Indian Institute of Information Technology, Nagpur
Department of Basic Sciences
Calculus for Data Science (MAL 105)
Sessional -I Examination
B.Tech. 1st Semester – CSE- Data Science, CSE-AIML

Duration: 1 hour | Max. Marks: 15
Date: December 19th, 2022 (Monday) | Time: 11:00 am - 12:00 pm

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Important Instructions:
(i) This is a closed book, closed notes examination.
(ii) This question paper comprises total 6 questions printed on one page. **Attempt any five questions.** Maximum marks for a particular question are indicated in the brackets [ ] on the extreme right of the corresponding question.
(iii) Use of non-programming calculators are permitted.
(iv) Please indicate the important steps of reasoning/calculations carefully.
(v) Assume suitable data wherever necessary. Please mention the assumptions made, if any.

Q. 1: Test the convergence of the following series:

$$x+\frac{2^2x^3}{2!}+\frac{3^3x^5}{3!}+\frac{4^4x^7}{4!}+\ldots$$ [CO 1] **[3 Marks]**

Q. 2: Use Taylor's theorem to prove that [CO 2] **[3 Marks]**

$$\tan^{-1}(x+h)=\tan^{-1}x+h\sin z.\frac{\sin z}{1}-(h\sin z)^2\frac{\sin 2z}{2}+(h\sin z)^3\frac{\sin 3z}{3}-\ldots+(-1)^{n-1}(h\sin z)^n\frac{\sin nz}{n}$$

Where $z=\cot^{-1}x$

Q. 3 Trace the curve $y^2(x^2+y^2)+a^2(x^2-y^2)=0$. [CO 2] **[3 Marks]**

Q. 4: Evaluate by using Beta and Gamma function [CO 2] **[3 Marks]**

$$\int_0^1\frac{x^2}{(1-x^4)^{1/2}}dx\times\int_0^1\frac{1}{(1+x^4)^{1/2}}dx$$

Q. 5: If 0<x<1, show that $2x<\log\frac{1+x}{1-x}<2x\left(1+\frac{1}{3}.\frac{x^2}{1-x^2}\right)$ [CO 2] **[3 Marks]**

Q. 6: Trace the curve $r=a\cos 3\theta$ [CO 2] **[3 Marks]**