TOTAL PAGES: 3

23NMB426N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BVoc DEGREE EXAMINATION MAY 2026
(Fourth Semester)

Branch- **NETWORKING AND MOBILE APPLICATION**

MATHEMATICAL STRUCTURES

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (10 × 1 = 10)

Question No.	Question	K Level	CO
1	If two matrices are equal, then their difference is a _____ matrix. a) Square b) 0 c) transpose d) none	K1	CO1
2	A matrix is said to be idempotent if A^2 = ____ . a) A b) 0 c) A^2 d) None	K2	CO1
3	Newtons Backward difference formula can be used to intropolate the value of y corresponding to the value of x chosen just ___ the end of the table value. a) After b) before c) middle d) second____	K1	CO2
4	Newtons Backward difference formula can be used to extrapolate the value of y corresponding to the value of x chosen just _____ ___ the end of the table value. a) After b) before c) middle d) second	K2	CO2
5	The other name for Simpson's one third rule is _____ rule. a) Parabolic b) elliptic c) circular d) none	K1	CO3
6	If the co-ordinates denote velocities at equal intervals of time, then Simpson's rule gives the _____. a) distance travelled b) speed aquired c) both (a) and (b) d) None	K2	CO3
7	In critical path analysis, CPM is _____ . a) Event oriented b) probabilistic in nature c) deterministic in nature d) None	K1	CO4
8	Network problems have advantage in terms of project _____ . a) Scheduling b) planning c) controlling d) all the above	K2	CO4
9	Multiple servers may be _____ . a) In parallel b) in series c) both a and b d) all the above	K1	CO5
10	The queue discipline FIFO means _____ . a) First in, first out b) first in the flow c) first out of the flow d) none	K2	CO5

Cont...

SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

<table>
<tr><th>Question No.</th><th>Question</th><th>K Level</th><th>CO</th></tr>
<tr><td>11.a.</td><td>If A = $\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}$, show that A satisfies the equation $A^2 - 5A - 2I = 0$.</td><td rowspan="2">K2</td><td rowspan="2">CO1</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>11.b.</td><td>If A = $\begin{bmatrix}cos\theta & sin\theta\\-sin\theta & cos\theta\end{bmatrix}$ Prove that A^3 = $\begin{bmatrix}cos3\theta & sin3\theta\\-sin3\theta & cos3\theta\end{bmatrix}$</td><td rowspan="3">K3</td><td rowspan="3">CO2</td></tr>
<tr><td>12.a.</td><td>The following are data from the steam table temperature °C. Find the pressure at Temperature 162°C
<table>
<tr><td>Temperature °C</td><td>140</td><td>150</td><td>160</td><td>170</td><td>180</td></tr>
<tr><td>Pressure kg f/cm^2</td><td>3.685</td><td>4.854</td><td>6.302</td><td>8.076</td><td>10.225</td></tr>
</table></td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>12.b.</td><td>Using Newton's formula, find the value of f(1.5) from the following data.
<table>
<tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>f(x)</td><td>858.3</td><td>869.6</td><td>880.9</td><td>892.3</td><td>903.6</td></tr>
</table></td><td rowspan="3">K3</td><td rowspan="3">CO3</td></tr>
<tr><td>13.a.</td><td>Find $\frac{dy}{dx}$ for x= 1.05, from the following table.
<table>
<tr><td>X</td><td>1.00</td><td>1.05</td><td>1.10</td><td>1.15</td><td>1.20</td><td>1.25</td><td>1.30</td></tr>
<tr><td>Y</td><td>1.00000</td><td>1.02470</td><td>1.04881</td><td>1.07238</td><td>1.09544</td><td>1.11803</td><td>1.14017</td></tr>
</table></td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>13.b.</td><td>From the values in the table given below, find the value of sec31° using numerical differentiation.
<table>
<tr><td>θ in degrees</td><td>31</td><td>32</td><td>33</td><td>34</td></tr>
<tr><td>tan θ</td><td>0.6008</td><td>0.6249</td><td>0.6494</td><td>0.6745</td></tr>
</table></td><td rowspan="4">K4</td><td rowspan="4">CO4</td></tr>
<tr><td>14.a.</td><td>A project schedule has the following characteristics:
<table>
<tr><th>Activity</th><th>Time</th><th>Activity</th><th>Time</th></tr>
<tr><td>1-2</td><td>4</td><td>5-6</td><td>4</td></tr>
<tr><td>1-3</td><td>1</td><td>5-7</td><td>8</td></tr>
<tr><td>2-4</td><td>1</td><td>6-8</td><td>1</td></tr>
<tr><td>3-4</td><td>1</td><td>7-8</td><td>2</td></tr>
<tr><td>3-5</td><td>6</td><td>8-10</td><td>5</td></tr>
<tr><td>4-9</td><td>5</td><td>9-10</td><td>7</td></tr>
</table>
Construct PERT network.</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>14.b.</td><td>Write the rules of network construction.</td></tr>
<tr><td>15.a.</td><td>Customers arrive at a sales counter manned by a single person according to poisson process with mean of 20 per hour. The time required to serve a customer has an exponential distribution with mean of 100 seconds. Find the average waiting time of a customer.</td><td rowspan="3">K4</td><td rowspan="3">CO5</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>15.b.</td><td>Explain the essential features of queuing system.</td></tr>
</table>

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SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

<table>
<tr><th>Question No.</th><th>Question</th><th>K Level</th><th>CO</th></tr>
<tr><td>16</td><td>Find the rank of the matrix $\begin{bmatrix} 1 & -1 & 2 \\ 2 & 6 & 3 \\ 3 & 13 & 4 \end{bmatrix}$</td><td>K2</td><td>CO1</td></tr>
<tr><td>17</td><td>Construct Newton's forward interpolation polynomial for the following data.
<table><tr><td>x</td><td>4</td><td>6</td><td>8</td><td>10</td></tr><tr><td>y</td><td>1</td><td>3</td><td>8</td><td>16</td></tr></table>Use it to find y for x = 5.</td><td>K3</td><td>CO2</td></tr>
<tr><td>. 18</td><td>Using Simson's rule, evaluate $\int sin^3x\,dx$ from the following data:
<table><tr><td>x</td><td>0</td><td>$\frac{\pi}{4}$</td><td>$\frac{\pi}{2}$</td><td>$\frac{3\pi}{4}$</td><td>π</td></tr><tr><td>sinx</td><td>0</td><td>0.7071</td><td>1.000</td><td>0.7071</td><td>0</td></tr></table></td><td>K3</td><td>CO3</td></tr>
<tr><td>19</td><td>A small project is composed of seven activities whose time estimates are listed in the table;
<table><tr><td>Activity i-j</td><td>optimistic</td><td>Most likely</td><td>pessimistic</td></tr><tr><td>1-2</td><td>1</td><td>1</td><td>7</td></tr><tr><td>1-3</td><td>1</td><td>4</td><td>7</td></tr><tr><td>1-4</td><td>2</td><td>2</td><td>8</td></tr><tr><td>2-5</td><td>1</td><td>1</td><td>1</td></tr><tr><td>3-5</td><td>2</td><td>5</td><td>14</td></tr><tr><td>4-6</td><td>2</td><td>5</td><td>8</td></tr><tr><td>5-6</td><td>3</td><td>6</td><td>15</td></tr></table>Draw the project network and find the expected duration of each activity. What is the expected project length?</td><td>K4</td><td>CO4</td></tr>
<tr><td>20</td><td>Consider a single server queuing system with poisson arrival and exponential service time. Suppose, the mean arrival rate is 3 calling units per hour, the expected service time is 0.25 hours and the maximum permissible member of calling units in the system is 2. Derive the steady – state probability distribution of the number of calling units in the system. Also, calculate expected number of calling units in the system.</td><td>K4</td><td>CO5</td></tr>
</table>

Z-Z-Z END