

UNIVERSITY OF NORTH BENGAL
B.Sc. Honours 4th Semester Examination, 2022

## SEC1-P2-MATHEMATICS

# The question paper contains SEC2A and SEC2B. <br> The candidates are required to answer any one from two papers. <br> Candidates should mention it clearly on the Answer Book. 

## SEC2A <br> GRAPH THEORY

## GROUP-A

1. Answer any four questions from the following:
$3 \times 4=12$
(a) Show that the maximum number of edges in a simple graph with $n$ vertices is
$\frac{1}{2} n(n-1)$.
(b) Show that if a simple graph $G$ is isomorphic to its complement $\bar{G}$, then $G$ has either $4 k$ or $4 k+1$ vertices for some natural number $k$.
(c) Prove that every graph with $n$ vertices and $k$ edges has atleast $(n-k)$ components.
(d) Show that the number of odd degree vertices in a graph is always even.
(e) Prove that every circuit in a graph contains a cycle.
(f) Draw a graph from the given incidence matrix.

$$
\begin{aligned}
& \\
& u \\
& v \\
& w \\
& z
\end{aligned}\left(\begin{array}{lllll}
a & b & c & d & e \\
1 & 2 & 1 & 0 & 0 \\
0 & 0 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 1 & 1
\end{array}\right)
$$

## GROUP-B

2. Answer any four questions from the following:
(a) If a simple regular graph has $n$ vertices and 24 edges, find all possible values of $n$.
(b) Let $G$ be a graph of order 3 with respect to $V(G)=\left\{v_{1}, v_{2}, v_{3}\right\}$. The adjacency matrix $A(G)$ with respect to order set $\left\{v_{1}, v_{2}, v_{3}\right\}$ is given below.

$$
\left(\begin{array}{lll}
2 & 2 & 0 \\
2 & 0 & 0 \\
0 & 0 & 1
\end{array}\right)
$$

Show that $G$ is disconnected.
(c) Let $u$ and $v$ be two non-adjacent vertices in a graph $G$ of order $n$ such that $\operatorname{deg}(u)+\operatorname{deg}(v) \geq n$. Prove that $G+u v$ is Hamiltonian iff $G$ is Hamiltonian.
(d) Let $G$ be a graph with $n(\geq 2)$ vertices. Then $G$ has atleast 2 vertices which are not cut vertices.
(e) Prove that a simple graph is bipartite iff all its cycles are even.
(f) Draw the graph whose incidence matrix is given by

$$
\left[\begin{array}{ccccc}
0 & 0 & 1 & -1 & 1 \\
-1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & -1 \\
0 & -1 & 0 & 0 & 0 \\
0 & 0 & -1 & 1 & 0
\end{array}\right]
$$

## GROUP-C

Answer any two questions from the following
3. (a) Let $G$ be a $p$-regular graph of order $n \geq 2(p+1)$ for $p \geq 1$. Prove that the complement of $G$ is Hamiltonian.
(b) Prove that a connected graph with $n$ vertices has atleast ( $n-1$ ) edges.
4. (a) Draw the complete graphs $K_{5}$ and $K_{6}$. Also find the number of edges in the graphs $K_{12}$ and $K_{15}$.
(b) If $G$ is a disconnected graph then prove that $\bar{G}$ is a connected graph.
5. (a) For a simple graph $G$ of order $n \geq 3$ and size $m$, show that for $G$ to be Hamiltonian if $m \geq \frac{1}{2}(n-1)(n-2)+2$.
(b) Show that a bipartite graph cannot contain an odd cycle.

## UG/CBCS/B.Sc./Hons./4th Sem./Mathematics/MATHSEC2/2022

6. (a) Prove that the maximum number of edges in a simple graph with $n$ number of vertices and $k$ components can be $\frac{(n-k)(n-k+1)}{2}$.
(b) A salesman has to visit five cities namely $A, B, C, D$ and $E$. Starting from the home city $A$ and visiting each city exactly once, he has to return to the city $A$. The distances from one city to another are given below. Find the optimal route and minimum distance of the route.

|  | $A$ |  | $B$ |  | $C$ |  | $D$ | $E$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $A$ | - | 4 | 7 | 3 | 4 |  |  |  |
| $B$ | 4 | - | 6 | 3 | 4 |  |  |  |
| $C$ | 7 | 6 | - | 8 | 5 |  |  |  |
| $D$ | 3 | 3 | 8 | - | 8 |  |  |  |
| E | 4 | 4 | 5 | 8 | - |  |  |  |
|  |  |  |  |  |  |  |  |  |

## SEC2B <br> OPERATING SYSTEM : LINUX <br> GROUP-A

1. Answer any four questions from the following: $3 \times 4=12$
(a) What is boot loader in Linux? 3
(b) What is a swap area? 3
(c) Explain the cut command. 3
(d) What is the core of the Linux Operating System? 3
(e) Explain command grouping in Linux. 3
(f) What is meant by Linux disk management? 3

## GROUP-B

2. Answer any four questions from the following:
(a) How can you determine the total memory used by Linux? 6
(b) Write a note on telnet, ftp, rsync and rsh. Why are these services called insecure
services?
(c) Explain the following commands with examples:
$\mathrm{ls}, \mathrm{rm}, \mathrm{cp}, \mathrm{mv}$, chown, chmod
(d) What are the common things between Linux and UNIX? 6
(e) Explain the Linux 'cd' command options along with the description. 6
(f) Enlist the features of the Linux operating system? 6
GROUP-C
Answer any two questions from the following ..... $12 \times 2=24$
3. (a) Why is Linux considered more secure than other operating systems? ..... 6
(b) Write a short note on Linux file permissions. ..... 6
4. (a) Enlist some Linux distributors along with its usage. ..... 6
(b) How pipes and redirection symbols work? Demonstrate with the help of ..... 6 examples.
5. (a) Discuss about disk drive partitions in Linux. ..... 5
(b) Explain various disk related commands in Linux. ..... 7
6. Write about the following Linux commands with examples: ..... 12 cal, cd, cp, bc, pwd, mkdir, rmdir, md, cut, Is
