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Q. 1 Do as directed

(i) The number of significant digit(s) in 0.0500 is/are ----------

(ii) Measurements done by the scale having calibration error will be Biased/Uncontained.

(iii) Truncation error in the central difference finite divide difference is of the order of----------.

(iv) Sum of 2.29 and 62.7 giving respect to accuracy level of each number is ---------

(v) Estimated error is always --------- than true error.

(vi) Well conditioned systems are those where small changes in coefficients result in ---------- changes in solution.

(vii) 1/3 Simpson's rule is ---------- order accurate.

(viii) Solution of the cubic differential equation with RK third order method will be ----------.

(ix) The valid Fortron code for $e^b\tan^3(a)$ is ----------

(x) While declaring any variable as doubleprecision in FORTRON code, by default it is considered as real variable (TRUE/FALSE).

Q. 2 (a) What do you understand by Accuracy and precision. Explain with suitable example. **(4)**

(b) Evaluate the sum $S = \sqrt{3} + \sqrt{5} + \sqrt{7}$ to 4 significant digits and find its absolute and relative error. **(5)**

(c) Round off the following to four significant digits. **(3)**
363042, 0.0063945, 0.090038

Q.3 (a) In environmental engineering, the following equation can be used to compute the oxygen level in a river downstream from a sewage discharge:

$$c = 10 - 20\left(e^{-0.2x} - e^{-0.75x}\right)$$

where *x* is the distance downstream in kilometres. Determine the distance downstream where the oxygen level first falls to a reading of 5. Determine your answer to a 1% error. Initial gauss can be chosen as 1. **(8)**

(b) Explain the concept of bisection method graphically and write the necessary conditions to find out the real root by bisection method**.** **(4)**

Q.4 (a) What do you understand by "Ill conditioned" and "well conditioned". **(3)**

(b) Given the system

$$x_1 + x_2 - x_3 = -3$$
$$6x_1 + 2x_2 + 2x_3 = 2$$
$$-3x_1 + 4x_2 + x_3 = 1$$

Solve by naïve Gauss elimination with partial pivoting. Show all the steps of computation. **(9)**

Q. 5 (a) The heat flux q is the quantity of heat flowing trough a unit area of a material per unit time. It can be computed with Fourier's law $q = -k\frac{dt}{dx}$ where q has unit W/m^2 and k is a coefficient of thermal conductivity that parameterizes the heat conducting properties of the material and has units of W/^{0}C.m, T = Temperature (^{0}C); and x = distance (m) along the path of heat flow. The following temperature are measured from the surface (x = 0) into a stone wall

x (m)	0	0.1	0.2
T (^{0}C)	20	17	15

If the flux at $x = 0$ is 60 W/m^2, compute k. **(8)**

(b) Derive the multiple application Trapezodial formula, to be used for numerical integration. **(4)**

Q. 6 (a) The table below gives the temperature T (^{0}C) and length l (mm)of a heated rod. If $l = a_0 + a_1T$, find the values of a_0 and a_1 using linear least squares. **(8)**

T	40	50	60	70	80
l	600.5	600.6	600.8	600.9	601.0

(b) Write the algorithm of finding the root by bisection method. **(4)**

Q. 7 Solve the following ODE using Euler's method from t = 0 to 3 taking step size of 0.5. Find the local error in each step.

$$\frac{dy}{dt} = -y + t \qquad \text{given } y(0) = 1$$ **(12)**

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