



**PSG COLLEGE OF ARTS & SCIENCE  
(AUTONOMOUS)**

**BSc / BCA DEGREE EXAMINATION DECEMBER 2025  
(Second Semester)**

**Common to Branches - INFORMATION TECHNOLOGY &  
COMPUTER APPLICATIONS**

**MATHEMATICAL FOUNDATIONS OF COMPUTING**

Time: Three Hours

Maximum: 75 Marks

**SECTION-A (10 Marks)**

Answer ALL questions

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

| Module No. | Question No. | Question                                                                                                                                                                                                                                                                                                                                                                                                                                          | K Level | CO  |
|------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----|
| 1          | 1            | If A and (A,B) have the same rank, then the equations are<br>a) Consistent                      b) Inconsistent<br>c) no solution                      d) linear                                                                                                                                                                                                                                                                                  | K1      | CO1 |
|            | 2            | The root of the characteristic equation is called _____<br>a) Vectors                      b) eigen vectors<br>c) eigen values                      d) scalar                                                                                                                                                                                                                                                                                     | K1      | CO1 |
| 2          | 3            | Which are the roots of $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$ ?<br>a) 1, -1                      b) -1, -1                      c) -1, 2                      d) -2, 1                                                                                                                                                                                                                                                                      | K1      | CO2 |
|            | 4            | Identify the roots of the equation whose solution is $y = (Ax + B)e^{m_1x}$<br>a) real and distinct                      b) real and equal<br>c) imaginary                      d) constant                                                                                                                                                                                                                                                       | K2      | CO2 |
| 3          | 5            | Obtain the PDE of $Z = ax + by + a$ by eliminating a & b<br>a) $Z = px + qy + p$ b) $Z = px + qy$ c) $Z = ap + bq + a$<br>d) $Z = p - q$                                                                                                                                                                                                                                                                                                          | K1      | CO3 |
|            | 6            | $\phi$ is the complete integral of a partial differential equation and $\phi$ is called as singular integral if _____ exist.<br>a) $\frac{\partial \phi}{\partial a} = \frac{\partial \phi}{\partial b}$ b) $\frac{\partial \phi}{\partial a} \neq \frac{\partial \phi}{\partial b}$<br>c) $\frac{\partial \phi}{\partial a} = \frac{\partial \phi}{\partial b} = 1$ d) $\frac{\partial \phi}{\partial a} = \frac{\partial \phi}{\partial b} = 0$ | K2      | CO3 |
| 4          | 7            | The Gauss elimination method is _____ method.<br>a) direct                      b) indirect<br>c) iterative                      d) convergent                                                                                                                                                                                                                                                                                                    | K1      | CO4 |
|            | 8            | The system $AX=B$ is called diagonal system if A is _____<br>a) diagonal matrix                      b) identity matrix c) diagonally dominant<br>d) singular matrix                                                                                                                                                                                                                                                                              | K2      | CO4 |
| 5          | 9            | The process of evaluating _____ is called numerical integration<br>a) derivative                      b) integral<br>c) definite integral                      d) constant                                                                                                                                                                                                                                                                        | K1      | CO5 |
|            | 10           | In Newton's backward difference formula, P is equal to<br>a) $\frac{x_n - x}{h}$ b) $\frac{x - x_n}{h}$ c) $\frac{x - x_0}{h}$ d) $\frac{x_0 - x}{h}$                                                                                                                                                                                                                                                                                             | K1      | CO5 |

Cont...

**SECTION - B (35 Marks)**

Answer ALL questions

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

| Module No. | Question No. | Question                                                                                                                                                                                                                                                                                                                                                                       | K Level | CO  |      |       |      |     |     |      |       |      |   |     |     |     |     |
|------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----|------|-------|------|-----|-----|------|-------|------|---|-----|-----|-----|-----|
| 1          | 11.a.        | Identify the rank of $\begin{bmatrix} 6 & 1 & 1 & 1 \\ 16 & 1 & -1 & 5 \\ 7 & 2 & 3 & 0 \end{bmatrix}$                                                                                                                                                                                                                                                                         | K2      | CO1 |      |       |      |     |     |      |       |      |   |     |     |     |     |
|            | (OR)         |                                                                                                                                                                                                                                                                                                                                                                                |         |     |      |       |      |     |     |      |       |      |   |     |     |     |     |
|            | 11.b.        | Find eigen values and eigen vectors of the matrix $\begin{bmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{bmatrix}$                                                                                                                                                                                                                                                        |         |     |      |       |      |     |     |      |       |      |   |     |     |     |     |
| 2          | 12.a.        | Solve $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 0$ .                                                                                                                                                                                                                                                                                                      | K3      | CO2 |      |       |      |     |     |      |       |      |   |     |     |     |     |
|            | (OR)         |                                                                                                                                                                                                                                                                                                                                                                                |         |     |      |       |      |     |     |      |       |      |   |     |     |     |     |
|            | 12.b.        | Solve $(3D^2 + D - 14)y = 13e^{2x}$ .                                                                                                                                                                                                                                                                                                                                          |         |     |      |       |      |     |     |      |       |      |   |     |     |     |     |
| 3          | 13.a.        | Eliminate the arbitrary function f and $\phi$ from the relation $z = f(x + ay) + \phi(x - ay)$ .                                                                                                                                                                                                                                                                               | K3      | CO3 |      |       |      |     |     |      |       |      |   |     |     |     |     |
|            | (OR)         |                                                                                                                                                                                                                                                                                                                                                                                |         |     |      |       |      |     |     |      |       |      |   |     |     |     |     |
|            | 13.b.        | Solve $z = px + qy + \sqrt{(1 + p^2 + q^2)}$ .                                                                                                                                                                                                                                                                                                                                 |         |     |      |       |      |     |     |      |       |      |   |     |     |     |     |
| 4          | 14.a.        | Apply Gaussian elimination method to solve the following system of equations<br>$\begin{matrix} x + y = 2 \\ 2x + 3y = 5 \end{matrix}$                                                                                                                                                                                                                                         | K5      | CO4 |      |       |      |     |     |      |       |      |   |     |     |     |     |
|            | (OR)         |                                                                                                                                                                                                                                                                                                                                                                                |         |     |      |       |      |     |     |      |       |      |   |     |     |     |     |
|            | 14.b.        | Apply Gauss Jordan method to solve the following system of equations<br>$\begin{matrix} x + y + z = 9 \\ 2x - 3y + 4z = 13 \\ 3x + 4y + 5z = 40 \end{matrix}$                                                                                                                                                                                                                  |         |     |      |       |      |     |     |      |       |      |   |     |     |     |     |
| 5          | 15.a.        | Given $u_0 = 5, u_1 = 15, u_2 = 57$ and $\frac{du}{dx} = 4$ at $x = 0$ and 72 at $x = 2$ . Evaluate $\Delta^3 u_0$ and $\Delta^4 u_0$ .                                                                                                                                                                                                                                        | K5      | CO5 |      |       |      |     |     |      |       |      |   |     |     |     |     |
|            | (OR)         |                                                                                                                                                                                                                                                                                                                                                                                |         |     |      |       |      |     |     |      |       |      |   |     |     |     |     |
|            | 15.b.        | Evaluate the gradient of the road at the middle point of the elevation above a datum line of seven points of a road from the following data<br><table><tr><td>x</td><td>0</td><td>300</td><td>600</td><td>900</td><td>1200</td><td>15000</td><td>1800</td></tr><tr><td>y</td><td>135</td><td>149</td><td>157</td><td>183</td><td>201</td><td>205</td><td>193</td></tr></table> |         |     | x    | 0     | 300  | 600 | 900 | 1200 | 15000 | 1800 | y | 135 | 149 | 157 | 183 |
| x          | 0            | 300                                                                                                                                                                                                                                                                                                                                                                            | 600     | 900 | 1200 | 15000 | 1800 |     |     |      |       |      |   |     |     |     |     |
| y          | 135          | 149                                                                                                                                                                                                                                                                                                                                                                            | 157     | 183 | 201  | 205   | 193  |     |     |      |       |      |   |     |     |     |     |