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DPP-1413

M. Sc. (Sem. II) Examination

March/April – 2016

Physics : PH-424

(Numerical Analysis & Computer Programming)

Time : 3 Hours] [Total Marks : 70

Instructions : (1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :
☛ **M. Sc. (Sem. 2)**

Name of the Subject :
☛ **Physics : PH-424**

☛ Subject Code No. : **1 4 1 3** ☛ Section No. (1, 2,.....) : **Nil**

Seat No. :

Student's Signature

(2) Attempt all questions.
(3) Symbols used have their usual meaning.
(4) Figures to the right indicate marks.
(5) Scientific calcualtor may be used.

1 Attempt any two questions.

(a) (i) Derive Simpson's 1/3 rule for integration. 3

(ii) Find all the eigen values and eigen vectors of the matrix given below using Jacobi method $\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$ 4

(b) (i) Explain the matrix inverse method for solution of simultaneous linear equations. Explain a method for finding the inverse of a matrix. 3

(ii) Given dy/dx = x+y and y(o)=1. Find y(0.2) using second order Runge-Kutta method and taking h=0.1. 4

(c) (i) Explain the 4th order Runge-Kutta method for solution of ordinary differential equations. What is the geometric significance of this method? 3

(ii) Compute the integral $\int_1^6 \frac{1}{x} dx$ using Simpson 1/3 rule. Also find the inherent error in your calculation. 4

2 Attempt any two questions.

(a) (i) Discuss the Householder method for solution of eigen value problem. 3

(ii) Two computations of a definite integral are made using Simpson's $1/3^{rd}$ rule giving R_1 and R_2 as corresponding results. Show that the inherent error in the second computation (E_2) is given by $E_2 = (R_2-R_1)/15$. When the number of subintervals used in the second computation is twice that used in the first. 4

(b) (i) Explain the importance of numerical analysis in solving problems in physics with the help of some examples. 3

(ii) Using the linear regression, find the straight line $y=mx+c$ that fits the following data: 4

x	0.5	1.0	1.5	2.0	2.5	3.0
y	15	17	19	14	10	7

(c) (i) Define the terms: (i) Operating system (ii) Higher level language (iii) Compiler. 3

(ii) What are the steps involved in writing a program in a high level language to getting output from it? Explain each of them in brief. 4

3 Attempt any two questions.

(a) (i) Discuss the general syntax of DO-loop with examples. 3

(ii) What is the first line of every FORTRAN program and what does it tell the compiler? 2

(iii) Write a FORTRAN expression corresponding to the following algebraic expression: 2

$$\left|x^2 - y^2\right| + \sqrt{2xy}$$

(b) (i) Discuss any two Format specifications used in FORTRAN with examples. 2

(ii) Write down syntax for IF-THEN-ELSE statement. 2

(iii) Write a FORTRAN program to arrange 'N' given numbers in ascending order. 3

(c) (i) What are the relational operators in FORTRAN? 3

(ii) Write down general syntax for WRITE statement with examples. 2

(iii) Explain any two file processing statements in FORTRAN. 2

4 Attempt any two questions.

(a) (i) Explain the different types of loops in C with syntax and example. 3

(ii) Write C program to find the largest of the three numbers. 4

(b) (i) Write a C program to read and display a text from the file. 4

(ii) Write a Program in C to reverse the digits of a given number. 3

(c) (i) Write a C Program to print prime numbers between 1 and 100. 3

(ii) Explain Recursive function with an example program. 4

5 Attempt any two questions.

(a) (i) Evaluate the following expression: 2

A=1.5; B=3.0

I=B/2.0+B*4.0/A-B+A**3

(ii) Write a FORTRAN program to read all the elements of a N x N real matrix given row-wise and find the sum of squares of the diagonal elements. 5

(b) (i) What is the hierarchy of the arithmetic operators in FORTRAN? 2

(ii) Write a **C** program to evaluate $\int_{1.0}^{1.4} 7 \log x dx$ using Simpson's 1/3 rule. 5

(c) (i) Find errors, if any, in the following assignment statements and rectify them: 2

(i) p*=x/y

(ii) a=b++c*2

(ii) Write a **C** or FORTRAN program to find a real root of a transcendental equation $x - 2\sin x = 1$ using *Newton Raphson method* assuming x_0 and x_1 where $f(x_0) < 0 < f(x_1)$. 5