Marks scored:

KATHMANDU UNIVERSITY
End Semester Examination [C]
November, 2018

Level : B.Sc.
Year : IV
Course : PHYS 405
Semester: I

Exam Roll No. :
Time: 30 mins.
F. M. : 15

Registration No.:
Date NOV 18 2018

SECTION "A"
[15 Q.× 1=15 marks]

I. *Choose and tick the most appropriate answer. The symbols, unless mentioned otherwise, have their usual meanings.*

1. The force law predicted by general relativity which is used to study the precession of perihelion of Mercury is

[a] $\vec{F} = -\frac{GM_S M_M}{r^2}\left(1+\frac{\alpha}{r^2}\right)\hat{r}$ [b] $\vec{F} = -\frac{GM_S M_M}{r^2}\left(1+\frac{\alpha}{r^4}\right)\hat{r}$

[c] $\vec{F} = -\frac{GM_S M_M}{r^2}\left(1-\frac{\alpha}{r^2}\right)\hat{r}$ [d] $\vec{F} = -\frac{GM_S M_M}{r^2}\left(1-\frac{\alpha}{r^4}\right)\hat{r}$

2. If E_x, E_y and E_z are the components of electric field at any point (x,y,z), then the appropriate syntax for plotting the field vector is

[a] `quiver2(x,y,z,Ex,Ey,Ez)` [b] `quiver(x,y,z,Ex,Ey,Ez)`
[c] `quiver3(x,y,z,Ex,Ey,Ez)` [d] `quiver3(Ex,Ey,Ez,x,y,z)`

3. The conditional statement in if-statement for $y = f(x)$ curve to locate the peaks position is

[a] `x(i)>x(i-1)&&x(i)>x(i+1)` [b] `x(i)<x(i-1)&&x(i)<x(i+1)`
[c] `y(i)<y(i-1)&&y(i)<y(i+1)` [d] `y(i)>y(i-1)&&y(i)>y(i+1)`

4. The random walk in which the walker sees the site of death and ends the walk after choosing all the sites of death is called

[a] simple random walk. [b] diffusive random walk
[c] self-avoiding walk [d] growing self-avoiding walk

5. The optimal value for the relaxation parameter in the second order difference approximation with N_x and N_y as the number of interval along x- and y- axes is

[a] $\frac{4}{2+\sqrt{4-\left[\cos\frac{\pi}{N_x}+\cos\frac{\pi}{N_y}\right]^2}}+1$ [b] $\frac{4}{2+\sqrt{4-\left[\cos\frac{\pi}{N_x}+\cos\frac{\pi}{N_y}\right]^2}}-1$

[c] $\frac{4}{2-\sqrt{4-\left[\cos\frac{\pi}{N_x}+\cos\frac{\pi}{N_y}\right]^2}}-1$ [d] $\frac{4}{2+\sqrt{4+\left[\cos\frac{\pi}{N_x}+\cos\frac{\pi}{N_y}\right]^2}}-1$

6. If v be a vector of length n. the syntax `A=diag(v,-1);A=diag(v,+1);` produces a matrix with dimension

[a] $n+1\times n-1$ [b] $n-1\times n+1$

[c] $n-1\times n-1$ [d] $n+1\times n+1$

7. To remove the elements of A greater than r_1 and less than r_2 for $r_1 < r_2$, the required syntax is

[a] `A(A>r1&A>r2)=[]` [b] `A(A>r1&A<r2)=[]`

[c] `A(A<r1&A<r2)=[]` [d] `A(A<r1&A<r2)=[]`

8. If D^+, D^- and D^0 are the forward, backward and central difference operators respectively, then the relation between them is

[a] $D^0 = \dfrac{D^+ + D^-}{2}$ [b] $D^0 = \dfrac{D^+ D^-}{D^+ + D^-}$

[c] $D^0 = \sqrt{D^+ D^-}$ [d] $D^0 = \dfrac{D^+ - D^-}{2}$

II. *Fill in the following blanks with appropriate answer. The symbols, unless mentioned otherwise, have their usual meanings*

9. The terms of column vector c of parameter array for classic RK method are .....

10. An electric field $E = E_0 \sin \omega t$ incident on a birefringence crystal of thickness D with refractive indices along x- and y- directions are n_x and n_y respectively. The x- and y-components of electric fields after emerging from crystal are ....

11. An anonymous function is declared as `F=@(x)[x,x^2,x+1]`. Then `F(2)` produces .....

12. The y-component of electric field used for writing the code and drawing the field vector around the straight wire carrying uniformly distributed total charge Q is .....

13. The one line syntax to find the sum $\sum_{n=1}^{N} \dfrac{\sin nx \cos nx}{n^2}$ for a given value of x of length N is .....

14. The initial conditions for solving time independent Schrodinger's equation for odd perity using shooting and matching method are .....

15. The program which display the animation of progressive wave for given wavelength and speed is ....

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SECTION "B"
[5Q ×3 = 15 marks]

1. Explain how the higher order ordinary differential equations can be reduced to first order differential equation.

2. Write a program to study the motion of a projectile in a field of linear velocity drag.

   OR

   Write a program to observe the waveform of beat and determine the beat period and frequency.

3. Write a program to study the intensity distribution in a N-slits diffraction.

4. Explain the method for solving the time-dependent Schrodinger's equation and obtain the discretized formula.

   OR

   Explain the matrix method for solving the time-independent Schrodinger's equation.

5. What do you mean by Monte Carlo integration? Using Monte Carlo integration, write a program to estimate the value of π.

SECTION "C"
[5Q × 5 = 25 marks]

6. With necessary formulation, write a program to study motion of a satellite around the Earth.

7. Write a program to simulate the oscillation of simple pendulum.

   OR

   Write a program to study the forced harmonic oscillation.

8. Deriving the necessary theory, write a program to visualize the rings on Newton's ring experiment.

9. Derive an expression for magnetic field due to the ring current and write a program to visualize the distribution of the field vector.

   OR

   Obtaining the finite difference formula, write a program for solving the Laplace's equation for a given boundary condition.

10. What is random walk? Write a program to explain the radioactive decay using random walk.