BITS PILANI, DUBAI CAMPUS
DUBAI INTERNATIONAL ACADEMIC CITY, DUBAI

SECOND SEMESTER 2013-14
CHE F242 NUMERICAL METHODS FOR CHEMICAL ENGINEERS
Comprehensive Examination (Closed Book)

Weightage: 40%
Max. Marks: 40

Date: 27. 5. 2014
Time: 8.30 AM -11.30 AM

Answer all the questions.
No programmable calculators are allowed.

1. Solve $\sin x - y + 1.32 = 0; x - \cos y - 0.85 = 0$ by Newton-Raphson method, up to one iteration with $x_0 = 0.6, y_0 = 1.9$. (3M)

2. Solve $x^4 - 8x^3 + 39x^2 - 62x + 50 = 0$, using Bairstow's method, taking $p_0 = 1.97, q_0 = -1.57$. (4M)

3. Solve by Gauss-Jordan method, using partial pivoting
   $x + 7y - 3z = -22, 2x - y + 6z = 22, 5x - 2y + 3z = 18$ (3M)

4. Using Gauss Jacobi method, solve
   $10x + y - z = 11.19, x + 10y + z = 28.08, -x + y + 10z = 35.61$, correct to 3 d.p. (3M)

5. Fit a cubic spline to the data:

x	0	1	2
y	1	2	5

(4M)

6. Find the dominant eigenvalue and the corresponding eigenvector of

$$\begin{pmatrix} 15 & -4 & -3 \\ -10 & 12 & -6 \\ -20 & 4 & -2 \end{pmatrix}$$ (3M)

7. Find an interpolating polynomial:

x	-2	0	2	3
y	0	1	0.4	-1

(3M)

8. Evaluate $\int_{0.2}^{1.4} (\sin x - \ln x + e^x) dx$ by (i) Simpson's 1/3 rule and (ii) Trapezoidal rule. Compare the results. (3M)

9. Use the following set of Pressure-volume data to find the best possible virial constants (A_1 & A_2) for the equation of the state shown below. R=0.082 and T = 303.

$$\frac{PV}{RT} = 1 + \frac{A_1}{V} + \frac{A_2}{V^2}$$

P	0.985	1.108	1.363	1.631
V	25	22.2	18	15

(4M)

10. Solve using RK method of 4th order:

$\frac{dy}{dx} = y - \frac{2x}{y}$, $y(0) = 1$ by finding *y(0.2) and y(0.4)* (4M)

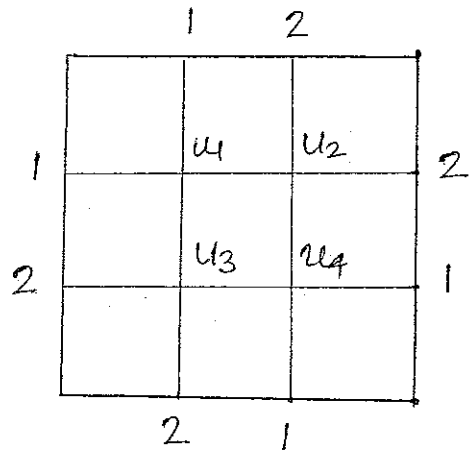
11. Solve the equation by an Implicit Scheme:

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$ with

$h = 0.5, u(0,t) = u(1,t) = 0, u(x,0) = 5 - \sin(\pi x), 0 < x < 1$ for one time step.

(3M)

12. Solve the Laplace equation for the following square mesh:



(3M)

All the Best!

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SECOND SEMESTER 2013-14
CHE F242 NUMERICAL METHODS FOR CHEMICAL ENGINEERS
Test 1 (Closed Book)

Weightage: 25% | Date: 03.03.2014
Max. Marks: 25 | Time: 9.20 AM -10.10 AM

Answer all the questions.
No programmable calculator is allowed.

1. Compute the relative maximum error in *f* when x = y = z = 1 and $f(x,y,z)=\frac{4x^2y^3}{z^4}$. Use the errors in x, y, z as 0.001. (6M)

2. Find a real root of $x^4 - x - 10 = 0$ by the secant's method which lies between 1 and 2 by performing five iterations. (6M)

3. Find a real root of $x\,e^x = \cos\ x$ lying between 0 and 1 by the regula-falsi formula correct to 3 d. p. (6M)

4. Use the Newton-Raphson method to find a negative real root of $\cos\left(\frac{\pi(x+1)}{8}\right) + 0.148\ x - 0.9602 = 0$ correct to 4 d. p. Also compute the true relative percent error. (7M)

All the Best!

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SECOND SEMESTER 2013-14
CHE F242 NUMERICAL METHODS FOR CHEMICAL ENGINEERS
QUIZ 1

Weightage: 8% | Date: 23.03.2014
Max. Marks: 8 | Time: 9.30 AM -9.50 AM

Name:_____ **ID No.:**_____

1. Using Gauss elimination method, solve $x+z=0.25,\ y+z=2.5,\ x+y+z=1.5$ (2M)

2. The order of convergence of Newton-Raphson method is _____ (2M)

3. Find a recurrence formula to find the square root of a positive number N by Newton's method. (2M)

4. Write any two differences of partial pivoting and complete pivoting techniques used in Gauss/Gauss Jordan methods. (2M)

All the Best!