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RN-6845

B. E. III (Sem. V) (I.T.) Examination

May / June – 2010

Numerical Methods in Engineering

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. 3 (Sem. 5) (I.T.)**

Name of the Subject :

☛ **Numerical Methods in Engineering**

☛ Subject Code No. : **6 8 4 5** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Answers to **both** the sections must be written in **separate** answer books.

(3) Figures to the extreme **right** indicate maximum marks.

(4) Assume **suitable data**, if **necessary**.

(5) Support your answer with **neat** and **clean** diagram wherever **necessary**.

SECTION - I

1 (a) (1) Do as directed : **6**

(i) Define interpolation and extrapolation.

(ii) Define transcendental equations.

(iii) Let x=0.005998, then the relative error is x is truncated to three decimal digits is _____.

(iv) Let x=0.00458529, then the absolute error is x is rounded-off to three decimal digits is _____.

(v) Define ordinary differential equation.

(vi) What is initial value problem ?

(2) State ture or false : 4

(1) False position method is faster than Secant method.

(2) If x_a is the approximate value of x after truncation to k digits is

$$\left[x - x_a\right] < 0.5 * 10^{-k+1}.$$

(3) Error in Runge-Kutta 2nd order method is $O\left(h^3\right)$ per step.

(4) 30.06 is the resultant number obtained when 30.0567 is rounded off to four significant digits.

(b) Calculate the value of tan 48°15' from the following table : 4

x^0	45	46	47	48	49	50
tan x^0	1.00000	1.03053	1.07237	1.11061	1.15037	1.19175

(c) Define error propagation. Explain error propagation in addition operation and in multiplication operation.

2 Attempt the following questions : (any **two**) **16**

(1) Derive the formula for the Newton's divided difference interpolation, also write down the algorithm.

(2) Derive the formula for Runge-Kutta fourth order method. Find the solution correct to three decimal position, in the interval [1, 1.5] for dy/dx=x*y with y(1)=5.

(3) Using Bisection method, find a real root of the equation $3x - \sqrt{1+\sin x}$. Guess the number of iterations.

3 (a) Find the cube root of 100 correct up to 3 decimal places using Newton-Raphson method. 8

OR

(a) Find the solution for the equation 8

$$x^2 - \log_e x - 12 = 0$$

using Secant method.

(b) Derive Newton's Forward difference interpolation. 8

Calculate the value of $\log_{10}656$.

x	$\log_{10}654$	$\log_{10}658$	$\log_{10}659$	$\log_{10}661$
$f(x)$	2.8156	2.8182	2.8189	2.8202

SECTION - II

4 (a) Answer the following questions : **6**

(1) Write the equation for the following :

"Regression Line of y on x".

(2) Define Skew-Symmetric Matrix.

(3) Gauss Elimination method is divided into two steps, they are _____ and _____.

(4) What is numerical quadrature ?

(5) State the Direct methods of non-homogeneous system of linear equations.

(6) Define identity matrix with example.

(b) State whether the given statements are true or false : 4

(1) If the function is tabulated at equal intervals then we can use divided difference interpolation.

(2) In Simpson's 1/3 rule, the given interval of integration must be divided into an even number of sub-interval.

(3) If any two rows of the determinant are interchanged, the determinant retains its value but the sign changes.

(4) Triangularization and back substitution are steps of Jacobi's method.

(c) (1) List down the properties of determinants. 4

(2) Compare and contrast between : 4

(a) Jacobi method ***Vs.*** Gauss Seidel method.

(b) Gauss elimination method ***Vs.*** Gauss Jordan method.

5 Attempt the following questions : (any **two**) **16**

(1) Find the solution of the following set of equations using method of factorization.

$2a + 8b + 2c = 14$

$a + 6b - c = 13$

$2a - b + 2c = 5$

(2) Fit a straight line to the following data 8
(Hint : Regression line of x on y)

x	1	2	3	4	5
y	5	7	9	10	11

Determine both regression lines and prove that they intersect at the means of x and y respectively.

(3) The distance covered by a athlete for the 50 metre race is given in the following table :

Time (sec):	0	1	2	3	4	5	6
Distance (metre):	0	2.5	8.5	15.5	24.5	36.5	50

Determine the speed of athlete at t=5 sec. correct to two decimals.

6 (a) Describe Gauss-Elimination method to find solution of system of linear equations. Also write a 'c' - programme for it. 8

(b) Use Simpson's 3/8 rule to find the approximation of the given integration. 8

$$\int_0^6 \left(e^x / 1 + x \right)$$

OR

(b) Use Trapezoidal rule and Simpson's 1/3 rule to find the approximation of the given integration. 8

$$\int_0^6 \left(dx / 1 + x^2 \right)$$