PAPER ID-410160

Subject Code: KOE065

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM VI) THEORY EXAMINATION 2023-24
COMPUTER BASED NUMERICAL TECHNIQUES

TIME: 3 HRS **M.MARKS: 100**

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief.

a.	Explain the concept of error in a series approximation.	2
b.	Give an example of a simple iteration method.	2
c.	Evaluate Hermite's Interpolation.	2
d.	What is the principle of finite difference?	2
e.	Distinguish Newton's forward formula and backward formula for numerical differentiation.	2
f.	Explain how Lagrange's interpolation can be used for numerical differentiation, even though it's primarily an interpolation method.	2
g.	Enumerate types of errors.	2
h.	Describe differential equation.	2
i.	Explain boundary value problem.	2
j.	Explain the calculation of a distillation column.	2

SECTION B

2. Attempt any *three* of the following:

a.	How are rounding and truncation techniques applied to numbers, and what are the implications of these operations on accuracy.	10
b.	Compare and contrast the use of Gauss forward and backward interpolation formulas with central difference formulas like Stirling's, Bessel's, and Everett's formulas. When might one type be preferred over the other?	10
c.	State and derive Simpson's 1/3 rule for numerical integration. What are its advantages and limitations?	10
d.	Using Picard's process of successive approximations, obtain a solution up to the fifth approximation of the equation dy/dx = y + x, such that y = 1 when x = 0.	10
e.	Describe the application of finite difference method to solve eigenvalue problems.	10

SECTION C

3. Attempt any *one* part of the following:

a.	Explain the importance of error analysis and uncertainty quantification in scientific and engineering applications, and describe some common methods used for this purpose.	10
b.	For the given function f(x) = x^3 – x – 1, a real root lies in between the interval [1,2]. Find the minimum number of iterations required to find the root up to the accuracy of two decimal points.	10

4. Attempt any *one* part of the following:

a.	Find Solution using Everett's formula **x** | **f(x)** **1** | **1** **1.1** | **1** **1.2** | **1.1** **1.3** | **1.1** For x=1.15	10
b.	How does Newton's divided difference formula differ from the standard Newton's forward and backward difference formulas? Explain its role in polynomial interpolation.	10

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5. Attempt any *one* part of the following:

a.	What is the general form of Newton's forward difference formula? Derive the formula for the first and second-order approximations.	10
b.	Find Solution using Newton's Backward Difference formula x=1925	10

x	f(x)
1891	46
1901	66
1911	81
1921	93
1931	101

6. Attempt any *one* part of the following:

a.	Find y(0.2) for y' = $\frac{x-y}{2}$, x_0=0, y_0=1, with step length 0.1 using Runge-Kutta 2 method (1st order derivative)	10
b.	Explain the significance of numerical methods in solving differential equations. Why are analytical solutions not always feasible, and how do numerical methods address these limitations?	10

7. Attempt any *one* part of the following:

a.	What is the significance of hyperbolic PDEs and how can they be solved numerically.	10
b.	Find the eigenvalues and eigenvectors of $\begin{pmatrix} 2 & 0 & 0 \\ 0 & 3 & 4 \\ 0 & 4 & 9 \end{pmatrix}$	10