

Master of Science (Instrumentation) Examination, 2018-19
1st year, 1st Semester
SUBJECT : Advance Mathematics and Computer Programming
PAPER : I, CODE : I101

Full Marks: 100

Time: 4Hours

Group A

Use Separate Answer scripts for each Group

Answer any six of the following questions:

6×10=60

1. a) Find out the analytic function, whose real part is $2xy$.
b) Find the Fourier series to represent x^3 in the interval $(-\pi, \pi)$.
c) Solve the wave equation

$$\frac{\partial^2 v}{\partial t^2} = a^2 \frac{\partial^2 v}{\partial x^2}$$

under the condition: $v = 0$ when $x = 0$ and $x = \pi$

$$\frac{\partial v}{\partial t} = 0 \text{ when } t = 0 \text{ and } v(x, 0) = x, 0 < x < \pi.$$

2+3+5

2. a) Show that the function $f(z) = 2y + ix$ is not differentiable anywhere in the complex plane.
b) Solve the following differential equation using Laplace transformation

$$\frac{d^2 y}{dt^2} + 4 \frac{dy}{dt} + 3y = 0, \text{ where } y(0) = 2 \text{ and } y'(0) = -4.$$

- c) Find the inverse Laplace transform of $\frac{s^2}{(s^2+a^2)^2}$ using convolution theorem. 3+3+4

3. a) Given that $L[f(t)] = \frac{s^2-s+1}{(2s+1)^2(s-1)}$, find out $L[e^{-2t}f(2t)]$.
b) Find the half range sine series for the function $f(x) = 2x - 1$ in the interval $0 < x < 1$.
c) Find the Fourier cosine transform of $e^{-2x} + 4e^{-3x}$. 3+3+4

4. a) Show that the function $x^2 - y^2$ is harmonic but the function x^2y is not harmonic.
b) Given that $f(x) = 1$ for $|x| < a$

$$= 0 \text{ for } |x| > a$$

using Parseval's identity evaluate the integral $\int_0^\infty \frac{\sin^2 ak}{k^2} dk$.

- c) Find the inverse Z-transform of $\frac{1}{(z-3)(z-2)}$ in the following region

i) $|z| < 2$ and ii) $|z| > 3$.

2+4+4

[Turn over

5. a) Applying Newton-Raphson method, find an approximate root of the equation

$$\cos x - xe^x = 0$$

- b) Find the order of convergence of Newton-Raphson Method.

5+5

6. a) Deduce Newton's forward difference interpolation formula.

- b) Evaluate $y(1.2)$, applying suitable interpolation formula and using following data

$$y(0) = 1, y(1) = 1.5, y(2) = 2.2, y(3) = 3.1, y(4) = 4.3$$

7+3

7. a) Use suitable interpolation formula to find $y(0)$; following the data

$$y(-1) = -1, y(-2) = -9, y(2) = 11, y(4) = 69.$$

- b) Find the positive real root of $x \log_{10} x = 1.2$ using the method of bisection.

5+5

8. a) The velocity v of a particle at a distance x from a reference point on its path is given by the following table :

x in metre	0	10	20	30	40	50	60
v in m/s	47	58	64	65	61	52	38

Estimate the time taken by the particle to traverse 60 metres.

- b) Given that $\frac{dy}{dx} = 1 - y$ with $y(0) = 0$, using Euler's method find $y(0.1)$ and $y(0.2)$ with step-size 0.05. Compare the result with the exact solution.

5+5

Group B

Use Separate Answer scripts for each Group

1. Answer all the following questions:

6×1=6

(a) Output of the program is _____.

```
#include<stdio.h>
#include<conio.h>
intmain()
{
    staticinti=5;
    if(--i){
        main();
        printf("%d ",i);
    }
    getch();
}
```

- (i) 0 0 0 0
- (ii) 5 5 5 5
- (iii) 1 1 1 1
- (iv) Error

(b) Output of the program is _____.

```
#include<stdio.h>
#include<conio.h>
intmain()
{
    staticintvar = 5;
    printf("%d ",var--);
    if(var)
        main();
    getch();
}
```

- (i) 1 2 3 4 5
- (ii) Error
- (iii) 5 5 5 5 5
- (iv) 5 4 3 2 1

(c) Output of the program is _____.

```
#include<stdio.h>
#include<conio.h>
intmain()
{
    intx = 5, p = 10;
    printf("%d*d", x, p);
    getchar();
    return0;
    getch();
}
```

(d) Output of the program is _____.

```
intmain()
{
    signedchari=0;
    for(; i >= 0; i++);
}
```

[Turn over

```

printf("%d\n", i);
getchar();
return 0;
}

```

- (i) 0
- (ii) -128
- (iii) Error
- (iv) 128

(e) Output of the program is _____.

```

char*getString()
{
char*str = "Nice test for strings";
returnstr;
}

```

```

intmain()
{
printf("%s", getString());
getchar();
return 0;
}

```

(f) What type of error is there in the following program?

```

#include<stdio.h>
intmain()
{
typedefstaticint*i;
intj;
i a = &j;
printf("%d", *a);
getchar();
return 0;
}

```

2. Answer any four of the following questions:

$$4 \times 3 = 12$$

- (a) Write a C program to print Fibonacci series up to n (user given). 3
- (b) Write a C program to check whether a user given year is leap year or not. 3
- (c) Write a C program to check whether a user given number is palindrome or not. 3
- (d) Write a C program to print reverse of a user given string. 3
- (e) Write a C program to print the following pattern: 3

```

****
***
**
*

```

3. Answer any two of the following questions:

$$2 \times 4 = 8$$

- (a) Write a C program to show addition of two $m \times n$ matrices. 4

- (b) Write a C program to compute factorial of a user given number using recursion. 4
(c) Write a C program to compute sum of a sine series. 4

4. Answer any two of the following questions:
 $2 \times 7 = 14$

- (a) Write a C program to print following details of n (user given) students using structure. 7
(i) Student Name
(ii) Student Roll Number
(iii) Address
(iv) PAN Card Number
- (b) Write a C program to compute multiplication of two $m \times n$ matrices. 7
(c) Write a C program to compute the answer of following integral:

$$\frac{h}{3} (y_0 + y_n) + 4(y_1 + y_3 + \dots + y_{n-1}) + 2(y_2 + y_4 + \dots + y_n)$$