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 $\int_0^{0.1} \int_0^{0.2} e^{2x+y} dx dy$. 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]

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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 $3/8^{th}$ 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 4^{th} order to find y(0.1) and y'(0.1) as solution of the initial value problem: y'' + xy' + 1 = 0, 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]

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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]

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SECOND SEMESTER - 2013-2014

QUIZ - II (CB)

Course Title: NUMERICAL ANALYSIS		Course No.: MATH F313/AAOC C341			
Max. Marks: 7 W	eightage: 7%	Date: 18-05-2014	Time: 20 min.		
NAME:		ID No			
Attempt all the questions pencil. Multiple answers v Fill in the blanks with	vill be treated as incorrec	e given for calculations/rough t answers.	n works. Do not use		
1. The value of the ir	tegral $\int_{-1}^{1} (2\cos x + 1) dx$	when 2-point Gauss-Lege	ndre quadrature is		
applied is	· · · · · · · · · · · · · · · · · · ·		[1]		
2. Basic Simpson's 1/3	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 i	ntegral obtained is 9.8,	then the value of <i>n</i> is	[2]		
3. The number of ed	ui-spaced subintervals	s of (a,b) required to ev	aluate $\int_{a}^{b} f(x)dx$ by		
	should be a multiple of		[1]		
4. If the values of k_i , k	$_{_{4}},k_{_{4}}$ in RK method of c	order four are 0.25, 0. 02, 0.0	1 respectively and		
k is 0.45, then the va	tlue of k_2 is U	sual notations are used.	[2]		
5. Transformation requ	ired to change the lim	aits of the integral $\int_1^5 f(x)$	dx from $(1, 5)$ to		
(-1, 1) is			[1]		

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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			
pencil. Multiple ansv	stions. No extra sheets will be vers will be treated as incorrect vith correct answers:		n works. Do not use		
1. The value of t	the integral $\int_{-1}^{1} (\cos x + 1) dx$	when 2-point Gauss-Lege	ndre 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 2.3 y: 2 n 10	2				
If the value of	the integral obtained is 9.8, t	hen the value of <i>n</i> is	[2]		
3. The number of	of equi-spaced subintervals	of (a,b) required to ev	aluate $\int_a^b f(x)dx$ 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 or	rder four are 0.05, 0. 02, 0.0	1 respectively and		
k is 0.045, then	the value of k_2 is U	sual notations are used.	[2]		
5. Transformation	required to change the limit	its of the integral $\int_2^5 f(x)$	dx from $(2, 5)$ to		
(-1, 1) is	•		[1]		

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QUIZ - II (CB)

Course Title: NUMERICAL ANA	LYSIS 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 she pencil. Multiple answers will be treated to Fill in the blanks with correct answe	·
1. The value of the integral $\int_{-1}^{1} (\cos t)$	(3x+2)dx when 2-point Gauss-Legendre quadrature is
applied is	[1]
2. Basic Simpson's 1/3 rd rule is app	lied 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 obtain	ed is 9.8, then the value of <i>n</i> is [2]
3. The number of equi-spaced su	bintervals of (a,b) required to evaluate $\int_a^b f(x)dx$ by
Simpsons 3/8 th rule should be a m	
4. If the values of k_1, k_3, k_4 in RK m	ethod 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 chang	ge the limits of the integral $\int_{2}^{4} f(x)dx$ from (2, 4) to
(-1, 1) is	[1]

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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 pencil. Multiple answers will be treated as incorrect Fill in the blanks with correct answers:		works. Do not use		
1. The value of the integral $\int_{-1}^{1} (\cos x + 4) dx$	when 2-point Gauss-Legen	ndre quadrature is		
applied is		[1]		
 2. Basic Simpson's 1/3rd rule is applied to the x: 1 1.6 2.2 y: 2 n 8 	following data to compute \int_1^1	f(x)dx:		
If the value of the integral obtained is 9.8,	then the value of <i>n</i> is	[2]		
3. The number of equi-spaced subintervals	g of (ah) required to over	hyata (b f(w) daha		
3. The number of equi-spaced subintervals Simpsons 3/8 th rule should be a multiple of		[1]		
If the values of k_1, k_3, k_4 in RK method of c	order four are 0.05, 0. 02, 0.01	respectively and		
k is 0.055, then the value of k_2 is U	Usual notations are used.	[2]		
Transformation required to change the lim	its of the integral $\int_0^8 f(x)dx$	x from (0, 8) to		
(-1, 1) is	-v .	[1]		

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SECOND SEMESTER - 2013-2014

QUIZ - I (CB)

Course Title: NUMERICAL ANALYSIS			Course No.: MATH F313/AAOC C34				
N	Iax. Marks: 8	Weightage:	8%	Date	: 09-04-2014	Time: 20) min.
N	AME:			ID No	0		
pe. Fi	tempt all the quest ncil. Multiple answ I l in the blanks v Consider the fo	vers will be treate vith correct ans llowing data:	ed as incorrectwers:	t answers.	lations/rough works	. Do not use	,
	The second ord	L	$\begin{array}{c ccc} x_i & 1 & 5 \\ f_i & 42 & 35 \\ \end{array}$ rence $f[x_0, x]$		*		[2]
2.	In the forward of degree		if $\Delta^5 f$ valu	es are equal	$(\neq 0)$, then f is a p	olynomial	of [1]
3.	In the Fourier se	eries of $f = x +$	$-x^3$ defined in	n (0, 2), the	Fourier coefficien	t A ₀ =	[1]
4.	Product of an e	ven and an odd	function is a	n	(even/odd) fur	nction.	[1]
Ti	ck ($$) the correc	ct option :					
5.	Roots of Cheby	shev's polynom	nial 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) N	None of these.		[1]
6.	The coefficient	of x^3 in 4^{th} deg	ree Chebysh	ev's polyno	mial is		
	a) 8	b) 6	c) 4	d) None	of these.		[1]
7.	If four points ar	e used, then for	natural splin	e,			
	a) $S_0 = 0, S_3 =$	0 b) $S_1 = 0, S$	$S_0 = 0$ c) S_0	$=1, S_3=0$	d) None of these		[1]

International Academic City, Dubai SECOND SEMESTER - 2013-2014

		QUIZ	– I (CB)	
C	Course Title: NUI	MERICAL ANALYSIS	Course No. : MATH F	313/AAOC C341
N	Iax. Marks: 8	Weightage: 8%	Date: 09-04-2014	Time: 20 min.
N	AME:		ID No	
pe. Fi	ncil. Multiple answ	ers will be treated as incorrec <mark>ith correct answers</mark> :	2	rks. Do not use
	The second orde	or divided difference $f[x_0]$,		[2]
2.	In the forward d degree	ifference table, if $\Delta^4 f$ val	ues are equal $(\neq 0)$, then f is	a polynomial of
3.	In the Fourier se	ries of $f = x + x^2$ defined	in (0, 2), the Fourier coeffic	ient $A_0 = $ [1]
4.	Product of an ev	en and an odd function is a	an(even/odd)	function. [1]
Ti	ck ($$) the correc	t option :		
5.	Roots of Chebys	shev's polynomial of degre	ee 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 o	f these [1]
6.	The coefficient	of x^4 in 4^{th} degree Chebys	hev's polynomial is	
	a) 8	b) 6 c) 4	d) None of these.	[1]
7.	If four points are	e used, then for natural spli	ne,	
	(a) $S_1 = 0, S_2 = 0$	b) $S_0 = 0, S_3 = 0$	c) $S_0 = 1, S_3 = 0$ d) No.	ne of these. [1]

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SECOND SEMESTER - 2013-2014

QUIZ – I (CB)

Course Title: NUMERICAL ANALYSIS Course No. : MATH F313/AAOC C3					341
Max. Marks: 8 We	ightage: 8%	Date: 09-0	04-2014	Time: 20	min.
NAME:		ID No _			
Attempt all the questions. A pencil. Multiple answers wi Fill in the blanks with consider the following	ll be treated as incorrect prrect answers:	answers.	s/rough works. L)o not use	
The second order divi	$ \frac{ f_i 42 35 }{\text{ded difference } f[x_0, x_1]} $		·		[2]
2. In the forward differe degree	nce table, if $\Delta^8 f$ value	es are equal(≠0)	, then f is a pol	ynomial of	f [1]
3. In the Fourier series of	$f f = x + 3x^2 \text{ defined i}$	n (0, 2), the Fou	rier coefficient	$A_0 = $. [1]
4. Product of an odd and	another odd function i	s an	(even/odd) f	unction.	[1]
Tick (√) the correct opti	on:				
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 the	se.	[1]
6. The coefficient of x^3	n 4 th degree Chebyshe	v's polynomial is	3		
a) 4 b) 6	c) 0	d) None of the	se.		[1]
7. If four points are used	then for natural spline	,			
a) $S_0 = 1, S_2 = 0$ b)	$S_1 = 0, S_2 = 0$ c) $S_2 = 0$	$=0, S_2=0$ d) 1	None of these.		F17

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SECOND SEMESTER - 2013-2014

QUIZ – I (CB)

Course Title: NUMERICAL ANALYSIS		S Cours	Course No.: MATH F313/AAOC C34				
1	Max. Marks: 8	Weightage: 89	%	Date	: 09-04-2014	Time:	20 min.
N	AME:			ID N	0		
$oldsymbol{F}^{e}$	ncil. Multiple answ ill in the blanks w Consider the fo	$\begin{bmatrix} i \\ x_i \\ f_i \end{bmatrix}$	as inco ers: 0 1 1 42	1 2 5 8 35 29	Ü	es. Do not u	ise
	The second orde	er divided differe	f[$x_0, x_1, x_2] = \underline{\hspace{1cm}}$		4	[2]
2.	In the forward d	ifference table, if	$\Delta^6 f$	values are equal	$(\neq 0)$, then f is a	polynomia	d of [1]
3.	In the Fourier se	eries of $f = 2x + 3$	x² defi	ned in (0, 2), the	e Fourier coeffici	ent $A_0 = $	[1]
4.	Product of an ev	en and an odd fur	nction	is an	(even/odd) fu	nction.	[1]
Ti	ck ($$) the correc	t option :					
5.	Roots of Chebys	hev's polynomial	of de	gree 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 th	ese.	[1]
6.	If four points are	used, then for na	itural s	pline,			
-		0 b) $S_1 = 0, S_2 = 0$				e .	[1]
7.		of x^6 in 6^{th} degree	,				F-3
	a) 0 b) 32	c) 35	d) Non	e of these.		[1]