Reg. No.										

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(MAHE Manipal)

I SEMESTER B. Sc. (Applied Sciences) in Engg.

End – Semester Theory Examination – Jan / Feb 2022

SUBJECT: MATHEMATICS -I (MA 111)

(BRANCH: COMMON TO ALL)

Time: 3 Hours **Date: 31 January 2022** **Max. Marks: 50**

- ✓ **Answer ALL Questions.**
- ✓ **Missing data, if any, may be suitably assumed.**

1A. Find the interval of convergence of the following series $3x+3^4x^4+3^9x^9+\cdots\cdots\cdots\cdots$

1B. Evaluate $\lim_{x\to 0}\left[\frac{\sinh x}{x}\right]^{\frac{1}{x^2}}$

1C. Find the ρ for the curve $r^m=a^m\cos m\theta$

(4+3+3)

2A. Find the missing value of

x	0	1	2	3	4	5	6
y	5	11	22	40	?	140	?

2B. Find the angle of intersection of two curves $r^n=a^n\cos n\theta$ and $r^n=b^n\sin n\theta$

2C. Using Lagrange's mean value theorem show that $\frac{x}{1+x}<\log(1+x)<x$, $x>0$. Hence show that $0<\left\{\left[\log(1+x)\right]^{-1}-x^{-1}\right\}<1$.

(4+3+3)

3A. Trace the curve $y^2\left(a^2+x^2\right)=x^2\left(a^2-x^2\right)$

3B. Test for convergence or divergence of the following series $\sum\sin^{-1}\left(1/n\right)$

3C. Verify Rolle's theorem for $f(x)=(x-a)^m(x-b)^n$; m, n being positive integers and $x\in[a,\ b]$. Hence find C.

(4+3+3)

4A. Expand $y = e^{\tan^{-1} x}$ in Maclaurin series upto term containing x^4.

4B. Find the area outside the circle $r = 2a\cos\theta$ and inside the cardioid $r = a(1+\cos\theta)$

4C. If $y = \sin\log\left(x^2 + 2x + 1\right)$, then show that

$$(x+1)^2 y_{n+2} + (2n+1)(x+1)y_{n+1} + \left(n^2+4\right)y_n = 0$$

(4+3+3)

5A. If $\cos^{-1}\left(\frac{y}{b}\right) = \log\left(\frac{x}{n}\right)^n$, then show that

$$x^2 y_{n+2} + (2n+1)xy_{n+1} + 2n^2 y_n = 0$$

5B. Find the surface of the solid formed by revolving the cardioid $r = a(1-\cos\theta)$ about the initial line.

5C. Evaluate $\int_0^{\pi} \sqrt{\frac{1-\cos\theta}{1+\cos\theta}} \sin^2\theta d\theta$

(4+3+3)