Mid-West University

Examinations Management Office

End Semester Examinations -2080

Bachelor level / B.E. Computer / 2nd Semester — Full Marks: 50
Time: 3 hours — Pass Marks: 25
Subject: Engineering Mathematics-II (SH421/SH503)

- *Attempt all the questions*
- *Figures in the margin indicate full marks.*
- *Assume suitable values, with a stipulation, if necessary.*
- *Candidates are required to answer the questions in their own words as far as possible.*

1 a. i. State and prove the Euler's theorem. [2]

ii. Find the extreme value for the function $x^2 + y^2 + z^2$ under the condition $x + y + z = 3a$. [3]

b. i. If $u = \log\frac{x^2+y^2}{x+y}$, then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 1$. [3]

ii. Evaluate $\int\int\int_V dxdydz$ over the region bounded by the planes $x = 0, y = 0, z = 0, y = 8$ and cylinder $x^2 + y^2 = 9$. [2]

2 a. i. Evaluate $\int_0^\infty \int_0^x x\, e^{\frac{-x^2}{y}} dxdy$ by changing the order of integration. [3]

ii. Find, by double integration, the area bounded by the curves $x^2 + y^2 = a^2$ and line $x + y = a$ in the first quadrant. [3]

b. i. Find the distance of the point $(1, -2, 3)$ from the plane $x - y + z = 5$ measured parallel to the line $\frac{x}{2} = \frac{y}{3} = \frac{z}{-6}$. [2]

ii. Find the magnitude and the equation of shortest distance between the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$. [4]

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

ii. Prove that the lines $\frac{x+1}{-3} = \frac{y-3}{2} = \frac{z+2}{1}$ and $\frac{x}{1} = \frac{y-7}{-3} = \frac{z+7}{2}$ are coplanar. Find the equation of plane containing them. [3]

b. State and prove the Rodrigue's Formula. [5]

4 a. i. Solve $y'' + xy' + y = 0$ by the power series method. [3]

ii. Prove that $J_{\frac{3}{2}}(x) = \sqrt{\frac{2}{\pi x}}\left(\frac{\sin x}{x} - \cos x\right)$. [2]

b. i. Find 'p' such that the vectors $2\vec{i} - \vec{j} + \vec{k}$, $\vec{i} + 2\vec{j} + 3\vec{k}$ and $3\vec{i} + p\vec{j} + 5\vec{k}$ are coplanar. [2]

ii. Find the set of the reciprocal system to the set of vectors $2\vec{i} - 3\vec{j} + 4\vec{k}, \vec{i} + 2\vec{j} - \vec{k}$, and $3\vec{i} - \vec{j} + 2\vec{k}$. [3]

5 a. Find the directional derivatives of $\emptyset(x, y, z) = x^2yz + 4xz^2$ at the point (1, -2,- 1) in the direction $2\vec{i} - \vec{j} - 2\vec{k}$. [3]

b. Find the radius of convergence and interval of convergence of the series $\sum_{n=1}^{\infty} \frac{(-3)^n(x)^n}{\sqrt{n+1}}$. [4]

The End