QPC: RJ19BTECH175 AR 19 Reg. No

GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Fourth Semester – Regular) Examinations, June – 2021

BPCCH4050 – Numerical Methods in Chemical Engineering

(Chemical Engineering)

Time: 2 hrs Maximum: 50 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) (1 x 10 = 10 Marks)

	Q.1. Answer ***ALL*** questions	[CO#]	[PO#]
a.	In Regula-falsi method, to reduce the number of iterations, we start with	1	1
	(i) Smaller interval (ii) Bigger interval		
	(iii) Infinite interval (iv) Semi closed interval		
b.	The rate of convergence in Newton-Raphson method is of order	1	2
	(i) 3 (ii) 6		
	(iii) 2 (iv) 1		
c.	Gauss-Seidal method is	2	1
	(i) Iterative method (ii) Direct method		
	(iii) Indirect method (iv) Analytical method		
d.	The power method will work satisfactorily only if 'A' has a _____ eigen value	1	2
	(i) Distinct (ii) Similar		
	(iii) Dominant (iv) Unique		
e.	What is the limitation of Gauss-Seidal method?	2	1
	(i) It cannot be used for the matrices with non-zero diagonal elements. (ii) It is more complex than any other methods		
	(iii) It does not guarantee the convergence of each and every matrix. (iv) It is an iterative technique.		
f.	Runge-Kutta method is used to solve _____ type of equations.	1	2
	(i) Differential equations (ii) Difference equations		
	(iii) Quadratic equations (iv) Algebraic equations		
g.	In solving equation $u_t = \alpha^2 u_{xx}$ by Crank-Nicholson method, to simplify method, we take $\frac{(\Delta x)^2}{\alpha^2 k}$ as	3	1
	(i) 1/2 (ii) 2		
	(iii) 1 (iv) 0		
h.	Milne's correction formula is given by	2	3
	(i) $y_{n+1}, C = y_{n+1} + \frac{h}{3}(y'_{n-1} - 4y'_n + y'_{n+1})$ (ii) $y_{n+1}, C = y_{n-1} + \frac{h}{3}(y'_{n-1} + 4y'_n + y'_{n+1})$		
	(iii) $y_{n+1}, C = y_{n-1} + \frac{h}{3}(y'_{n-1} + 2y'_n + y'_{n+1})$ (iv) $y_{n+1}, C = y_{n-1} + \frac{h}{3}(y'_{n+1} + 4y'_n - y'_{n+1})$		
i.	Milne's method is a self-starting method	1	2
	(i) True (ii) False		
	(iii) Cannot be determined (iv) None of these		
j.	To use Milne's method, we need at lest _____ values of 'y' prior to the required value of 'y'.	2	2
	(i) 3 (ii) 6		
	(iii) 2 (iv) 4		

PART – B: (Short Answer Questions) **(2 x 5 = 10 Marks)**

Q.2. Answer ***ALL*** questions	[CO#]	[PO#]
a. State the order of convergence and convergence condition for Newton's Raphson method.	1	1
b. Write down the formula for numerical differentiation of 'y' with respect to 'x' once.	2	2
c. Write down the Crank-Nicholson formula to solve $u_t = u_{xx}$.	3	2
d. Write the finite difference form of $\frac{\partial^2 u}{\partial t^2}$.	3	3
e. What is the condition to apply Adams-Bashforth method?	4	1

PART – C: (Long Answer Questions) **(6 x 5 = 30 Marks)**

Answer ***ANY FIVE*** questions	Marks	[CO#]	[PO#]
3. Find the smallest positive root of the equation $x^3 - 2x + 0.5 = 0$ by Newton-Raphson's formula.	(6)	1	1
4. Solve the following system of equations by Gauss-Seidal iteration method. $4x + 2y + z = 14$ $x + 5y + z = 10$ $x + y + 8z = 20$	(6)	1	2
5. Using modified Euler method, find the solution of initial value problem $\frac{dy}{dx} = \log(x + y),\ y(0) = 2$ at $x = 0.2$ by assuming $h = 0.2$.	(6)	3	3
6. Given $\frac{dy}{dx} = x^2(1 + y),\ y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979,$ evaluate $y(1.4)$ by Adam's-Bashforth method.	(6)	2	2
7. Evaluate $\int_0^2 \frac{1}{x^2 + 4} dx$ using Romberg's method. Hence obtain an approximate value for 'π'.	(6)	4	3
8. Find the value of $y(1.1)$ using Runge-Kutta method of the third order given that $\frac{dy}{dx} = y^2 + xy;\ y(1) = 1.$	(6)	3	2
9. Solve by Crank-Nicolson's method $\frac{\partial u}{\partial t} = \frac{1}{16}\frac{\partial^2 u}{\partial x^2},\ 0 < x < 1, t > 0, u(x, 0) = 0,$ $u(0, t) = 0, u(1, t) = 100t$. Compute 'u' for one step with $h = \frac{1}{4}$.	(6)	3	2
10. Solve the differential equation $\frac{d^2y}{dx^2} - y = x$ with $y(0) = 0, y(1) = 0$ with $h = \frac{1}{4}$.	(6)	4	1

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