Reg. No.									

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(MAHE Manipal)

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

End – Semester Theory Make-up Examination – March 2022

SUBJECT: MATHEMATICS -I (MA 111)

(BRANCH: COMMON TO ALL)

Time: 3 Hours **Date: Wednesday 23 March 2022** **Max. Marks: 50**

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

1A. Trace the curve $r = a\cos(2\theta),\ a > 0$

1B. Test whether the following series is convergent or divergent, $\sqrt[3]{n^3+1} - n$

1C. Prove that if $0 < a < b$, $\dfrac{b-a}{1+b^2} < \left(\tan^{-1} b - \tan^{-1} a\right) < \dfrac{b-a}{1+a^2}$

(4+3+3)

2A. Expand $y = \log\left(1+\sin^2 x\right)$ in Maclaurin series upto the term containing x^4

2B. Find the volume generated by an arc of the parabola $y^2 = 4ax$ from the vertex to the latus rectum about x axis.

2C. Verify Cauchy's mean value theorem for $f(x) = x^2$, $g(x) = x^4$ in $[a,\ b]$, $a,\ b > 0$ and hence find the value of c.

(4+3+3)

3A. Using Newton's divided difference formula, find $f(8)$ and $f(15)$ from the following data

x	4	5	7	10	11	13
$f(x)$	48	100	294	900	1210	2028

3B. Evaluate $\int_2^3 (x-2)^4 (3-x)^5\, dx$

3C. Evaluate $\lim_{x\to 0}\left[\dfrac{a}{x} - \cot\left(\dfrac{x}{a}\right)\right]$

(4+3+3)

4A. Find the interval of convergence of the following series $\frac{x}{1+\sqrt{1}}+\frac{x^2}{2+\sqrt{2}}+\frac{x^3}{3+\sqrt{3}}\cdots\cdots\cdots\cdots$

4B. Find the length of the arc of parabola $x^2=4ay$ measured from the vertex to one extremity of latus rectum.

4C. Show that evolute for the curve $x^{2/3}+y^{2/3}=a^{2/3}$ is $(x+y)^{2/3}+(x-y)^{2/3}=2a^{2/3}$

(4+3+3)

5A. (a) Find $\frac{dS}{dx}$ for the curve $x^{2/3}+y^{2/3}=a^{2/3}$

(b) Find $\frac{dS}{dt}$ for the curve $x=ae^t\sin t,\ y=ae^t\cos t$

5B. Show that the curve $r^n=a^n\sec(n\theta+\alpha)$ and $r^n=b^n\sec(n\theta+\beta)$ intersects at an angle which is independent of a and b.

5C. Find the n^{th} derivative of the function $f(x)=\frac{1}{1-x-x^2+x^3}$

(4+3+3)