



SB-3540

M. Sc. (Part - II) Examination

April / May - 2011

Mathematics : Paper - 5022

(Numerical Analysis & Mathematical Software)

(New Course)

Time : Hours]

[Total Marks :

Instructions :

(1)

नीचे दर्शावेल निशानीवाणी विगतो उत्तरवडी पर अवश्य लभवी.
 Fillup strictly the details of signs on your answer book.

Name of the Examination :

Name of the Subject :

Subject Code No. : Section No. (1, 2,.....) :

Seat No. :

Student's Signature

- (2) Attempt all questions.
- (3) Figures to the right indicates marks.
- (4) Follow usual notations and conventions.
- 1 (a) Let $x = \xi$ a root of $f(x) = 0$ and let I be an interval 8
 containing the point $x = \xi$. Let $\phi(x)$ and $\phi'(x)$ be
 continuous in I, where $\phi(x)$ is defined by the equation
 $x = \phi(x)$. Which is equivalent to $f(x) = 0$. Then prove
 that if $|\phi'(x)| < 1$ for all x in I, the sequence of
 approximations x_0, x_1, \dots, x_n defined by $x_{n+1} = \phi(x_n)$
 converges to the root ξ , provided that the
 initial approximation x_0 is chosen in I.
- (b) Use the method of false position, to find the fourth
 root of 32 correct to three decimal places.
- (c) By using the bisection method, find an approximate
 root of the equation $\sin x = \frac{1}{x}$, that lies between $x = 1$
 and $x = 1.5$ (measured in radians). Carry out computation
 up to the 4th stage.

- 1 (a) Find the real root of the equation $x^3+x^2-1 = 0$ by iteration method on the interval $[0, 1]$ with an accuracy of 10^{-3} . 8
- (b) Find a real root of the equation $x^3-2x-5 = 0$ using secant method correct up to three decimal places.
- (c) Prove that bisection method has linear convergence.

- 2 (a) Solve the following system by Gauss Jordan method : 8
- $$\begin{aligned} x_1+2x_2+x_3 &= 8 \\ 2x_1+3x_2+4x_3 &= 20 \\ 4x_1+3x_2+2x_3 &= 16 \end{aligned}$$
- (b) Explain LU - Decomposition method to solve the system of linear equations with forward and backward substitution.
- (c) Determine whether the following linear system of equations is consistent :
- $$x-4y+5z = 8, \quad 3x+7y-z = 3, \quad x+15y-11z = -14.$$

OR

- 2 (a) Find numerically, the largest eigenvalue of the matrix 8

$$\begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix} \text{ using power method correct up to 4 places}$$

of decimals.

- (b) Find the inverse of the matrix $\begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 4 \\ 2 & 4 & 3 \end{bmatrix}$ using

Cholesky method.

- (c) Discuss the least squares curve fitting procedures.

- 3 (a) What do you mean by initial value problem (IVP) ? 8
Apply Runge-Kutta 4th order method to find approximate

value of y for $x = 0.2$, in steps of 0.1 , if $\frac{dy}{dx} = x + y^2, y = 1$ when $x = 0$.

- (b) What do you mean by boundary value problem

(BVP) ? Solve the BVP $y'' + (1+x^2)y + 1 = 0, y(-1) = y(1) = 0$, using the finite difference scheme, with $h = 0.5$.

- (c) Use Newton-Raphson method to solve the equations $x = x^2 + y^2, y = y^2 - x^2$ correct to two decimal, starting with the approximation $(0.8, 0.4)$.

OR

- 3 (a) Apply Runge-Kutta 2nd order method to find approximate value of y for $x = 0.4$, in step of 0.1, 8
 if $\frac{dy}{dx} = y - x$, given that $y = 2$ when $x = 0$.
- (b) Use the second order method solve :
 $u'' = u + x; u(0) = u(1) = 0$ with $h = 0.25$.
- (c) Use Euler's method to solve $\frac{dy}{dx} = -y; y(0) = 1$. Choose $h = 0.01$ to calculate $y(0.04)$, and compare the value so obtained with the exact value (obtained by solving the given differential equation directly).

- 4 (a) Write short note on Script files and Function files. 9
 State the point of differences between the two.
- (b) Write a MATLAB program to check whether the given number is odd or even.
- (c) Explain the logical operations in MATLAB.

OR

- 4 (a) Write a note on : Control structures in MATLAB. 9
- (b) Write a MATLAB program to print fibonacci numbers.
- (c) Explain array operations in MATLAB.

- 5 (a) Write an assignment statement in MATLAB to 9

calculate the value of w using $w = \frac{(x^2 + 3) \sin \pi x^2 \sin^2 \pi x}{(x^2 + 3)}$.

Write a MATLAB script file to plot the graph of w over the range $0 \leq x \leq 10$ and taking 100 equally spaced points.

- (b) Write a note on use of :
- (i) Subplots in MATLAB
 - (ii) Sprintf command in MATLAB
 - (iii) Inline function in MATLAB.
- (c) Write the output of the following MATLAB commands :
- ```
A = ones (4, 1)
s = size (A)
B = [1; 2; 3]
A [: s(2)] = B
```

**OR**

- 5 (a) Write a MATLAB script file to overlay the plots of 9  
the curves defined by  $y = \sin x$  and  $z = 1 - \frac{x^2}{2} + \frac{x^4}{24}$   
over the range  $0 \leq x \leq \pi$  and taking 100 equally  
spaced points.
- (b) Explain how data can be read from a .dat file  
in MATLAB.
- (c) State the output of the following MATLAB code :
- ```
for i = 1:2  
for j = 1:3  
A(i,j) = (2*i)-j  
end  
end  
B = A(:,2) + A(2,:).'
```
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