RAMAIAH UNIVERSITY OF APPLIED SCIENCES

Reg. No. of Student													

MATLAB Semester End Examination Model Question Paper

Faculty	**Engineering and Technology**		
Programme	**B. Tech**	**Department**	**Mathematics and Statistics**
Semester / Year	**3/2**	**Batch**	**2022**
Course Code	**MTB201A**		
Course Title	**Engineering Mathematics-3**		

INSTRUCTIONS TO STUDENTS:

1. **In the actual exam, you will not get internal choices as shown in the model question paper.**
2. **Answer any five full questions**
3. Use only SI units
4. Missing data may be appropriately assumed
5. Notations used have usual meaning
6.

Maximum Duration: 2 Hours **Maximum Marks: 50**

IMPORTANT:
Do not write anything except your register number on the question paper. Please handover the question paper to the room supervisor at the end of examination.

Q. No.	Question	Marks	CO
1	a. Given $A = \begin{bmatrix} 4 & 6 & 9 \\ 3 & 0 & 9 \\ 5 & 3 & 15 \end{bmatrix}$ Use MATLAB operations or built-in functions to obtain: I. Determinant of A II. Transpose of A III. Rank of A	**6**	**4**
	b. Write a MATLAB script to determine the following sum: $$S_n = \sum_{i=0}^{n} \frac{1}{i^2 + 1}.$$ Hence find the value of sum for $n = 10$. OR Use MATLAB built-in function to determine the Fourier transform of $$f(t) = \cos 3t + \sin 2t.$$	**4**	**4**

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2	a. Plot the periodic function $f(x) = x^2 + x + 2,\ \ 0 < x < 3,$ $f(x+3) = f(x)$ in the interval $(0, 9)$. OR Plot the periodic function $f(x) = \begin{cases} x & 0 < x < \pi \\ 2\pi - x & \pi \le x < 2\pi \end{cases}$, $f(x + 2\pi) = f(x)$ in the interval $(-4\pi, 4\pi)$.	**5**	**4**
	b. Plot the vector field $\mathbf{F}(x, y, z) = x\mathbf{i} + y^2\mathbf{j} + (z^2 + 1)\mathbf{k}$ in the interval $-2 \le x \le 2,\ -2 < y \le 2$ and $-2 \le z \le 2$.	**5**	**4**
3	Given that x: 5, 6, 9, 11 $f(x)$: 12, 13, 14, 16 a. Write a MATLAB function to interpolate the given data by using Lagrange's interpolation and compute $f(10)$. b. Plot the given data and interpolating polynomial in the same graph.	**10**	**4**
4	Write a MATLAB function to evaluate following integral by using the Trapezoidal/Simpson's 1/3rd rule by dividing the intervals into 6 equal subintervals. $\int_0^6 \frac{dx}{1+x^2}\ dx.$	**10**	**5**
5	**Manual Calculation:** Obtain the solution of the equation $x - \cos x = 0$ by Newton-Raphson method with the initial approximation $x_0 = 0.5$.	**10**	**5**
6	**Manual Calculation:** Determine the solution of the following system of equations by using Gauss-Seidel method by performing four iterations: $10x + 2y + 3z = 15$ $3x + 11y + 7z = 21$ $x + 2y - 10z = -7$	**10**	**5**

Solution:

1 a)

```
>> A=[4 6 9;3 0 9;5 3 15];

>> det(A)
ans =
 -27.0000
>> transpose(A)
ans =
   4    3    5
   6    0    3
   9    9   15
>> rank(A)
ans =
   3
```

1b)

```
s=0;
n=10;
for i=1:n
    s=s+(1/(i^2+1));
end
fprintf('Sum of the series is %f\n',s)

>> testeq
Sum of the series is 0.981793
```

OR

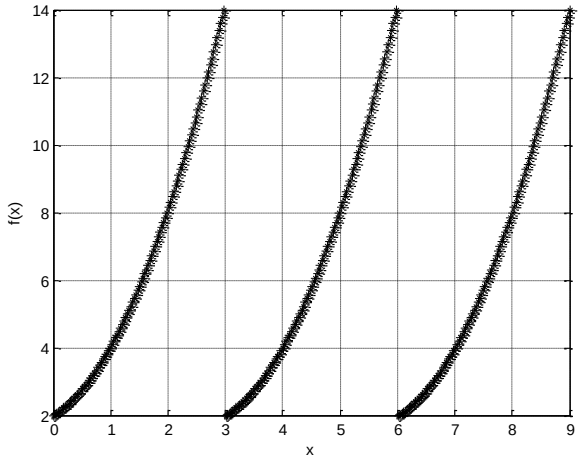
```
>> syms t w
>> f=cos(3*t)+sin(2*t);
>> fourier(f,t,w)

ans =

pi*(dirac(w - 3) + dirac(w + 3)) - pi*(dirac(w - 2) - dirac(w + 2))*i
```

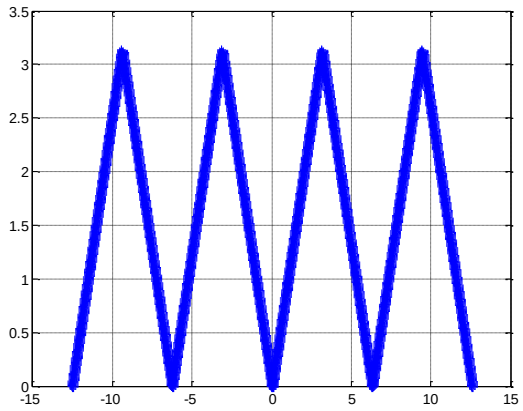
2 a)

```
x = linspace(0,3);
y = x.^2+x+2;
ry = repmat(y,1,3);
rx = linspace(0,9,length(ry));
plot(rx,ry,'k*')
xlabel('x')
ylabel('f(x)')
grid on
```



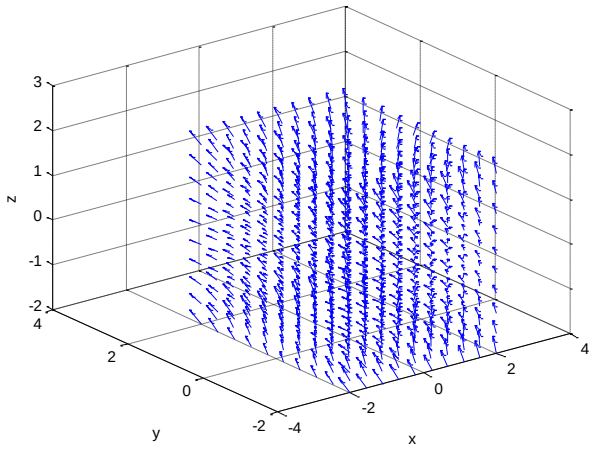
OR

```
f= @(x) (x).*(0<=x & x<pi)+(2*pi-x).*(pi<=x & x<2*pi);
x1=linspace(0,2*pi,1000);
pfx = repmat(f(x1),1,4);
x2 = linspace(-4*pi,4*pi,length(pfx));
plot(x2,pfx,'*b')
grid
```



2b)

```
x=linspace(-2,2,5);
y=linspace(-2,2,5);
z=linspace(-2,2,5);
[x,y,z]=meshgrid(x,y,z);
f1=x;
f2=y.^2;
f3=z.^2+1;
quiver3(x,y,z,f1,f2,f3)
xlabel('x')
ylabel('y')
zlabel('z')
```



3

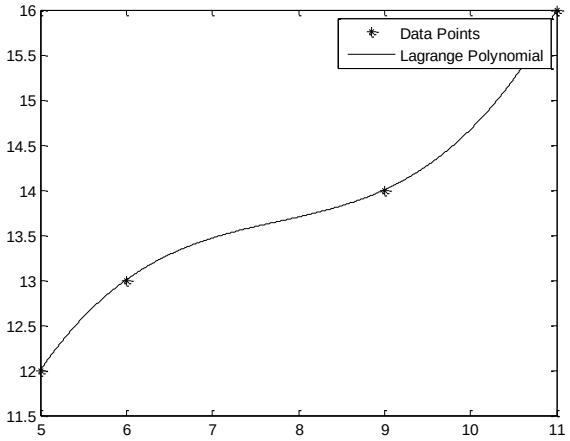
```
function [poly] = lag_poly(x,y)
n=length(x);
syms t
poly=0;
for i=1:n
    L=1;
    for j=1:n
        if(i~=j)
            L=L*(t-x(j))/(x(i)-x(j));
        end
    end
    poly=poly+L*y(i);
end
poly=simplify(poly);
t = x(1):0.001:max(x);
z = eval(poly);
plot(x,y,'*k',t,z,'k')
legend('Data Points','Lagrange Polynomial')
end
```

```
>> x=[5 6 9 11];y=[12 13 14 16];
>> [poly] = lag_poly(x,y)

poly =

t^3/20 - (7*t^2)/6 + (557*t)/60 - 23/2
```

$$f(10) = 14.6667$$



4

Trapezoidal rule

```
function [I] = trapez(f,a,b,n)
h=(b-a)/n;
x=a:h:b;
I= (h/2)*(f(a)+2*sum(f(x(2:n)))+f(b));
end
```

>> f=@(x) 1./(1+x.^2);

>> a=0; b=6; n=6;

>> trapez(f,a,b,n)

ans = 1.4108

OR

Simpson's 1/3rd rule

```
function [I] = simpson13(f,a,b,n)
h=(b-a)/n;
x=a:h:b;
I= (h/3)*(f(a)+4*sum(f(x(2:2:n)))+2*sum(f(x(3:2:n-1)))+f(b));
end
```

>> f=@(x) 1./(1+x.^2);

>> a=0; b=6; n=6;

>> simpson13(f,a,b,n)

ans = 1.3662

5)

$f(x) = x - \cos x, x_0 = 0.5$

$f'(x) = 1 + \sin x$

Newton Raphson Method is given by

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} = x_n - \frac{x_n - \cos x_n}{1 + \sin x_n} = \frac{x_n \sin x_n + \cos x_n}{1 + \sin x_n}$$

i	x_i
1	0.5
2	0.7552
3	0.7391
4	0.7390
5	0.7390

Therefore $x = 0.739$ is the root of the given equation

6) Given

$$10x + 2y + 3z = 15$$
$$3x + 11y + 7z = 21$$
$$x + 2y - 10z = -7$$

Solving for x, y, z, we get:

$$x = \frac{1}{10}(15 - 2x - 3z);$$
$$y = \frac{1}{11}(21 - 3x - 7z);$$
$$z = \frac{1}{10}(7 + x + 2y)$$

The iterations by Gauss Seidel are:

1	1.500000	1.500000	1.150000
2	0.855000	0.944091	0.974318
3	1.036705	1.006333	1.004937
4	0.991178	0.999264	0.998971

Therefore $x = y = z = 1$ is the solution.