2018
PHYSICS
PHY - 303
NUMERICAL METHODS AND COMPUTATION

Full Marks-40

Time–2 hours

(The figures in the margin indicate full marks for the questions)

Answer the following (any four) $10 \times 4 = 40$

1. (a) Find the real root of the equation $2x^3 - 2.5x - 5 = 0$ in the interval $[1, 2]$ using Regula-Falsi method (perform four iterations).

    5

    (b) The velocity of a body is given by,   5

$$v(t) = 2t, \qquad\qquad 1 \le t \le 5$$

$$= 5t^2 + 3, \qquad\qquad 5 \le t \le 14$$

    where t is in seconds, and v is in *m/s*. Using two-segment Simpson's 1/3 rule, estimate the distance covered by the body from $t = 2$ to $t = 9$ seconds.

2. (a) Using Lagrange interpolation find the value of $f(1.5)$ from the following table if $f(x) = \sin 3x$.   5

x	1	1.3	1.6	1.9	2.2
$f(x)$	0.1411	-0.6878	-0.9962	-0.5507	0.3115

    (b) Find the values of m and c if a straight line of the form $y = mx + c$ is fitted to the following data. Also find the correlation coefficient.

    4+1=5

P.T.O.

x	1	2	4	5	6	12
y	14	10	12	8	6	1

3. (a) Using the Gauss elimination method with partial pivoting solve the following system of equations,   6

$$3x + 2y + 105z = 104$$
$$2x - 3y + 103z = 98$$
$$x + y + 3z = 3$$

(b) Find the value of $\sqrt{11}$ using Newton-Raphson method.   4

4. (a) Given, $\frac{dy}{dx} = y - x^2 + 1$, where $y(0) = 0.5$. Using 4th order Runge-kutta method evaluate $y(0.5)$ & $y(1)$ with $h = 0.5$. If the analytical solution is $y = x^2 + 2x + 1 - 0.5e^x$, calculate the numerical error if any.   7

(b) Find $y(1.1)$, given $\frac{dy}{dx} = x + y$, $y(1) = 2$ by Euler's method.   3

5. (a) Find a polynomial of degree 2 for the data by Newton's Forward difference method: 5

x	0	1	2	3	4	5	6	7
y	1	2	4	7	11	16	22	29

(b) Correct the error (if any) $1 \times 2 = 2$

(i)
```
#include<iostream>
    Using namespace std;

int main(){
cout<<x<<endl;
cin>>x;
```

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P.T.O.

```
return 0;
}
```

(ii)
```
#include<iostream>
    Using namespace std;

int main(){
int sum=0
for (i=1; i<=10; i++){
sum = sum +i;
}
cout<<sum<<endl;
return 0;
}
```

(c) Write how you implement the following expressions in c++. $1 \times 3 = 3$

(i) $2x^3 + e^x + \frac{1}{2}$

(ii) $\sqrt{2x^3} + \sqrt{a^2 + b^2}$

(iii) $\frac{-b + \sqrt{b^2 - 4ac}}{2a}$

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