

1058
B. Engg. (Mechanical Engg.)
4th Semester
MEC-404: Numerical Analysis

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Q. No. 1 which is compulsory and selecting atleast two questions from each Unit. Use of simple calculator is allowed. Each question carries equal marks.

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I. Attempt the following: -

- (a) What are significant digits? Round off to four significant digits:
 - (i) 49.85561
 - (ii) 0.0022218
- (b) Define absolute error, relative and percentage error. Given that $C = 15300 \pm 100$, find the maximum value of the absolute error in C^3 .
- (c) How does the secant method compare with Regular-Falsi method, Newton's method? List out the similarities and differences between them.
- (d) Differentiate between interpolation and extrapolation. Write down any three uses of polynomial interpolation.
- (e) Explain the similarities and differences between Lagrange interpolation and Hermite interpolation.
- (f) What is partial and complete pivoting? Explain why do we do pivoting.
- (g) List out the limitation of Taylor series method.
- (h) Evaluate: $\frac{\Delta}{E}(\sin x)$, taking 'h' as the interval of differencing.
- (i) Give the error in Simpson's $\frac{1}{3}$ rd rule.
- (j) What is economization of power series? (5×2)

UNIT-I

- II.
 - (a) Explain how error propagation can lead to numerical instability? Given that $u(x,y,z)=xy+yz=zx$, find the relative percentage error in the computation of $u(x,y,z)$ at $x=2.104$, $y=1.935$ and $z=0.845$.
 - (b) Find the smallest positive root of equation $\tan x = x$, using iteration method correct to four decimal places. (5+5)
- III.
 - (a) Find a quadratic factor of the polynomial $f(x) = x^3 - x - 1$, using Lin-Baisstow's method.
 - (b) Given $\sin 45^\circ = 0.7071$, $\sin 50^\circ = 0.7660$, $\sin 55^\circ = 0.8192$, $\sin 60^\circ = 0.8660$, find $\sin 52^\circ$, by using method of interpolation. (5+5)

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(2)

- IV. (a) Using the following table, find $f(x)$ as a polynomial in powers of $(x-3)$:

x:	5	11	27	34	42
f(x):	23	899	17315	35606	68510

- (b) Apply Hermite's formula to find a cubic polynomial which meets the following conditions:

	xk:	f(xk)	F'(xk)
x ₁	0	0	0
x ₂	1	1	1

(5+5)

UNIT-II

- V. (a) Solve the following system by Gauss-Scidel iteration method:
 $x-y+5z=7$; $x+4y-z=6$, $6x+y+z=20$

- (b) Reduce the matrix: $A = \begin{bmatrix} 1 & 3 & 4 \\ 3 & 2 & -1 \\ 4 & -1 & 1 \end{bmatrix}$ to the tridiagonal form. (5+5)

- VI. (a) Explains power method for finding the dominant eigenvalue of a square matrix. Find the largest eigenvalue and the associated eigenvector of the matrix $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ using it.

- (b) Apply Romberg's method of show that $\int_0^{\frac{\pi}{2}} \sin x dx = 1$. (5+5)

- VII. (a) Use Runge-Kutta fourth order method to find $y(0.2)$ given that $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, $y(0) = 1$

- (b) Economize the power series $\sin x = x - \frac{x^3}{6} + \frac{x^5}{120} - \frac{x^7}{5040}$ (5+5)

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