BITS PILANI – DUBAI CAMPUS

International Academic City, Dubai

SECOND SEMESTER - 2013-2014

COMPREHENSIVE EXAMINATION (CB)

Course Title: Numerical Analysis **Course No. : MATH F313/AAOC C341**

Max. Marks: 40 **Weightage: 40%** **Date: 05-06-2014** **Time: 3 hours**

Attempt all the questions.

1. Solve the following system by Gauss-Seidel iteration method:

$$4x - y + z = 12,$$
$$-x + 4y - 2z = -1,$$
$$x - 2y + 4z = 5.$$

Take initial approximations as $x_0 = y_0 = z_0 = 0$ and perform 5 iterations. Use 5-digit arithmetic with rounding. [5]

2. Decompose the following matrix in L-U form such that $A = LU$: [3]

$$A = \begin{bmatrix} 2 & -6 & 8 \\ 5 & 4 & -3 \\ 3 & 1 & 2 \end{bmatrix}$$

L and U are in usual notations.

3. Use Simpson's $\frac{1}{3}$ rule to evaluate the integral $\int_2^3 \frac{x^2 - 2\cos x}{x + 2e^x} dx$. Take $h = 0.125$. Use 6-digit arithmetic with rounding. [4]

4. Use trapezoidal rule to evaluate $\int_0^{0.1} \int_0^{0.2} e^{2x+y} dxdy$. Take 2 subintervals for x and 4 subintervals for y. Use 5-digit arithmetic with rounding. [5]

5. The profits of a company (in thousands of rupees) is given below:

Year (x)	2000	2003	2006	2009	2012
Profit (y)	120.25	100.56	111.05	100.02	99.12

Use Newton's forward interpolation formula to find the profit in 2001. [3]

BITS PILANI – DUBAI CAMPUS

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SECOND SEMESTER - 2013-2014

TEST – II (OB)

Course Title: Numerical Analysis **Course No. : MATH F313/AAOC C341**

Max. Marks: 20 **Weightage: 20%** **Date: 07-5-2014** **Time: 50 min.**

Prescribed textbook, hand-written class notes, non-programmable calculators are allowed.

Attempt all the questions.

1. Use Simpson's 3/8th rule to evaluate $\int_0^{1.2} \frac{xe^x + \sin x}{x+1} dx$. Take $h = 0.2$. Use 6 digit arithmetic with rounding. [5]

2. Use 3-point Gauss-Legendre quadrature to evaluate $\int_0^{1/2} \frac{\cos 2x}{\ln(2+x)} dx$. Use 6-digit arithmetic with rounding. [5]

3. Use R-K method of 4th order to find $y(0.1)$ and $y'(0.1)$ as solution of the initial value problem: $y'' + xy' + 1 = 0, \quad y(0) = 0, y'(0) = 0$. Take h=0.1. Use 5-digit arithmetic with rounding. [5]

4. Use power method to find the numerically largest eigen value of the following matrix:

$$\begin{bmatrix} 0 & 11 & -5 \\ -2 & 17 & -7 \\ -4 & 26 & -10 \end{bmatrix}$$

Perform 6 iterations and use 6-digit arithmetic with rounding. [5]

BITS PILANI – DUBAI CAMPUS

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SECOND SEMESTER - 2013-2014

TEST – I (CB)

Course Title: Numerical Analysis **Course No. : MATH F313/AAOC C341**

Max. Marks: 25 **Weightage: 25%** **Date: 12-03-2014** **Time: 50 min.**

Attempt all the questions.

1. Rewrite the following system of equations so that it becomes diagonally dominant and then use Gauss-Seidel iteration method to find the solution of the system:

$$8x+5y-z=23$$
$$5x-y+10z=38$$
$$2x+5y-z=11$$

Take initial approximations as $x_0=y_0=z_0=0$. Use 6-digit arithmetic with rounding and perform four iterations only. [6]

2. Solve the following equation by Newton's method taking initial approximation $x_0=1$: $2e^x-3x^3-1=0$. Result should be correct to 5 significant digits. [6]

3. Find 1-norm, ∞-norm and Frobenius norm for the following matrix:

$$A=\begin{pmatrix}4 & -5 & 9\\ -2 & 6 & -7\\ 5 & -5 & 8\end{pmatrix}$$ [3]

4. Decompose the following matrix into $L*U$ form where the notations L and U have usual meanings.

$$A=\begin{pmatrix}2 & -4 & 9\\ -2 & 6 & -7\\ 5 & -5 & 8\end{pmatrix}$$

If we want '2' as each diagonal element of L, what will be the revised $L*U$ equivalent of A? [5]

5. Perform one iteration of Muller's method using 5-digit arithmetic with rounding for finding a root of $2x^2-5e^x+6=0$. Take starting values as 1, 0, 0.5. [5]

A

BITS PILANI – DUBAI CAMPUS

International Academic City, Dubai

SECOND SEMESTER - 2013-2014

QUIZ – II (CB)

Course Title: NUMERICAL ANALYSIS **Course No. : MATH F313/AAOC C341**

Max. Marks: 7 **Weightage: 7%** **Date: 18-05-2014** **Time: 20 min.**

NAME: **ID No**

Attempt all the questions. No extra sheets will be given for calculations/rough works. Do not use pencil. Multiple answers will be treated as incorrect answers.

Fill in the blanks with correct answers:

1. The value of the integral $\int_{-1}^{1}(2\cos x+1)dx$ when 2-point Gauss-Legendre quadrature is applied is _____. [1]

2. Basic Simpson's 1/3rd rule is applied to the following data to compute $\int_{1}^{2.2} f(x)dx$:

   x: 1 1.6 2.2

   y: 5 n 10

   If the value of the integral obtained is 9.8, then the value of n *is* _____. [2]

3. The number of equi-spaced subintervals of (a,b) required to evaluate $\int_{a}^{b} f(x)dx$ by Simpsons 3/8th rule should be a multiple of _____. [1]

4. If the values of k_1, k_3, k_4 in RK method of order four are 0.25, 0. 02, 0.01 respectively and k is 0.45, then the value of k_2 is _____. Usual notations are used. [2]

5. Transformation required to change the limits of the integral $\int_{1}^{5} f(x)dx$ from (1, 5) to (-1, 1) is _____. [1]

A

BITS PILANI – DUBAI CAMPUS

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SECOND SEMESTER - 2013-2014

QUIZ – II (CB)

Course Title: NUMERICAL ANALYSIS **Course No. : MATH F313/AAOC C341**

Max. Marks: 7 **Weightage: 7%** **Date: 18-05-2014** **Time: 20 min.**

NAME: **ID No**

Attempt all the questions. No extra sheets will be given for calculations/rough works. Do not use pencil. Multiple answers will be treated as incorrect answers.

Fill in the blanks with correct answers:

1. The value of the integral $\int_{-1}^{1}(\cos x+1)dx$ when 2-point Gauss-Legendre quadrature is applied is _____ . [1]

2. Basic Simpson's $1/3^{rd}$ rule is applied to the following data to compute $\int_{1}^{2.2} f(x)dx$:

   x: 1 1.6 2.2

   y: 2 n 10

   If the value of the integral obtained is 9.8, then the value of n *is* _____. [2]

3. The number of equi-spaced subintervals of (a,b) required to evaluate $\int_{a}^{b} f(x)dx$ by Simpsons $3/8^{th}$ rule should be a multiple of _____ . [1]

4. If the values of k_1, k_3, k_4 in RK method of order four are 0.05, 0. 02, 0.01 respectively and k is 0.045, then the value of k_2 is _____. Usual notations are used. [2]

5. Transformation required to change the limits of the integral $\int_{2}^{5} f(x)dx$ from (2, 5) to (-1, 1) is _____. [1]

B

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SECOND SEMESTER - 2013-2014

QUIZ – II (CB)

Course Title: NUMERICAL ANALYSIS **Course No. : MATH F313/AAOC C341**

Max. Marks: 7 **Weightage: 7%** **Date: 18-05-2014** **Time: 20 min.**

NAME: **ID No**

Attempt all the questions. No extra sheets will be given for calculations/rough works. Do not use pencil. Multiple answers will be treated as incorrect answers.

Fill in the blanks with correct answers:

1. The value of the integral $\int_{-1}^{1}(\cos x+2)dx$ when 2-point Gauss-Legendre quadrature is applied is _____ . [1]

2. Basic Simpson's 1/3rd rule is applied to the following data to compute $\int_{1}^{2.2} f(x)dx$:

   x: 1 1.6 2.2

   y: 2 n 5

   If the value of the integral obtained is 9.8, then the value of n *is* _____. [2]

3. The number of equi-spaced subintervals of (a,b) required to evaluate $\int_{a}^{b} f(x)dx$ by Simpsons 3/8th rule should be a multiple of _____ . [1]

4. If the values of k_1, k_3, k_4 in RK method of order four are 0.05, 0. 02, 0.01 respectively and k is 0.035, then the value of k_2 is _____. Usual notations are used. [2]

5. Transformation required to change the limits of the integral $\int_{2}^{4} f(x)dx$ from (2, 4) to (-1, 1) is _____. [1]

B

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SECOND SEMESTER - 2013-2014

QUIZ – II (CB)

Course Title: NUMERICAL ANALYSIS **Course No. : MATH F313/AAOC C341**

Max. Marks: 7 **Weightage: 7%** **Date: 18-05-2014** **Time: 20 min.**

NAME: **ID No**

Attempt all the questions. No extra sheets will be given for calculations/rough works. Do not use pencil. Multiple answers will be treated as incorrect answers.

Fill in the blanks with correct answers:

1. The value of the integral $\int_{-1}^{1}(\cos x+4)dx$ when 2-point Gauss-Legendre quadrature is applied is _____ . [1]

2. Basic Simpson's 1/3rd rule is applied to the following data to compute $\int_{1}^{2.2} f(x)dx$:

   x: 1 1.6 2.2

   y: 2 n 8

   If the value of the integral obtained is 9.8, then the value of n *is* _____. [2]

3. The number of equi-spaced subintervals of (a,b) required to evaluate $\int_{a}^{b} f(x)dx$ by Simpsons 3/8th rule should be a multiple of _____ . [1]

4. If the values of k_1, k_3, k_4 in RK method of order four are 0.05, 0. 02, 0.01 respectively and k is 0.055, then the value of k_2 is _____. Usual notations are used. [2]

5. Transformation required to change the limits of the integral $\int_{0}^{8} f(x)dx$ from (0, 8) to (-1, 1) is _____. [1]

A1

BITS PILANI – DUBAI CAMPUS

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SECOND SEMESTER - 2013-2014

QUIZ – I (CB)

Course Title: NUMERICAL ANALYSIS **Course No. : MATH F313/AAOC C341**

Max. Marks: 8 **Weightage: 8%** **Date: 09-04-2014** **Time: 20 min.**

NAME: _____ **ID No** _____

Attempt all the questions. No extra sheets will be given for calculations/rough works. Do not use pencil. Multiple answers will be treated as incorrect answers.

Fill in the blanks with correct answers:

1. Consider the following data:

i	0	1	2
x_i	1	5	12
f_i	42	35	21

The second order divided difference $f[x_0, x_1, x_2] =$ _____. [2]

2. In the forward difference table, if $\Delta^5 f$ values are equal($\neq 0$), then f is a polynomial of degree _____. [1]

3. In the Fourier series of $f = x + x^3$ defined in (0, 2), the Fourier coefficient $A_0 =$ _____. [1]

4. Product of an even and an odd function is an _____ (even/odd) function. [1]

Tick (√) the correct option :

5. Roots of Chebyshev's polynomial of degree 2 are

a) $\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}$ b) $\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}$ c) 1, -1 d) None of these. [1]

6. The coefficient of x^3 in 4^{th} degree Chebyshev's polynomial is

a) 8 b) 6 c) 4 d) None of these. [1]

7. If four points are used, then for natural spline,

a) $S_0 = 0, S_3 = 0$ b) $S_1 = 0, S_2 = 0$ c) $S_0 = 1, S_3 = 0$ d) None of these. [1]

A2

BITS PILANI – DUBAI CAMPUS

International Academic City, Dubai

SECOND SEMESTER - 2013-2014

QUIZ – I (CB)

Course Title: NUMERICAL ANALYSIS **Course No. : MATH F313/AAOC C341**

Max. Marks: 8 **Weightage: 8%** **Date: 09-04-2014** **Time: 20 min.**

NAME: _____ **ID No** _____

Attempt all the questions. No extra sheets will be given for calculations/rough works. Do not use pencil. Multiple answers will be treated as incorrect answers.

Fill in the blanks with correct answers:

1. Consider the following data:

i	0	1	2
x_i	3	5	12
f_i	42	35	21

The second order divided difference $f[x_0, x_1, x_2] =$ _____ . [2]

2. In the forward difference table, if $\Delta^4 f$ values are equal($\neq 0$), then f is a polynomial of degree _____ . [1]

3. In the Fourier series of $f = x + x^2$ defined in (0, 2), the Fourier coefficient $A_0 =$ _____ . [1]

4. Product of an even and an odd function is an _____ (even/odd) function. [1]

Tick (√) the correct option :

5. Roots of Chebyshev's polynomial of degree 2 are

a) $\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}$ b) $\frac{3}{\sqrt{2}}, -\frac{1}{\sqrt{2}}$ c) 1, -1 d) None of these. [1]

6. The coefficient of x^4 in 4^{th} degree Chebyshev's polynomial is

a) 8 b) 6 c) 4 d) None of these. [1]

7. If four points are used, then for natural spline,

a) $S_1 = 0, S_2 = 0$ b) $S_0 = 0, S_3 = 0$ c) $S_0 = 1, S_3 = 0$ d) None of these. [1]

B

BITS PILANI – DUBAI CAMPUS

International Academic City, Dubai

SECOND SEMESTER - 2013-2014

QUIZ – I (CB)

Course Title: NUMERICAL ANALYSIS **Course No. : MATH F313/AAOC C341**

Max. Marks: 8 **Weightage: 8%** **Date: 09-04-2014** **Time: 20 min.**

NAME: _____ **ID No** _____

Attempt all the questions. No extra sheets will be given for calculations/rough works. Do not use pencil. Multiple answers will be treated as incorrect answers.

Fill in the blanks with correct answers:

1. Consider the following data:

i	0	1	2
x_i	3	5	8
f_i	42	35	26

The second order divided difference $f[x_0, x_1, x_2] =$ _____ . [2]

2. In the forward difference table, if $\Delta^8 f$ values are equal($\neq 0$), then f is a polynomial of degree _____ . [1]

3. In the Fourier series of $f = x + 3x^2$ defined in (0, 2), the Fourier coefficient $A_0 =$ _____ . [1]

4. Product of an odd and another odd function is an _____ (even/odd) function. [1]

Tick (√) the correct option :

5. Roots of Chebyshev's polynomial of degree 3 are

a) $0, \frac{\sqrt{3}}{2}, -\frac{\sqrt{3}}{2}$ b) $0, \frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}$ c) 0, 1, -1 d) None of these. [1]

6. The coefficient of x^3 in 4^{th} degree Chebyshev's polynomial is

a) 4 b) 6 c) 0 d) None of these. [1]

7. If four points are used, then for natural spline,

a) $S_0 = 1, S_3 = 0$ b) $S_1 = 0, S_2 = 0$ c) $S_0 = 0, S_3 = 0$ d) None of these. [1]

B 2

BITS PILANI – DUBAI CAMPUS

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SECOND SEMESTER - 2013-2014

QUIZ – I (CB)

Course Title: NUMERICAL ANALYSIS **Course No. : MATH F313/AAOC C341**

Max. Marks: 8 **Weightage: 8%** **Date: 09-04-2014** **Time: 20 min.**

NAME: _____ **ID No** _____

Attempt all the questions. No extra sheets will be given for calculations/rough works. Do not use pencil. Multiple answers will be treated as incorrect answers.

Fill in the blanks with correct answers:

1. Consider the following data:

i	0	1	2
x_i	1	5	8
f_i	42	35	29

The second order divided difference $f[x_0, x_1, x_2] =$ _____. [2]

2. In the forward difference table, if $\Delta^6 f$ values are equal($\neq 0$), then f is a polynomial of degree _____. [1]

3. In the Fourier series of $f = 2x + x^2$ defined in (0, 2), the Fourier coefficient $A_0 =$ ____. [1]

4. Product of an even and an odd function is an _____ (even/odd) function. [1]

Tick (√) the correct option :

5. Roots of Chebyshev's polynomial of degree 3 are

a) $0, \frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}$ b) $0, \frac{\sqrt{3}}{2}, -\frac{\sqrt{3}}{2}$ c) 0, 1, -1 d) None of these. [1]

6. If four points are used, then for natural spline,

a) $S_0 = 0, S_3 = 0$ b) $S_1 = 0, S_2 = 0$ c) $S_0 = 1, S_3 = 0$ d) None of these. [1]

7. The coefficient of x^6 in 6^{th} degree Chebyshev's polynomial is

a) 0 b) 32 c) 35 d) None of these. [1]