MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL

II SEMESTER B.TECH. END SEMESTER (MAKE-UP) EXAMINATIONS JUNE 2019

SUBJECT: ENGINEERING MATHEMATICS - II [MAT 1251]

Time : 3 hrs

Max. Marks: 50

Instructions to Candidates:

- Answer ALL the questions & missing data may be suitably assumed

1A) Expand $f(x,y) = x^2y + 3y - 2$ in powers of $(x-1)$ and $(y+2)$ up to second degree terms.

1B) Verify Cauchy Mean value theorem for the functions $f(x) = e^x$ and $g(x) = e^{-x}$ in the interval [3,5].

1C) Test the convergence of the series

$$\frac{1}{1.2.3} + \frac{3}{2.3.4} + \frac{5}{3.4.5} + \cdots$$

(4+3+3)

2A) Find the values of $'m'$ and $'n'$ such that $\lim_{x\to 0} \frac{x(1+m\cos x) - n\sin x}{x^3} = 1$.

2B) Find the maxima and minima of the function $f(x,y) = x^3 + y^3 - 3axy$ where $a \neq 0$.

2C) Find the equation of the sphere having the circle

$x^2 + y^2 + z^2 + 10y - 4z - 8 = 0, x + y + z = 3$ as a great circle.

(4+3+3)

3A) Using Laplace transforms, solve the differential equation

$y''(t) - 3y'(t) + 2y(t) = 4t + e^{3t}$, when $y(0) = 1, y'(0) = -1$.

3B) Prove that $\beta(m,n) = \frac{\Gamma m\, \Gamma n}{\Gamma(m+n)}$ for $m, n > 0$

3C) Express the function $f(t) = \begin{cases} 0, & 0 < t < 1 \\ t-1, & 1 < t < 2 \\ 1. & t > 2 \end{cases}$ in terms of unit step function and hence find $L\{f(t)\}$.

(4+3+3)

4A) Change of order of integration and hence evaluate $\int_0^a \int_{x^2/a}^{2a-x} xy\, dy\, dx$

4B) Find $L^{-1}(\log\frac{s+1}{s-1})$

4C) If $z = \sqrt{x^2+y^2}$ and $x^3 + y^3 + 3axy = 5a^2$, then find the value of $\frac{dz}{dx}$, when $x = y = a$.

(4+3+3)

5A) Evaluate $\iint (x+y)^2 dxdy$ over the region R, the parallelogram in the xy-plane with vertices $(1,0), (3,1), (2,2), (0,1)$, using the transformation $u = x + y$ and $v = x - 2y$.

5B) Find the volume of the solid bounded by the planes

$$x = 0, y = 0, x + y + z = 6 \text{ and } z = 0.$$

5C) Test the convergence of the series $\sum_{n=1}^{\infty} \frac{\sqrt{n}}{\sqrt{n^2+1}} x^n$ where $x > 0$.

(4+3+3)