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Total No. of Questions : 09

B.Tech.(CE) (2011 Onwards) (Sem.–6)

NUMERICAL METHODS IN CIVIL ENGINEERING

Subject Code : BTCE-604

M.Code : 71085

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q1. Answer the following :

a) Define least square interpolation.

b) Find an interval containing a root of the equation $x - \cos(x) = 0$.

c) Explain Implicit solutions.

d) Determine the Lagrange interpolating polynomial passing through the points (2, 4) and (5, 3).

e) Explain Explicit solutions.

f) Explain briefly the Newmarks procedure.

g) What is the order of convergence when Newton Raphson's method is applied to the equation $x^2 - 6x + 9 = 0$ to find its multiple root.

h) Use the forward-difference formula to approximate the derivative of $f(x) = \ln x$ at $x_0 = 1.8$ using $h = 0.01$.

i) Write a short note on bisection method.

j) Define initial value problem with a suitable example.

SECTION-B

Q2. Use the Runge-Kutta method of order 4 ton approximate the solution of the following initial value problem

$y' = y - t^2 + 1,\ 0 \le t \le 2,\ y(0) = 0.5.$

Q3. Apply Gauss Jordan method to find the inverse of the matrix

$$\begin{bmatrix} -2 & -3 \\ 6 & 7 \end{bmatrix}$$

Q4. The following data is given :

1.0	1.3	1.6	1.9	2.2
0.7651977	0.6200860	0.4554022	0.2818186	0.1103623

Use Lagrange interpolation to approximate $f(1.5)$ with $x_0 = 1.6$.

Q5. Find a real root, correct to three decimal places of the equation $2x - 3 = \cos(x)$ lying in the interval $\left[\frac{3}{2}, \frac{\pi}{2}\right]$.

Q6. Use Newton's iterative method to find the root of the equation $3x - \cos(x) + 1 = 0$ starting with an initial guess 0.6.

SECTION-C

Q7. Determine the values of h that will ensure an approximation error of less than 0.00002 when approximating $\int_0^{\pi} \sin x dx$ and employing :

a) Composite trapezoidal rule.

b) Composite Simpson's rule.

Q8. The function $f(x) = \tan \pi x - 6$ has a zero at $\pi \arctan 6 \approx 0.447431543$. Let $p_0 = 0$ and $p_1 = 0.48$. Use ten iterations of the secant method to approximate this root.

Q9. A certain stimulus administered to each of the 12 patients resulted in the following increase in blood pressure :

5, 2, 8, –1, 3, 0, –2, 1, 5, 0, 4, 6.

Can it be concluded that the stimulus will, in general, be accompanied by an increase in blood pressure.

NOTE : Disclosure of identity by writing mobile number or making passing request on any page of Answer sheet will lead to UMC case against the Student.