

KATHMANDU UNIVERSITY
End Semester Examination
March/ April, 2017

Level : B. Sc.

Course : PHYS 405

Year : IV

Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 15

Registration No.:

Date

MAR 30 2017

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. An anonymous function is defined as

$$F = @(x, y) [x(1) * y(2), y(3) ^ 2 * x(2) + y(1) * x(3)].$$
 Then

$$F([2, 1, 3], [1, 0, -1])$$
 produces

[a] [0, 4]

[b] [2, 2]

[c] [4, 0]

[d] [0, 2]

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

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

3. The conditional statement in if-statement for $y = f(x)$ curve to locate the peak 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 chooses the appropriate site to proceed the random walk 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 A be a matrix of random numbers between 0 and 1. In order to count the random number less than p in A the required expression is

[a] `sum(A < p)`[b] `count(A < p)`[c] `sum(sum(A < p))`[d] `sum(A > p)`

KATHMANDU UNIVERSITY
End Semester Examination
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MAR 30 2017

Level : B. Sc.
Year : IV
Time : 2 hrs. 30 mins.

Course : PHYS 405
Semester : I
F. M. : 40

SECTION "B"

[5Q × 3 = 15 marks]

1. Explain how the system of 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 quadratic velocity drag.
OR
What is meant by beat? Write a program to observe the waveform of beat and determine the beat frequency.
3. Write a program to study the intensity distribution in a single slit 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 volume of a ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$.

SECTION "C"

[5Q × 5 = 25 marks]

6. With necessary formulation, write a program to study motion of a spacecraft after shooting toward the Moon.
7. Write a program to simulate the oscillation of simple pendulum.
OR
Write a program to study the damped harmonic oscillation. Your program should produce the plot for difference damping situations.
8. Deriving the necessary theory, write a program to find the radius of the Newton's rings and another program to visualize the ring.
9. Derive an expression for resultant electric field due to a ring charge of radius R and a line charge of length L passing through the center and perpendicular to the plane of the ring.
OR
Obtaining the finite difference formula, write a program for solving the Poisson's equation.
10. Show that the probability in random walk obeys the diffusion equation. Write a program to animate the diffusion of cane-sugar block in water.

