

OR

- 6 a. Find the directional derivative of $\phi = x^2yz + 4xz^2$ at $P(1, -2, -1)$ in the direction of $2\mathbf{i} - \mathbf{j} - 2\mathbf{k}$. (06 Marks)
- b. If $\vec{F} = (x+y+1)\mathbf{i} + \mathbf{j} - (x+y)\mathbf{k}$. Show that $\vec{F} \cdot \text{curl } \vec{F} = 0$. (05 Marks)
- c. If $\vec{F} = \nabla(xy^3z^2)$, find $\text{div } \vec{F}$ and $\text{curl } \vec{F}$ at the point $(1, -1, 1)$. (05 Marks)

Module-4

- 7 a. Obtain the reduction formula for $\int \cos^n x dx$. (06 Marks)
- b. Solve $ye^{xy} dx + (xe^{xy} + 2y)dy = 0$. (05 Marks)
- c. Find the orthogonal trajectories of the family of curves $y^2 = Cx^3$. (05 Marks)

OR

- 8 a. Evaluate $\int_0^1 x^{3/2}(1-x)^{3/2} dx$. (06 Marks)
- b. Solve $\frac{dy}{dx} - \frac{2}{x}y = \frac{y^2}{x^3}$. (05 Marks)
- c. A body is heated to 110°C and placed in air at 10°C . After one hour its temperature becomes 60°C . How much additional time is required for it to cool to 30°C ? (05 Marks)

Module-5

- 9 a. Find the rank of the matrix $A = \begin{bmatrix} 4 & 0 & 2 & 1 \\ 2 & 1 & 3 & 4 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix}$. (06 Marks)
- b. Solve the following system of equations by Gauss Jordan method:
 $x + 2y + z = 3$, $2x + 3y + 3z = 10$, $3x - y + 2z = 13$ (05 Marks)
- c. Reduce the matrix $A = \begin{bmatrix} -1 & 3 \\ -2 & 4 \end{bmatrix}$ to the diagonal form. (05 Marks)

OR

- 10 a. Solve the following system of equations by Gauss-Seidal method:
 $20x + y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$. Perform three iterations. (06 Marks)
- b. Show that the transformation, $y_1 = 2x_1 - 2x_2 - x_3$, $y_2 = -4x_1 + 5x_2 + 3x_3$, $y_3 = x_1 - x_2 - x_3$ is regular and find the inverse transformation. (05 Marks)
- c. Reduce the quadratic form, $3x^2 + 3y^2 + 3z^2 + 2xy - 2yz + 2zx$ into the canonical form. (05 Marks)
