2016

MATHEMATICS

[Honours]

PAPER – VIII

Full Marks : 60

Time : 3 hours

The figures in the right hand margin indicate marks

GROUP – A

(*Numerical Analysis*)

[*Marks* : 25]

1. Answer any *two* questions : 8 × 2

   (*a*) Explain the method of fixed point iteration for the numerical solution of an equation $f(x) = 0$ by resetting it in the form $x = \phi(x)$. Find the condition of convergence of the method. Is it possible to formulate more than one iterative scheme for the equation ? Justify your answer. 3 + 3 + 2

(*b*) (*i*) Prove that the relative error in the product of two approximate numbers is approximately equal to sum of their relative errors. 4

(*ii*) Establish trapezoidal formula for numerical integration of $f(x)$ in $[a, b]$. Find the error of the formula. 4

(*c*) (*i*) Define the k-th order difference of a function $f(x)$ and show that

$$\Delta^K f(x) = \sum_{i=0}^{k} (-1)^i \binom{k}{i} f\{x + (k-i)h\}$$

where h is the step length. 4

(*ii*) Define the operators E, ∇, Δ, μ and δ and establish the following relations: 4

(1) $\mu\delta = \frac{1}{2}\Delta E^{-1} + \frac{1}{2}\Delta$,

(2) $(1+\Delta)(1-\nabla) = 1$.

2. Answer any *two* questions : 4×2

(*a*) Find the quadratic polynomial which takes

the same values as $f(x)$ at $x = -1, 0, 1$ and integrate it to prove that

$$\int_{-1}^{1} f(x)dx = \frac{1}{3}[f(-1) + 4f(0) + f(1)].$$

Assuming the error to have the form $Af^{(iv)}(\xi)$, $(-1 < \xi < 1)$, find the value of A. 4

(*b*) Using Runge-Kutta method of fourth order to find $y(0{\cdot}1)$ and $y(0{\cdot}2)$ with step size $h = 0{\cdot}1$, given that

$$\frac{dy}{dx} = (y - x),\ y(0) = 2.$$ 4

(*c*) Describe Gauss' elimination method for the solution of a system of n linear equations with real coefficients in n unknowns. 4

3. Answer any *one* question : 1×1

(*a*) State the theorem on which polynomial interpolation is based. 1

(*b*) Define the term 'significant figure' with example. 1

GROUP – B

(*Elements of Computer Science*)

[*Marks* : 35]

4. Answer any *one* question : 15×1

(*a*) (*i*) Convert the decimal number 25·375 to its binary equivalent. What are machine language and assembly language ? 3 + 2

(*ii*) Explain the terms with suitable examples :

Syntax error, Run-time error. 5

(*iii*) Design a flowchart for finding the largest of 25 given positive numbers, using appropriate diagrams. 5

(*b*) (*i*) How many types of numerical variables are used in Fortran or in C ? Identify them with one example each. 3 + 2

(*ii*) Write a computer program to find the g.c.f. and l.c.m. of two positive integers. 5

(*iii*) Find the truth table and the circuit using only NOR gates for the function

$$(A+B)\cdot(A+C).$$ 5

5. Answer any *two* questions : 8 × 2

(*a*) (*i*) Given a matrix $A=\begin{pmatrix}1 & 2 & 3\\ 4 & 5 & 9\end{pmatrix}$. Write a program to read it row-wise and print its transpose. 4

(*ii*) Obtain the logical diagram for the function $AB'+(C+D)'=E$. 4

(*b*) (*i*) Write algorithm and corresponding computer program for computing ${}^{n}C_{r}$ for a given positive integer n and r ($\leq n$). 5

(*ii*) Express the boolean function

$$xyz + xy'z' + x'yz' + x'y'z'$$

in conjunctive normal form. 3

(*c*) (*i*) Design a flowchart to find the sum of all odd integers from 1 to 100. 4

(*ii*) Write short notes on (any *two*) : 4

(1) GOTO statement

(2) DIMENSION

(3) for loop in C

(4) if else statement in C

(5) DO statement in FORTRAN

(6) do-while loop in C.

6. Answer any *one* question : 4×1

(*a*) Write a computer program in C or in FORTRAN to find a real root of the equation

$$x^3 - 5x + 1 = 0$$

by Newton-Raphson method correct to 4D. 4

(*b*) Write a computer program for the calculation of e

$$e = 1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \ldots$$

by direct summation of successive terms neglecting the term whose value is less than 10^{-8}. 4

NEW

Part–III 3-Tier

2016

MATHEMATICS

(Honours)

PAPER—VIII

(PRACTICAL)

Full Marks : 30

(PROBLEM – 24 + PNB & VIVA – 6)

TIME — 2 HOURS

Group—C

Answer *two* questions : 2×12

The questions must be allotted by Lottery.

Program must be written either in FORTRAN-*l*anguage or in C-*l*anguage.

Set—I

1. Write a program to test whether a matrix is symmetric or skew-symmetric.
2. Write a program to determine whether a matrix of order 3×3 is singular or not.
3. Write a program to check a string for palindrome without using library function.
4. Write program which will converts lowercase characters of a string to uppercase characters.
5. Write a program to find the second and third central moments for the sample 345·21, 567·98, 298·09, 123·54, 349·10, 908·23, 342·33.
6. Write a program to compute the value of sine series upto 15 and 20 terms and compare the result when $x = 0{\cdot}75$.
7. Write a program to find the value of $n!$ for n = *5, 8, 15, 20* and *26*.

(Turn Over)

8. Write a program to find the values of ${}^{n}C_{r}$ for given values of n and r. Demonstrate your program for $n = 10, r = 4$.

9. Write a program to a test whether a positive integer is prime number or not. Demonstrate your program for the integers 2, 12, 153, 34577.

10. Write a program to evaluate $\int_{0}^{1} x + e^{2x}\, dx$ by Simpson 1/3rd rule taking 50 subintervals.

11. Write a program to find a real root near x=1 of the equation $x^{30}-1 = 0$ using Regula-falsi method correct up to 4 decimal places.

12. Write a program to find a root of $x = \cos x$ by bisection method, correct up to 5 decimal places.

13. Write a program to find a real root of the equation $3x^5 - 10x^4 - 4x^2 + 2x + 8 = 0$ by Newton-Raphson method correct up to 5 decimal places.

14. Write a program to find the value of y (0.1) from the differential equation.

$\frac{dy}{dx} = x + 2y + 10$, x (0) = 1·1 by second order Runge-Kutta methods.

15. Write a program to find the sum of the series

$1 + \frac{1}{(2\times5)^2} + \frac{1}{(2\times5)^4} + \frac{1}{(2\times5)^6} \ldots$ correct up to 5 decimal places.

16. Write a program to compute ${}^{n}P_{r}$ and ${}^{n}C_{r}$ using a function. Demonstrate your program using ${}^{4}P_{2}$ and ${}^{5}C_{3}$.

17. Write a program to convert binary number to a decimal number. Demonstrate your program for 110011001001.

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Set—II

1. Write a program to find the area and circumference of a circle whose diameter is given. Demonstrate your program for the diameters 1034·78 and 14445·44.

2. Write a program to find the roots of a quadratic equation $ax^2 + bx + c = 0$. Demonstrate your program for the equation $4{\cdot}12456x^2 - 412{\cdot}2256x - 12332234{\cdot}913 = 0$.

3. Write a program to find the G.C.D. between two integers. Demonstrate your program for the numbers 310213 and 18972.

4. Write a program to subtract the matrix A from the matrix 4·5A.

5. Write a program to subtract a matrix B from the matrix A.

6. Write a program which will converts uppercase characters of a string to lowercase characters. Demonstrate your program for the string '1901. Rabindra Nath Sarkar'.

7. Write a program to sort a group of names in descending order. Demonstrate your program for the set of strings Gopal, Krishna, Kanai, Surya, Barun, Pati.

8. Write a program to rewrite name of a person in short form (i.e. Janaki Ranjan Sarkar in the form J. R. Sarkar).

9. Write a program in to find the mean and standard deviation of a set of 10 numbers. Demonstrate your program for the numbers 3·214, 1·82, 9·08, 12·356, 22·323, 4·532, 1·230, 43·21, 20123·0.

10. Write a program to find a root of the equation $(x-1\cdot5)(x-2\cdot5)(x-3\cdot5)(x-4\cdot5)=0$ by bisection method, correct up to 5 decimal places starting from x = 1·0.

11. Write a program to find a real root near x = 1 of the equation $x^{50} - 1 = 0$ using Regula-falsi method correct up to 4 decimal places.

12. Write a program to evaluate $\int_{1\cdot4}^{2\cdot2} \left(2\log x + x^3\right) dx$ by Simpson 1/3rd rule taking 100 subintervals.

13. Write a program in to find the value of y (0·2) from the different equation.

$\frac{dy}{dx} = x + y^2 + 1\cdot03$, $x(0\cdot05) = 1$ by fourth order Runge-Kutta methods.

14. Write a program to search word in a text without using library function. Demonstrate your program for the word 'student' in a text 'Rahim is a good student in a class.'

15. Write a program to check a strain for palindrome without using library function. Demonstrate your program for the strings 'madam' and 'sir.'

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Set—III

1. Write a program to evaluate $\int_{1.5}^{2} (x\log x + \sin x)dx$ by trapezoidal rule taking 120 subintervals.

2. Write a program to find all the numbers between 1 and N that are divisible by 7 and 20.

3. The terms of the Fibonacci series is defined as :

   F(0) = 1

   F(1) = 1

   F(n + 2) = F(n) + F(n + 1), n = 0, 1, 2, ...

   Write a program to find the first 50 Fibonacci numbers.

4. Write a program to find all the prime numbers between 100 and 200.

5. Write a program to find the L.C.M. between two integers. Demonstrate your program for the integers 12001 and 35544.

6. Write a program to evaluate $\int_0^1 \left(x^2 + \alpha \cos x\right) dx$ by Simpson $\frac{1}{3}$rd rule taking $h = 0{\cdot}1$ and α is your class roll number.

7. Write a program to find the value of y(0·2) from the differential equation :

   $\frac{dy}{dx} = x^2 + y$, x(0·1) = 1 by second order Runge-Kutta methods.

8. Write a program to find the sum of the series :

   $x + \frac{x^2}{2 \cdot 3} + \frac{x^3}{3 \cdot 4} + \frac{x^4}{4 \cdot 5} + \cdots + \frac{x^n}{n \cdot (n+1)}$ for n = 20 and x = 1·3.

9. Write a program to test the orthogonality of a matrix.

10. Write a program to find the sum of all elements of a matrix and the trace of the same matrix.

11. Write a program to find the length (i.e. the number of characters including blank spaces) of a string. Demonstrate your program for the string 'I am very strong in Computer Programming'.

12. Write a program to search a sub-string within a string. Using your program find the occurrences of the substring 'th' within the string 'What is the name of this college ?'

13. Write a program to find a real root of the equation $x^5 - 3x^3 + 10x - 14 = 0$ using Newton-Raphson method, correct up to 5 decimal places.

14. Write a program to find the L.C.M. and GCD between two integers. Demonstrate your program for the integers 28, 46.

15. Write a program to find the sum of the series :

   $1 + \frac{x}{2!} + \frac{x^2}{3!} + \frac{x^3}{4!} + \ldots\ldots\ldots\ldots$

   Correct up to 5 decimal places for x = 1·3.

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