

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2024

Programme: BE

Full Marks: 100

Course: Algebra and Geometry

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) Check whether the given system of linear equations is consistent or not, if consistent then solve the system of linear equations
 $2x + 5y + 6z = 13, 3x + y - 6z = 13, x - 3y - 8z = -13.$ 7
- b) i) State Cayley Hamilton theorem. Verify it for the matrix
 $A = \begin{pmatrix} 1 & -2 \\ 4 & 5 \end{pmatrix}.$ 4+4
- i) Check whether the set of vectors $\{(1, 1, 0), (1, 0, 1), (3, 1, 1)\}$ form a basis for \mathbb{R}^3 or not. 4
2. a) Define eigen value and eigen vector. Find the eigen values and corresponding eigen vectors of $\begin{pmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{pmatrix}.$ 7
- b) Convert the following primal LPP into dual LPP and solve by using simplex method: Minimize $Z = 8x_1 + 9x_2$ subject to
 $x_1 + 3x_2 \geq 4, 2x_1 + x_2 \geq 5, x_1 \geq 0, x_2 \geq 0.$ 8
3. a) Find the set of reciprocal system of vectors to $\vec{a} = 2\vec{i} + 3\vec{j} - 2\vec{k}, \vec{b} = \vec{i} - \vec{j} - 2\vec{k}$ and $\vec{c} = -\vec{i} + 2\vec{j} + 2\vec{k}.$ 7
- b) Find the interval of convergence, centre of convergence and radius of convergence of an infinite series $\sum \frac{n^2}{2^n} (x + 4)^n.$ 8
4. a) State Cauchy root test. Test the convergence of the following infinite series:
 - i. $\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots$
 - ii. $\sum \left(\frac{2n}{n+1} \right)^n$
- b) Find the vertex, eccentricity, foci and equation of directrix of the ellipse: $3x^2 + 4y^2 - 12x - 8y + 4 = 0.$ 8

5. a) Find the condition for the line $y = mx + c$ to be the tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1.$ Also, find the point of contact. 7

OR

Sketch and describe the polar conic $r = \frac{12}{3+2\cos\theta}.$

- b) Define skew lines. Find the shortest distance between the lines

$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}.$ Also, find the equation of the line of shortest distance. 8

6. a) i) Find the equation of the cone with vertex at the origin and which passes through the curve of intersection of $ax^2 + by^2 + cz^2 = 1$ and $lx + my + nz = p.$ 2

ii. Find the equation of the right circular cylinder of radius 2 whose axis is the line $\frac{x-1}{2} = \frac{y-2}{1} = \frac{z-3}{2}.$ 5

- b) Find the centre and radius of the circle $x^2 + y^2 + z^2 - 8x + 4y + 8z - 45 = 0, x - 2y + 3z = 3.$ 8

OR

Show that the plane $2x - 2y + z = -12$ touches the sphere $x^2 + y^2 + z^2 - 2x - 4y + 2z = 3.$ Also, find the point of contact.

7. Attempt all the questions: 4x2.5

- a) Check whether the transformation $T: \mathbb{R}^2 \rightarrow \mathbb{R}$ defined by $T(x, y) = x + y$ is linear or not.

- b) Find the volume of the parallelopiped whose concurrent edges are given by: $\vec{a} = \vec{i} + 2\vec{j} + 3\vec{k}, \vec{b} = 3\vec{i} + 4\vec{j} - 5\vec{k}, \vec{c} = \vec{i} - 2\vec{j} + 3\vec{k}.$

- c) Transform the equation $x^2 + 3xy + y^2 = 0$ in which the origin is transformed to (2, 3) with axes remaining parallel to the old axes.

- d) Show that the line joining the points (-2, 1, 3) and (1, -3, 4) is parallel to the plane $2x + 3y + 6z + 5 = 0.$

POKHARA UNIVERSITY

Level: Bachelor

Programme: BE

Course: Applied Chemistry

Semester: Spring

Year : 2024

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) What are the differences between a galvanic cell and electrolytic cell? 8

A galvanic cell consists of two electrode, zinc and lead, zinc electrode is immersed in 0.1 M zinc ion solution and lead electrode in 0.02 M lead ion solution. Calculate the emf of the cell at 298 K. Write the equations of electrode process and represent the cell schematically. Given that $E^\circ_{(Zn^{2+}/Zn)} = -0.76$ volt and $E^\circ_{(Pb^{2+}/Pb)} = -0.13$ volt.

OR

Define electrochemical series. Write the applications of electrochemical series. From the following data, calculate the emf of cell at 25°C.

$$E^\circ_{Ni^{2+}/Ni} = -0.25V$$

$$E^\circ_{Cu^{2+}/Cu} = +0.34V$$

$$[Ni^{2+}] = 0.1M, \quad [Cu^{2+}] = 0.2M$$

$$R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$$

$$F = 96500C$$

- b) Differentiate between Zn-Cu and Ni-Cd batteries illustrating with suitable diagram and the involved cell reactions. 7

2. a) Define air pollution. Write cause, effect and preventive measure of air pollution. 8

- b) Define hardness of water. How can you determine free chlorine in the water sample in laboratory? How can you determine permanent hardness of water in lab. 7

OR

Define alkalinity and COD. How do you measure alkalinity and dissolved oxygen in laboratory, explain.

3. a) Write the electronic configuration of first series transition elements. Explain why $ZnSO_4$ and TiO_2 are colorless. 8
- b) Describe the various characteristics of transition elements. 7
4. a) Differentiate between S_N1 and S_N2 reaction. Give the mechanism and stereochemistry of S_N1 reaction in favors of tertiary butyl bromide in presence of aqueous NaOH solution. 8
- b) Differentiate E_1 and E_2 reactions with mechanism and kinetics. 7
5. a) What are photovoltaic cells? Explain its basic principle and mention some of its major applications. 7
- b) Define cement with its types and chemistry. And describe the setting and hardening mechanism of cement. 8
6. a) What are polymers and polymerization? Differentiate addition polymer from the condensation polymer giving suitable example of each. 8
- b) How do biodegradable polymers differ from non-biodegradable polymer? Explain with suitable examples. 7
7. Write short notes on: (Any two) 2×5
- a) Acid-Base titration
- b) Buffer Solution and pH measurement
- c) Saytzeff's Rule

POKHARA UNIVERSITY

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

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Assume suitable data if necessary.

Attempt all the questions.

1. a) Define instrumentation system. What are the components of an instrumentation system explain with a block diagram. 8
b) Describe the operation of LVDT for the measurement of direction of the movement. 7

2. a) A pressure gauge of range 50 bar is stated to have an error of 10.15 bar when calibrated by the manufacturer. Determine a) percentage error on the basis of maximum scale value. b) possible error as a percentage of the indicated value when a reading of 10 bar is obtained in a test. 8

OR

A strain gauge is bonded to a beam 0.1 m long and has cross-sectional area of 4 cm^2 . Young's modulus for steel is 2.7 GN/m^2 . The strain gauge has an unstrained resistance of 240Ω and gauge factor of 2. When a load is applied the resistance of gauge changed by 0.017Ω . Calculate the change in length of the steel beam and the length of the steel beam and the amount of force applied to the beam.

- b) Describe the construction and working principle of an Induction type single phase energy meter. 7

3. a) Define power factor meter. Explain the working principle of single phase electrodynamometer power factor meter with necessary expressions. 8
b) Explain the single channel Data Acquisition System (DAS) with the help of block diagrams. 7

4. a) Define Instrumentation amplifier. Explain the working principle of an instrumentation amplifier. 8
b) What digital output you will find of 7.27 volts input from 5-bit SA ADC with reference voltage of 11V. 7

5. a) Explain the working principle of delta-sigma ADC with necessary block diagram and steps. 7
 b) Define wave analyzer. Explain the frequency selective wave analyzer in detail with necessary block diagram. 8

6. a) Explain operation and application of Spectrum Analyzer. 7
 b) Explain about the working principle of oscilloscope with the help of its block diagram. 8

OR

What is a recorder? Draw and explain the strip-chart recorder in detail.

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

 - a) Magnetic tape recorder
 - b) Digital Multimeter
 - c) RS-232 cable

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Data Structure and Algorithms (New)

Semester: Spring

Year : 2024
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) What is algorithm analysis? For the given algorithm, compute its total running time $T(n)$ for worst and best-case. 7

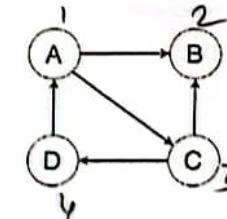
Algorithm for XYZ (n)	Cost	Time
m=1	C1	1
for i=1 to n	C2	n
for j=1 to n	C3	n
xyz=i*j	C4	n
return xyz	C5	1

OR

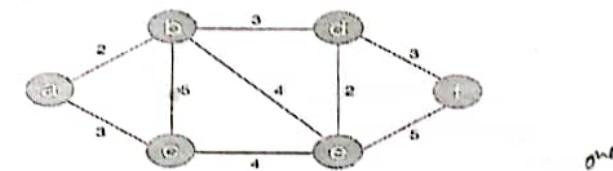
What is a greedy algorithm? Explain how the greedy algorithm works with an example of any greedy algorithm like Kruskal's algorithm.

- b) How does a stack become an ADT? Implement stack using an array with its basic operations. 8
2. a) What is a base case? Write a program in C or C++ to implement the sum of n natural numbers using recursion and explain how the base case is set and how it is reached. 8
- b) Define Deque. State and explain in which scenario the Deque is used in real world. 7
3. a) Define a node class for a singly linked list to contain a data and a link to the next node. Implement the insertion operation to insert a node at the end and display all the node data in the single linked list. 8
- b) What is the advantage of linked implementation? Explain the linked implementation of queue in detail. 7
4. a) Define Binary Search Tree. Construct a BST from the data: 43,60,30,20,18,54,58,12,32 and perform the following operations: 7
 - i. Traverse in preorder, in-order and post-order.
 - ii. Delete 30.

- b) Explain the problems with unbalanced binary trees. Create an AVL tree from the following data: 17,42,9,55,23,8,36,71,65,1,7. 8
5. a) Perform heap sort on: 25,33,20,10,100,2,5,40. 5
- b) Design and implement a simple hash system with a hash function where $h(x) = x \% 10$ using C or C++ code. If collision occurs, use quadratic probing for collision resolution. 10
6. a) Define a directed graph. For the given graph, represent it using adjacency matrix and find its transitive closure using Warshall's algorithm. 7

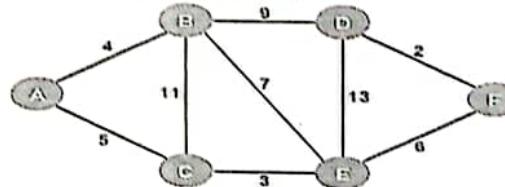


- b) Find the minimum spanning tree of the given graph using Prim's algorithm. 8



OR

Find the shortest path from the source vertex A to all vertices of the following graph using Dijkstra's algorithm.



7. Write short notes on: (Any two) 2x5
- a) Types of data structure
- b) Quick Sort Algorithm
- c) Binary Search

POKHARA UNIVERSITY

Level: Bachelor

Programme: BE

Course: Applied Physics

Semester: Spring

Year : 2024

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) Derive time period of torsion pendulum and find an expression for modulus of rigidity of the material of the suspension wire. 9

OR

Differentiate the terms free, damped and forced vibration. Develop the differential equation of a particle executing damped vibration in a medium. Explain the physical meaning of each term and each constant in the equations.

- b) Categorise the wave according to the modes of vibrations and show that the intensity of a progressive wave is directly proportional to the square of its amplitude. 6

2. a) Explain the construction and working of He-Ne laser with a suitable energy level diagram. Hence, explain its applications. 9

- b) The reverberation time of an empty hall is 1.5 sec. The same hall with 500 people is 1.4 sec. Find the reverberation time with 800 people in hall. 6

3. a) What do you mean by capacitance? Derive a relationship for charge stored at any time 't' in the capacitor in case of discharging and show that the charge decreases to 37% of its maximum value at capacitive time constant. 9

- b) A solid sphere of mass 40 kg and diameter 0.10 m is suspended on a wire. Find the period of angular oscillations for small displacement if the torque required to twist the wire is 4×10^{-3} Nm/rad. 6

4. a) Derive an expression for the resonant frequency in a forced EM oscillation. Hence, find the maximum current in the circuit. 9

- b) Show that $\nabla \cdot \vec{J} + \frac{d\rho}{dt} = 0$. Where symbols carry their usual meaning. 6

5. a) Using Schrodinger's wave equation obtain the energy and wave function of a small particle confined in an infinite potential well. And show that energy level are quantized. 9

- b) Show that, $\vec{D} = \epsilon_0 \vec{E} + \vec{P}$, where \vec{D} = displacement vector, \vec{E} = electric field and \vec{P} = polarizing vector. 6

6. a) Explain the modes of heat transfer with suitable examples. 9
b) A refrigerator has to transfer an average of 200 J of heat per second from the temperature 15°C to 30°C. Calculate the average power consumed, assuming an ideal reversible cycle and no other losses. 6

OR

A thin metal plate is insulted on the back and exposed its front surface to solar radiation. The exposed surface of the plate has an emissivity of 0.7. If the solar radiation is including on the plate at the rate of 750 W/m² and the surrounding air temperature is 20°C, determine the surface temperature of the plate. Assume convection heat transfer coefficient 40 W/m²K.

7. Write short notes on: (Any two) 2x5
a) First law of thermodynamics
b) Semi-conductor laser
c) Inadequacy of classical mechanics

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2024

Programme: BE

Full Marks: 100

Course: Object Oriented Programming in C++ (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 makes object-oriented programming better than procedure-oriented programming? Justify your answer with features of object-oriented programming. 7
- b) List out the advantages of adopting RDD. Draw CRC cards for Library Management system. 8
2. a) What are static data members and static functions? Explain with examples. 7
- b) What is constructor? Explain three types of constructor with example program. 8
3. a) Create a class Person with data members Name and age. Derive a class Employee from Person with its data member employee_id. Derive another class Manager from Employee with its data member department. Receive the data members from each class's member function and display the data of all classes from the class Manager. 8
- b) How composition differs from inheritance? Write a program to concatenate two strings (name and address of a person) using the concept of containership. 7

OR

During the time of hybrid inheritance when there is hierarchical inheritance at the upper level and multiple inheritance at lower level, ambiguity occurs due to duplication of data from multipath at the grand child class. How this kind of ambiguity is resolved? Explain with suitable example.

4. a) What is the major difference between compile time and runtime polymorphism? How runtime polymorphism can be achieved? Explain with example. 7
- b) What do you mean by type casting? Write a program to convert an 8

object of Rectangle class into the object of Polar class by using type conversion routine.

OR

What are functions overloading and overriding? Explain with examples.

5. a) What are the advantages of function template? Create a function template to swap two integers, two floating point data and two characters. 7
- b) What is the Standard Template Library (STL)? Explain any one container of STL with example. 8
6. a) What is exception? Describe exception handling in C++ with example. 7
- b) Write a program that prompts the user to enter their name and age, write the entered data into a file named "userinfo.txt", read the details from "userinfo.txt" and display the data on the console. 8
7. Write short notes on: (Any two) 2x5
 - a) Software reusability
 - b) Dynamic Memory Allocation
 - c) Computation as simulation