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RE-3577-78

M. Sc. (Part - II) Examination

April / May – 2010

Physics : Paper - I

(Numerical Analysis & Computer Programming & Subatomic Physics)

Time : **3** Hours] [Total Marks : **70**

RE-3577

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. - 2

Name of the Subject :
☛ PHYSICS - 1

☛ Subject Code No. : 3 5 7 7 ☛ Section No. (1, 2,.....) : 1

Seat No. :

Student's Signature

(2) Answers to the two sections must be written in separate answer books.

(3) Assume data if required.

(4) Symbols have their usual meaning.

(5) Figures to the right indicate full marks.

1 (a) Explain Taylor series method for solution of first order ordinary differential equations. **2**

(b) Given $\frac{dy}{dx} = x + y$, and $y(0) = 1$ **4**

Find $y(0 \cdot 1)$ and $y(0 \cdot 2)$ using fourth order Runge-Kutta method.

(c) What is the order of inherent error in Weddle rule for numerical integration. **1**

(d) What is the use of DIMENSION statement in FORTRAN? Is it an executable statement? **2**

(e) Explain the use of Break Statement in a C-program. **2**

2 (a) Derive an expression for inherent error in the Simpson's 1/3rd rule for integration. 4

(b) Describe various steps involved in running a higher level language computer program. 3

(c) Solve the system of equations given below using matrix inversion method 5

$x + y + z = 7$

$3x + 3y + 4z = 24$

$2x + y + 3z = 16$

OR

2 (a) What is the difference between the Jacobi method and the Householder method for solution of eigenvalue problem. 3

(b) Discuss least-square fit method. 2

(c) What are the basic components of a computer? 2

(d) Evaluate $\int_0^4 \left(2x^4 + x^3/2 + x^2\right) dx$ 5

using Simpson's 1/3rd rule and taking $h = 1$. Also find the inherent error in this calculation.

3 (a) Explain the difference between the following in FORTRAN: 6

(i) STOP and END

(ii) GOTO and computed GOTO

(iii) OPEN and CLOSE

(b) Is there any difference in the following FORTRAN arithmatic expressions: 1

3.2 * 3.2 and 3.2 ** 2.0 ?

(c) Write C-program to multiply two matrices. 5

OR

3 (a) What is Pointer data type in C? Explain with an example. 2

(b) What are the various input and output statements in C? 2

(c) What is the difference between Global, local and static variables in C? 3

(d) Write a FORTRAN program to solve 5

$\frac{dy}{dx} = \frac{(y+x)}{(y-x)}$ with given (x_0, y_0) and h and using the fourth order Runge-Kutta method.

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Name of the Examination :

☛ **M. Sc. - 2**

Name of the Subject :

☛ **PHYSICS - 1**

☛ Subject Code No. : **3 5 7 8** ☛ Section No. (1, 2,.....) : **2**

Seat No. :

Student's Signature

(2) Answers to the two sections must be written in separate answer books.

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(5) Figures to the right indicate full marks.

4 (a) What is the difference between compound nuclear reactions and direct reactions? **2**

(b) Give a brief account of the differences and similarities of QED and QCD. **2**

(c) What is meant by hypercharge? What is Gell-Mann Nishijima formula? **2**

(d) What are neutrinos? Why is it required in weak beta decay processes? **2**

(e) Compute the binding energy for $_{26}Fe^{56}$ given that $m(_{26}Fe^{56}) = 55.934932$ amu, $m_n = 1.008665$ amu, $m_H = 1.007825$ amu. **3**

5 (a) Explain how important are the spin-orbit interaction in nuclear potential. Show how it helps to explain the observed magic numbers in nuclei using the shell model. **4**

(b) Explain how the liquid drop model of the nuclei helps to understand the nuclear fission. **4**

(c) Draw the single particle shell model structure and determine the spin parity of their ground states of $_{17}Cl^{35}$ and $_{11}Na^{23}$. **4**

OR

5 (a) Deduce the expression for the differential cross section in terms of the scattering amplitude. Using the partial wave analysis compute the scattering amplitude. 4

(b) Explain the general features of Resonance reactions. 4

(c) List all the possible multipole transitions from an excited state $3/2^+$ to ground state $1/2^+$. 4

6 (a) Mention one example each of an iso-singlet, an iso-doublet and an iso-triplet. 4

(b) Discuss Heisenberg, Majorana, Bartlett and Wigner exchange forces. 4

(c) Check for the following reactions using the quark contents of the hadrons involved: 4

(i) $p + \pi^+ \rightarrow \Sigma^+ + K^+$

(ii) $\Delta^{++} \rightarrow P^+ + \pi^+$

OR

6 (a) What are mesons? What is meant by pseudo scalar mesons and vector mesons? 4

(b) What is spontaneous symmetry breaking? How is it related to Higgs particle? 4

(c) What is a tensor potential? Give an experimental proof that nuclear potential has a tensor component. 4