RV University

School of Computer Science and Engineering

B.Tech Degree Examination-May 2025

Semester : **IV**

Course Code : **CS2802**

Course Title : **Calculus and Laplace Transforms**

Duration : **2 Hours** **Max. Marks: 30**

Instructions to students:

- *There are **3** pages in the question paper in two parts, **Part-A and Part-B**. Ensure that you have a complete set of question paper before answering.*
- *Write your **USN** number on the question paper as soon as you receive it.*
- *Do not write any part of the answers on the question papers.*
- *The number in square bracket [ ] at the end of each questions indicate the marks for that question.*
- ***Basic non-scientific calculators are allowed.***
- *All questions are compulsory.*

Sl. No.	PART A – Max Marks (10)	Marks	L1 - L6	CO
1.	Assume that the activation function of a neural network has the general form given by $y(u) = \frac{1}{u}$. If u is a function of x and it is given by, $u(x) = 1 + e^{-3x}$: a) Determine $y(x)$. [2] b) The derivative of $y(x)$ with respect to x, i.e., $y'(x)$ is an important quantity to compute back propagation in neural networks. Compute $y'(x)$. [3]	5	L2	CO1
2.	A function $f(x,y)$ is given by: $f(x,y) = \frac{x^2}{16} + \frac{y^2}{25}$. a) Calculate the tangent plane at $P_0 = (1,1)$. [3] b) Compute the divergence of the gradient of $f(x,y)$ at P_0. [2]	5	L2	CO3

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Sl. No.	PART B – Max Marks (20)	Marks	L1-L6	CO
3.	The data flow over a network as function of time, t in seconds is given to be: $f(t) = 2t^3 - 12t^2 + 18t$ in megabits. a) Calculate the data speed in mbps at time t ? [2] b) Using MVT, determine the instant of time $t = c$ where the instantaneous data speed is equal to the average speed on the interval [1,2]. [3] c) Calculate the total data (using integration) that has flown through the network in the interval, [1,2]. [3] d) Determine whether the data speed is increasing or decreasing at $t = 1.5sec.$ [2]	10	L3	CO2
4.	In an industrial cooling system, the temperature distribution in a 3D space (in meters) is modelled by the function is $f(x, y, z) = x^2 + 2y^2 + 3z^2$, where $f(x, y, z)$ gives the temperature in degrees Celsius, and x, y, z represent spatial coordinates inside the cooling chamber. a) Calculate the partial derivatives of $f(x, y, z)$with respect to $x, y, and\ z$. [3] b) If a sensor starts at position (1,1,0) inside the chamber, simulate the first two steps of movement along the temperature surface using a step size of 0.1 mtrs ($\alpha = 0.1$), based on the gradient of the temperature field. [5] c) Compute the gradient vector $\nabla f(x, y, z)$ at the point (1,1,0). [2]	10	L3	CO3

Course Outcomes:

CO1	Apply foundational concepts of functions, limits, continuity and derivatives to solve various engineering problems.
CO2	Apply derivatives and integrations in problems including rate of change, surface areas, volumes, probabilities and single variable optimization.
CO3	Solve linear approximations and unconstrained optimization problems related to engineering applications.
CO4	Apply Laplace transform to solve problems on time varying signals.

Marks Distribution

L1	L2	L3	L4	L5	L6	CO1	CO2	CO3	CO4
-	10	20	-	-	-	5	10	15	-