Question Paper

Exam Date & Time: 14-Jun-2024 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SECOND SEMESTER B.TECH. EXAMINATIONS - JUNE 2024
SUBJECT: MAT 1271/MAT_1271 - ENGINEERING MATHEMATICS - II
(CHEMISTRY GROUP)

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1A) Find the maxima and minima of the function (5)

$$f(x,y) = x^2 + xy + y^2 + 3x - 3y + 4.$$

1B) (5)

(i) If $u = x^2 + xy + y^2 + z^2$ then find $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}$.

(ii) If $u = e^x \sin y$ then find $\frac{\partial^2 u}{\partial x^2}$ and $\frac{\partial^2 u}{\partial y^2}$.

2A) Find the equation of the sphere having the circle (4)

$$x^2 + y^2 + z^2 - 9 = 0\,;\ x + y + z = 3$$

as a great circle.

2B) Expand $f(x,y) = x^3y^2 + 3xy - 4$ about the point $(1,1)$ up to second degree terms. (3)

2C) Evaluate $\lim_{x\to 2} \frac{x^3-7x^2+10x}{x^2+x-6}$ (3)

3A) Evaluate (5)

$$\int_{x=0}^{4}\int_{y=0}^{5}(x+y)dy\,dx$$

3B) Using Beta and Gamma functions, evaluate (5)

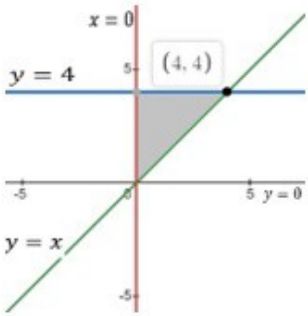
$$\int_0^{\frac{\pi}{2}} \sqrt{\cot\theta}\ d\theta$$

4A) Using Laplace transforms, solve $y'' + 7y' + 12y = 0$ where $y(0) = 1, y'(0) = 0$. (5)

4B) Evaluate $L^{-1}\left\{\frac{1}{(s-2)(s+3)}\right\}$ (5)

5A) Using double integrals, find the area of the shaded region bounded by the lines (4)

$y = x\,, y = 4$ and $x = 0$.



5B) Use Quotient test and discuss the convergence of the series (3)

$$\sum_{n=1}^{\infty} \frac{n+2}{n^2(n-3)}$$

5C) Use Ratio test and discuss the convergence of the series (3)

$$\sum_{n=1}^{\infty} \frac{n!\,3^n}{n^n}$$

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