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Total Number of Pages: 02 **M.TECH**
P2PRCC14

2nd Semester Regular Examination 2016-17
Advance Numerical Methods

BRANCH: MECHANICS, SOIL MECHANICS & FOUNDATION ENGG, STRUCTURAL & FOUNDATION ENGG, STRUCTURAL ENGG, TRANSPORTATION ENGG, WATER RESOURCE ENGG, WATER RESOURCE ENGG AND MANAGEMENT

Time: 3 Hours
Max Marks: 100
Q.CODE: Z953

Answer Question No.1 which is compulsory and any FOUR from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: ***Short answer type*** **(2 x 10)**

a) Develop a recursive power function in C language for evaluating X^y where X is mantissa and y is exponent.
b) What is Roll's theorem?
c) What are the different conditions for satisfying vector norm?
d) Find rational approximation $of\ the\ form\ \frac{a_0+a_1x.}{1+b_1X}$
e) How can you represent a range of computer number in IEEE standard?
f) State Gaussian Quadrature for numerical integration.
g) State *forward substitution method* for solving a system of linear equations.
h) What is the difference between *nodal points* and *grid points*?
i) Devise the procedure for improving accuracy of Trapezoidal rule using Romberg equation by eliminating successive terms in asymptotic expansion.
j) Differentiate between *interpolation* and *extrapolation*.

Q2 **a)** Explain Newton- Raphson Method for solving system of nonlinear equation? Find Error Criteria in NR method. **(10)**

b) Using Gauss Elimination method, solve the following system of linear equations. **(10)**

$$x_{1+}x_{2+}x_3 = 6$$
$$3x_{1+}3x_{2+}4x_3 = 2$$
$$2x_{1+}\ x_{2+}3x_3 = 13$$

Q3 **a)** Solve the initial value problem. **(10)**

u'=-2tu^2,u(0)=1.
With h=0.2 on interval [0, 0.4]. Use fourth order classical RungeKuatta method.

b) Evaluate double integral $\int_1^5 ((\int_1^5 (\frac{dx}{(x2+y2)1/2})) dy$. **(10)**
Using trapezoidal rule with two subintervals and extrapolate.

Q4 **a)** Evaluate $\int_0^1 \frac{dx}{1+x}$. **(10)**
Using Simpsons 3/8th rule. Compare with exact solution.

b) Using Newton's backward difference interpolation, construct the interpolating polynomial that fits data. **(10)**

x	0.1	0.3	0.5	0.7	0.9	1.1
f(x)	-1.699.	-1.073	-0.375	0.443	1.429	2.631

Estimate value of f(x) at x=0.6 and x=1.0

Q5 **a)** Find all Eigen values and vectors of the given matrix. **(10)**

$$A=\begin{pmatrix} 3 & 2 & 2 \\ 2 & 5 & 2 \\ 2 & 2 & 3 \end{pmatrix}$$

b) What are Harmonic and Biharmonic equations? **(10)**
Using the transformation functions, show that the Bi-Harmonic equations are invariant.

Q6 **a)** Using shooting method, solve the first boundary value problem. **(10)**
u''=u+1, 0<x<1
u(0)=0, u(1) = e-1
Use Euler Cauchy method with h=0.25 to solve resulting system of first order initial value problems.

b) Find general solution of difference equations. **(10)**
$\Delta^2 u_n - 3\,\Delta u_n + 2u_n = 0$
Is the solution bounded?

Q.7. **a)** Solve the boundary value problem. **(10)**
u''=u'+1
u (0)=1,u(1)=2(e-1). Use Fourth order Runge Kutta method with h=1/3.

b). The following data for function f(x)=x^4 is given. Find f'(0.8) and f''(0.8) using quadratic interpolation . Compare with exact solution. Obtain bound on truncation errors. **(10)**

x	0.4	0.6	0.8
f(x)	0.0256	0.1296	0.4096