b) What is Normal Form in CFL? Explain the CNF and GNF with example.

8

OR

✓ Simplify the following grammar:

$$S \rightarrow aBB \mid aA$$

$$A \rightarrow Aaa \mid \epsilon$$

$$B \rightarrow bB \mid bbC$$

$$C \rightarrow b$$

5. a) Define Universal Turing Machine. Design a Turing Machine for $f(n) = n + 2$. 7

- b) Describe multi-tape Turing machines. How do they compare with single-tape ones? 8

6. a) What is the Church-Turing Thesis? Explain its significance. 7

- b) Explain the types of class problems like P, NP, NP-hard and NP-complete with example. 8

7. Write short notes on following (Any Two) 5x2

a) Pigeonhole Principle

b) Halting Problem

c) Recursively Enumerable Language and Recursive Language

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First Term Examinations

Level: Bachelor

Semester: IV_Spring

Year : 2025

Program: B.E. Computer

F.M. : 100

Course: Computer Organization & Architecture

P.M. : 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) Differentiate between Computer Architecture and Computer Organization. 8
 - b) Define RTL. Explain all micro operation with RTL code. 7
2.
 - a) Describe the basic CPU with its functional block diagram. 7
 - b) Write the codes for the operation $y = \frac{AXB-C}{E+F}$ using 3, 2, 1 and 0 address instruction format. 8
3.
 - a) Divide -12 by 5 using unsigned division algorithm. 7
 - b) Perform $(-9) \times (5)$ using booth algorithm. 8
4.
 - a) Write VHDL Code for full adder using structural modeling. 8
 - b) What are different registers used for storage and data transfer in CPU? 7
5.
 - a) What are the modern design principles used in designing computers? 7
 - b) Differentiate between Microprogrammed and Hardwire control unit. 8
6.
 - a) Explain the different instruction format of MIPS. 8
 - b) What is normalization in floating point operation? Explain how to store floating point numbers in a computer memory. 7
7. Write short notes on any two: 2×5
 - a) HDL
 - b) VHDL
 - c) Harvard Architecture

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First Term Examinations

Level: Bachelor

Semester: IV_Spring

Year : 2025

Program: B.E. Computer

F.M. : 100

Course: Research Fundamentals

P.M. : 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 do you mean by research? Differentiate between qualitative and quantitative research. 8

b) What are the aims and objectives of research? 7

2. a) What do you understand by plagiarism? Explain about the types of plagiarism. 8

b) What do you mean by literature review? Elaborate the sources of literature with examples. 7

3. a) What are the types of research? Differentiate between applied and basic research. 8

b) What are the main features of research? Explain. 7

4. a) What are the differences between conceptual and empirical research? Explain. 8

b) What are the purposes of conducting research? Elaborate. 7

5. a) What is referencing? Mention the objectives of referencing. 8

b) What do you understand by research question? Write about the characteristics of research question. 7

6. a) What are the 6Ps of research? Explain. 8

b) What are the objectives of literature review? Explain. 7

7. Write short note on (any two) $5*2=10$

i. Bibliography and reference

ii. Conceptual framework

iii. Sources of reference

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First Terminal Examination

Level: Bachelor

Program: BE Computer

Course: Theory of Computation

Semester: IV_Spring

Year : 2025

Full Marks: 100

Pass Marks : 45

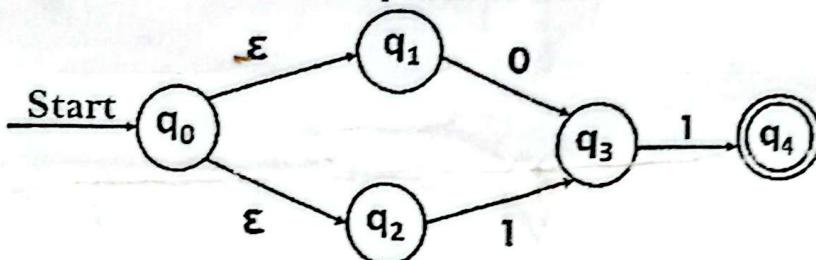
Time : 3 hrs.

Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Define finite automata. Explain DFA and NFA with examples. 7

b) Convert the NFA With Epsilon to DFA. 8



2. a) Design a DFA which accepts all the strings in which every 'a' should never be followed by 'bb' over {a,b} 8

b) Write CFG which generates palindrome of a,b. 7

3. a) State and prove the pumping lemma for regular sets. 8

OR

Prove that the language $L = \{a^n b^n \text{ for } n=1,2,3,\dots\}$ is not regular.

b) For all $n \geq 1$, prove that $1^2 + 2^2 + 3^2 + \dots + n^2 = n(n+1)(2n+1)/6$ by using mathematical induction. 7

4. a) When the grammar is ambiguous? Show that the given grammar is ambiguous: $S \rightarrow SbS, S \rightarrow a$ 8

b) Construct a derivation tree for the string aaabb for the CFG given by, 7

$$S \rightarrow ASA \mid B$$

$$B \rightarrow aCb \mid bCa$$

$$C \rightarrow ACA \mid A$$

$$A \rightarrow a \mid b$$

5. a) Construct a regular expression for following state diagram. 8

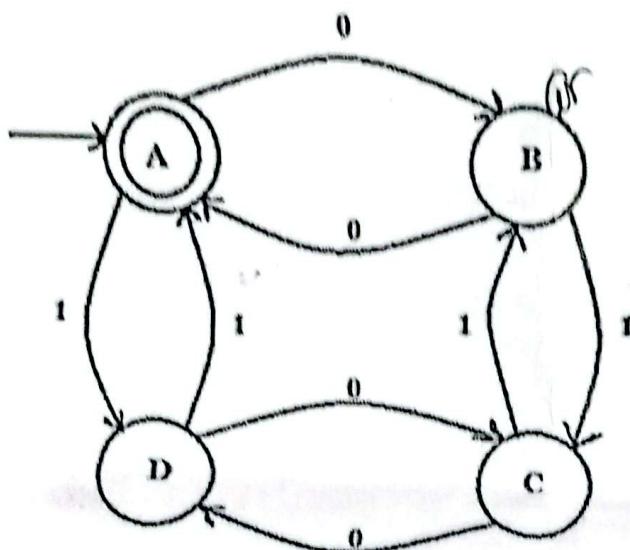


Fig: Transition diagram

b) Construct a finite automata equivalent to $10 + (0 + 11)0^* 1$. 7

6. a) Prove that if n is integer and $n^3 + 5$ is odd, then n is even using contradiction. 8

OR

Explain the Pigeonhole principle with examples.

b) Define Alphabet and Language. Explain the Chomsky Hierarchy with diagram. 7

7. Write any two short notes: $5 \times 2 = 10$

a) Parse Tree

b) Set and Relations

c) Diagonalization Rule

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'First Terminal Examination'

Level: Bachelor

Semester : IV_Spring

Year : 2025

Program: B.E. Computer

F.M. : 100

Course: Applied Mathematics

P.M. : 45

Time : 3 Hrs.

Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Show that $\lim_{z \rightarrow 0} f(z)$ does not exists if $f(z) = \frac{xy}{2x^2+y^2}$ and $f(0) = 0$ [7]
b) Show that Cauchy-Riemann equations are the necessary condition for the analyticity of a function $f(z)$. [8]

- 2.a) Show that the function $u = \cos x \cosh y$ is harmonic and find its harmonic conjugate. [7]
b) Prove that $u = y^3 - 3x^2y$ is a harmonic function. Find the analytic function $f(z) = u+iv..$ [8]

- 3.a) State & prove Cauchy's integral theorem. [7]
b) Evaluate the integrals, counterclockwise [8]

$$\oint_C \frac{dz}{z^2 + 1}, \text{ where } C: |z - i| = 1$$

- 4.a) Integrate $f(z)$ around C
 $f(z) = \frac{\cosh 4z}{(z+i)^2}$ c: $|z| = 6$ (counter clockwise) and
c: $|z - 3| = 2$ (clockwise) [7]

- b) Find the expansion of Laurent series $f(z) = \frac{1}{z-z^3}$ in the region $1 < |z - 1| < 2$ [8]

- 5.a) Calculate the residue of the function $f(z)$ at each of its singular points, where [8]

$$f(z) = \frac{z+2}{(z-2)^2(z^2+1)}$$

b) Using Cauchy Residue theorem evaluate:

$$\oint_C \frac{1}{(z^2 + 4)^3} dz, \text{ where } C : |z - i| = 2$$

[7]

6.a) Determine the region $W = e^{i\pi/4}$ in the W-plane corresponding to the triangular region bounded by the lines $x=0$, $y=0$, $x=1$ and $y=2$ in the z-plane.

b) Find $Z(e^{-iat})$ and hence deduce the values of $Z(\cos at)$ and $Z(\sin at)$.

[7]

[8]

7. Solve:

a) Express $f(z) = \cos z$ in the form $f(z) = u + iv$.

[2x5=10]

b) Find the Z transform of $Z(-1)^n$.

[]

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First Terminal Examination

Level: Bachelor

Semester : IV_Spring

Year : 2025

Program: B.E. Computer

F.M. : 100

Course: Numerical Methods

P. M. : 45

Time : 3 Hrs.

Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks.

Attempt all the questions.

1. a) An approximate value of π is given by $x_a = 3.1428571$ and if its true value is $x_t = 3.1415926$. Find the absolute and percentage relative error. [7]

b) Using False position method find a root of the equation

$3x + \sin x - e^x = 0$. correct to four decimal places.

[10]

2. a) Using secant method, find a root of the equation

$x^3 + x - 1 = 0$ so that error is less than 10^{-4}

[9]

b) Write an algorithm for the implementation of bisection method.

[7]

3. a) Using Newton-Raphson method find a root of the equation

$\log x - \cos x = 0$ correct to four decimal places.

[9]

b) Find a root of the equation $x^3 + x^2 - 1 = 0$ using fixed point iteration method.

[8]

4. a) Solve the following system of equations using LU decomposition method

$$2x - y - 7z = 3;$$

[10]

$$5x - 2y + 3z = -1;$$

$$-3x + 9y + z = 2.$$

b) Using Gauss-Seidel method, solve the following system of equations correct to two decimal place.

[8]

$$10x_1 + 3x_2 + 4x_3 = 15;$$

$$2x_1 - 10x_2 + 3x_3 = 37;$$

$$3x_1 + 2x_2 - 10x_3 = -10;$$

5. a) Using Gauss elimination method with partial pivoting, solve:

[10]

$$5x_1 + x_2 + x_3 + x_4 = 4; \quad x_1 + 7x_2 + x_3 + 4x_4 = 12;$$

$$x_1 + x_2 + 6x_3 + x_4 = -5; \quad x_1 + x_2 + x_3 + 4x_4 = -6;$$

b) Using Gauss-Jordan method, solve:

[7]

$$2x_1 + 2x_2 + x_3 = 6; \quad 4x_1 + 2x_2 + 3x_3 = 6; \quad x_1 - x_2 + x_3 = 0.$$

6. a) Find the cube root of 11 using Newton's method.

[7]

b) Write short notes on round off errors and truncation errors with an example of each.

[8]

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First Term Examinations

Level: Bachelor

Semester: IV_Spring

Year : 2025

Program: B.E. Computer

F.M. : 100

Course: Advance Java Programming

P.M. : 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 Java. How it becomes platform independence? Explain the compilation process along with diagram in details. (8)
b) Why do we need coding standard? Write down the naming standard rules while developing java software system. (7)
- 2.a) Define Class Object and Constructor with code example (7)
b) Define Package and Interface. Write down the steps to create a package with example. (8)
- 3.a) Write down the need of exception handling. Also, code to handle user defined exception. (8)
b) Write down the use of conditional statements with example. (7)
- 4.a) Define Layout Management. Explain different types of Layouts in brief with example. (8)
b) Write about Applet, AWT and Swing in details.
OR
What is the use of looping statement in software development? Explain with code example. (7)
- 5.a) Define inheritance. Explain different types of inheritance with code example. (8)
b) What is the use of collection framework? Explain with code example (7)
6. a) Method Overloading vs Method Overriding (5)
b) final vs finally keywords (5)
c) upcasting and down casting (5)
7. Write short notes on (Any two) (2 x 5 = 10)
a) OOPS b) Polymorphism
c) Access Modifier

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2025

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 analytic function. Show that the necessary condition for a function $f(z) = u + iv$ to be analytic is $u_x = v_y$ and $u_y = -v_x$. 7
 b) Define harmonic function. Check $u = \sin x \cosh y$ is harmonic or not? If yes, find a corresponding harmonic conjugate v of u and corresponding analytic function $f(z)$. 8
2. a) Find the Laurent's series expansion of $f(z) = \frac{4z+3}{z^3-z^2-6z}$ in the following regions 7
 - i. $0 < |z| < 2$
 - ii. $2 < |z| < 3$
 - iii. $|z| > 3$

OR

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 unit circle $|z| = 1$.

- b) State and prove Cauchy integral formula. Evaluate: $\oint_C \frac{e^{2z}}{(z-1)^4} dz$, where C is the circle $|z| = 2$ in counter clockwise direction. 8
3. a) Find:
 - i. $Z^{-1} \left[\frac{z}{(z^2 - 5z + 6)} \right]$ 3
 - ii. $Z^{-1} \left[\frac{z}{(z+2)(z-1)^2} \right]$ 4
- b) Define Z-transform of a function. Prove that 8
 $Z[a^n f(t)] = F\left(\frac{z}{a}\right)$, where $Z[f(t)] = F(z)$.

Using it, find $Z(a^n e^{bt})$ and hence deduce the values of $Z(a^n \cos bt)$ and $Z(a^n \sin bt)$.

4. a) Using Z-transform, solve the difference equation: 7
 $y_{n+2} + 6y_{n+1} + 9y_n = 2^n, y_0 = 0, y_1 = 0$
- b) Derive one dimensional wave equation with required assumptions. 8

OR

Express the Laplacian $\nabla^2 u = \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$ in polar co-ordinates.

5. a) A homogeneous rod of conducting material of length 100 cm has its ends kept at zero temperature and the temperature initially is 7
 $f(x) = \begin{cases} x & \text{if } 0 \leq x \leq 50 \\ (100 - x) & \text{if } 50 < x \leq 100 \end{cases}$

Find the temperature $u(x, t)$.

- b) Find the solution of one dimensional heat equation 8
 $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ assuming the appropriate initial and boundary conditions.

6. a) Using Fourier integral representation, show that 7

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

- b) Find the Fourier cosine transform of $f(x) = e^{-x}$ and by using Parseval's identity, show that $\int_0^\infty \frac{dx}{(1+x^2)^2} = \frac{\pi}{4}$. 8

7. Attempt all the questions 4×2.5

- a) Evaluate: $\oint_C \frac{2z}{(z-1)(z+3)} dz$, where C is the circle $|z| = 2$ in counter clockwise direction by using Cauchy residue theorem.
- b) Check whether the function $u(x, y) = z\bar{z}$ is analytic or not.
- c) Find $Z(n^2)$.
- d) Solve $u_x + u_y = 0$ by using separation of variables.

$$\begin{aligned} & \frac{1}{z^n} \\ &= L + \frac{1}{z} + \frac{1}{z} \\ &= \frac{1}{L - n/z} \quad \frac{z}{z-n^2} \end{aligned}$$

POKHARA UNIVERSITY

Level: Bachelor'

Semester: Spring

Year : 2025

Programme: BE

Full Marks : 100

Course: Computer Architecture (New)

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 are the functions of a computer that is essential to design the architecture of a computer? Explain in detail. 7

OR

What are the key features that distinguish computer architecture with computer organization?

- b) How programs can be written using VHDL? Write VHDL code for a simple ALU that performs arithmetic and logical operation 8

2. a) Explain about design principles for modern systems. 8

- b) Differentiate between hardwired and microprogrammed control unit. 7

3. a) Why are most of the processors adopting RISC architecture over CISC architecture? 8

- b) How are integer and floating point numbers represented for computer arithmetic? Explain. 7

4. a) Multiply 8*5 using booth's algorithm and explain the algorithm. 8

OR

Perform 2's complement binary division for 7/3 with its algorithm.

- b) What is pipelining hazards? Explain structural and data hazards and its solutions. 7

5. a) Explain the set associative cache mapping technique with suitable diagram. Explain about InfiniBand 244. 5+3

- b) Even though we have programmed I/O and Interrupt enabled I/O, but still DMA is needed. Why? Describe how DMA works with necessary diagrams. 2+5

6. a) Explain Flynn's classification. 8

- b) Explain different types of hardware and software performance issues in multicore computers. 7
7. Write short notes on: (Any two) 2×5
- a) Addressing modes
 - b) Data paths
 - c) GPU and TPU

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2025

Programme: BE

Full Marks : 100

Course: Research Fundamentals

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 do you mean by research? Differentiate between qualitative and quantitative research. 7
 - b) What are the 6Ps of research? Explain briefly each P with an example. 8
2.
 - a) What do you mean by the research process? Explain the research process model with a neat diagram. 7

OR

- What is citation, and why is it important? Explain the various citation styles used in research.
3.
 - a) What do you mean by research strategy? Indicate the difference between case study and ethnographic study. 8
 - b) Explain any two data generation techniques. 7
 4.
 - a) What is triangulation in research? Mention the types of triangulation in a research project. 8
 - b) Why is informed consent important in research involving human participants? What ethical issues might arise if informed consent is not properly obtained? 7

OR

- What are the rights of people directly involved in the research process? Explain.
5.
 - a) Describe the different types of research participants and explain their respective roles in the research process. 7
 - b) What is the essence of research proposal? Explain the different scenarios where research proposal is required. 8

6. a) Write the components of a research proposal and explain the methodology section. 8
- b) What do you mean by research report? Explain the significance of a research report in academic and professional research. 7
7. Write short notes on: (Any two) 2×5
- a) Features of research
- b) Plagiarism
- c) Referencing system

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2025

Programme: BE

Full Marks : 100

Course: Advanced Programming with Java

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 the term Architectural Neutral. Write down the code to handle user defined exception for LowBalance when balance is less than 10 rupees on your mobile. 7
- b) Define multithreading. Explain the techniques to create thread using anonymous class. 8

OR

Write down the advantage of ORM over JDBC. Explain Singleton Pattern and Factory method pattern in detail.

2. a) Explain the concept of inheritance in Java. What are the benefits of using inheritance, and how does it promote code reusability and polymorphism? Provide an example to support your explanation. 8
- b) Differentiate between abstract class and interface? Explain final classes and methods. 7
3. a) Write down the JavaFx code to design a login page as shown in the figure below when user click on login button test the username is "PU" and password is "PU@2025Spring" or not. 8



- b) Why do we need layout management? Explain GridBag layout with suitable example. 7
4. a) What is the significance of stub and skeleton in RMI? Create a RMI application such that a client sends an integer number to the server and the server return the factorial value of that integer. 8
- b) Create a TCP client server application where the client sends a string and the server responds by echoing the same string in upper case. 7
5. a) A table student consists of id, name and program. Write a program that asks users to enter a program name and displays the total number of students enrolled in that program. 7
- OR
- What is SQL Injection Attack? Write sample program using prepared statement to prevent SQL Injection Attack. 7
- What is package in java? How can you create user-defined package in java? Explain with example. 8
6. a) Differentiate between servlet and JSP. Create a HTML file with two text fields to First name and Last name. Then create a JSP file that reads values from the HTML form and display full name. 8
- b) What is cookie? How can you store and read cookies by using servlet. Explain with proper example. 7
7. Write short notes on: (Any two) 7
- a) Hibernate ORM
b) CORBA
c) SQL Escapes. 2x5

POKHARA UNIVERSITY

Semester: Spring

Year : 2025

Full Marks : 100

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) ✓ Find the root of the equation $x^3 + x^2 - 3x - 3 = 0$ correct up to three decimal place using Bisection method. 7
- b) ✓ What are the limitations of NR method? Using NR method, find the root of $\log x - \cos x = 0$ correct up to three decimal places. 8

OR

Write an algorithm to find a real root of a non-linear equation using secant method.

2. a) The following table gives the population of a town during the last six censuses. Estimate the increase in the population during the period from 1976. 8

Year:	1941	1951	1961	1971	1981	1991
Population:(i n thousand)	12	15	20	27	39	52

OR

The velocity of a rocket is measured at three different times as follows:

Time, t(s) Velocity, v(t) (m/s)

10	227.04
15	362.78
20	517.35

Using a quadratic Lagrange interpolating polynomial, determine time t at which the rocket's velocity is 300m/s.

Fit the equation from the given set of data.

7

$$y = \frac{1}{ax + b}$$

x	-5	-4	-3	0	2	3	6	8
y	0.15	0.18	0.23	2	-0.5	-0.31	-0.143	-0.1

3. a) Evaluate the integral $I = \int_4^{5.2} \log x \, dx$ for $n = 6$ using for simpsons 1/3 rule and 3/8 rule. Compare the result in both conditions.

rule and 3/8 rule. Compare the result in both conditions.

- b) Evaluate the integral $\int_{0.5}^{1.5} e^{x^2} \, dx$ using the 3 point Gaussian quadrature.

Using the LU Crout decomposition method solve the following system of equations.

$$\begin{aligned} 4x_1 - x_2 + x_3 &= 7 \\ -2x_1 + 6x_2 + x_3 &= 9 \\ x_1 + x_2 + 7x_3 &= -6 \end{aligned}$$

b) Find the solution of the given simultaneous linear equation using Gauss Seidel method.

$$6x_1 - 2x_2 + x_3 = 11$$

$$-2x_1 + 7x_2 + 2x_3 = 5$$

$$x_1 + 2x_2 - 5x_3 = -1$$

5. a) Find the solution of the given ordinary differential equation at $x=0.5$ using the step size of $h=0.25$ using RK4 method.

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

b) Solve the following equation for $y(0.2)$ using shooting method:

$$\frac{d^2y}{dx^2} + 2 \frac{dy}{dx} - 3y = 6x \text{ Given } y(0) = 0, y'(0) = 1.$$

6. a) Solve the Poisson equation $\nabla^2 f = 2x^2 y^2$ over the square domain

$0 \leq x \leq 3, 0 \leq y \leq 3$, with $f = 0$ on the boundary and $h = 1$.

b) Solve the elliptic equation $U_{xx} + U_{yy} = 0$ over a square mesh of side four units satisfying the following boundary conditions;

$u(0, y) = 0$ for $0 \leq y \leq 4$, $u(4, y) = 12 + y$ for $0 \leq y \leq 4$;
 $u(x, 0) = 3x$ for $0 \leq x \leq 4$, $u(x, 4) = x^2$ for $0 \leq x \leq 4$.

7. Write short notes on: (Any two)

2×5

- a) Importance of Numerical methods
b) Power Method
c) Review of ODEs

POKHARA UNIVERSITY

Semester: Spring

Year : 2025

Full Marks : 100

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)~~ Explain Mathematical Induction. Using mathematical induction prove that sum of first n positive odd numbers $1+3+5+\dots\dots+2n-1 = n^2$. 7

b) Differentiate Between DFA and NFA? Design a DFA that accepts the language given by $L=\{wc\{0,1\}^*\}$; w contains '00' or '11' as substring}. Hence test your design for 101001 and 0101010. 8

2. a) Minimize the following DFA (Draw initial diagram first). Specify performed operations in each step. 7

δ/Σ	0	1
$\rightarrow Q_0$	Q1	Q2
*Q1	Q1	Q3
*Q2	Q2	Q2
*Q3	Q5	Q2
*Q4	Q4	Q2
*Q5	Q4	Q2
Q6	Q5	Q6
Q7	Q5	Q6

Note: \rightarrow for start state, * for final state

b) State Pumping Lemma for regular set. Use pumping lemma to prove that the language $L=\{0^n 1^n : n \geq 0\}$. 8

3. a) What is GNF? Convert the following CFG into GNF. 7

$$S \rightarrow XA|BB$$

$$B \rightarrow b|SB$$

$$X \rightarrow b$$

$$A \rightarrow a$$

- b) Design a PDA which accepts the language $L = \{w \in \{0,1\}^* : w \text{ has equal number of } 0's \text{ and } 1's\}$ and also test your design for strings "010110" and "11010".

OR

Design a PDA which accepts the language $L = \{a^i b^j c^k : k = i+j\}$ and also test your design for strings "aabccc" and "bbccc".

4. a) When is the grammar said to be ambiguous? Prove the grammar is ambiguous: $S \rightarrow 0S1 \mid 1S0 \mid SS \mid \epsilon$.

- b) What is Unrestricted Grammar? Design a Turing Machine to accept the language $L = \{0^n 1^n : n \geq 1\}$.

OR

Formally define a Turing Machine $M = (Q, \Sigma, \Gamma, \delta, q_0, B, F)$ that accepts the language: $L = \{w \in \{a, b\}^* \mid w \text{ is a palindrome}\}$. Trace the steps of the machine when processing the input string abba.abba.

5. a) How does Turing Machine compute a function? Design a Turing machine to compute a function $f(m) = m+1$ where m belongs to set of Natural numbers.

b) What is recursive and recursively enumerable language? Show that the intersection of two recursive language is also recursive.

6. a) Explain the Church-Turing thesis. How does the Post correspondence problem (PCP) demonstrate computational undecidability?

b) What is meant by time and space complexity? Explain the classes P and NP in detail with examples. How are they related to real-world problem-solving?

7. Write short notes on: (Any two)

2x5

- a) Pigeonhole principle
b) Pumping Lemma for CFL
c) Universal Turing Machine