

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE – RAIGAD – 402 103**

Summer Supplementary Semester Examinations – May – 2018

Branch: M.Tech. (Structural Engineering)

Semester: I

Subject with Subject Code:- Numerical Methods CVSE-E1/02

Marks: 60

Date:- May 05, 2018

Time: 3 Hrs.

Instructions to the Students

1. Each question carries 12 marks.
2. Attempt any five questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.
5. Show all computations up to the fourth place of decimal.

- Q1 (a) Write a short note on the different representations of numbers in different bases. 4
(b) The numerical representation in the octal number system for a certain number is 435.231. 4
However, in a certain computer, the limitation for storage of numbers is only upto the fourth place after the floating point. Find the percentage error incurred in the storage of the number. 4
(c) Write short notes on (i) mantissa and (ii) exponent.

- Q2 (a) Use the Gaussian Jordan method to solve the following system of equations. 4
$$\begin{aligned} 3x + 5y + 4z + 5w &= 17 \\ 7x + 2y - 3z + 8w &= 14 \\ 3x + 8y - 2z - 2w &= 7 \\ 5x + 7y - 3z - 3w &= 6 \end{aligned}$$

(b) What is the requirement of the Gauss Siedel method for convergence? 4
(c) Explain the bisection method with a diagram. Explain the mathematical theory behind the method. 4

- Q3 (a) Use the following data to create the Newton interpolant polynomial to determine the value of the interpolant at $x=1$. 6

x	-5	-2	0	2	5
y	0.0385	0.2000	1.0000	0.2000	0.0385

- (b) Find the quadratic polynomial $y = ax^2 + bx + c$, which fits the following data, using the least squares method: 6

x	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
y	8.9708	8.4743	8.0494	8.2300	8.2635	8.5345	8.3241	9.0896	8.5293	8.8433	9.9670

- Q4 (a) Use the Simpson's $1/3^{\text{rd}}$ rule to compute the value of the following integral 6

$$\int_5^6 \frac{4x^3 + 14x}{x^4 + 7x^2 + 10} dx$$

.Use 6 segments for the calculation. Compute the percentage error with respect to the value obtained using classical methods.

- (b) Use appropriate Gaussian Quadrature to solve the integral: 6

$$\int_0^{\infty} e^{-x^2} \left(\frac{3x^2 + 10x}{x^3 + 5x^2 - 6} \right) dx$$

- Q5 (a) Solve the following differential equation with the Euler method: 6

$$\frac{dy}{dx} = xy^2 + x^2y + 1, \quad y(x = 0) = 0.1$$

Find the value of y at $x = 1$. Use a step size of 0.1.

- (b) Write a short note on the Wilson Theta method. 6

- Q6 (a) Write a short note on eigen values and eigen vectors. 6

- (b) Solve the boundary value problem using the shooting method: 6

$$\frac{d^2y}{dx^2} - 2y = 8x(9 - x)$$

with the boundary conditions $y(x = 0) = 0$, and $y(x = 1) = 0$. Use a step size of 0.25.