8. (a) Write an algorithm to find the solutions of a quadratic equation. Also draw its correcponding flowchart. 4+3=7

(b) Write the MATLAB program to find the solutionof a given quadratic equation 3

$$ax^2 + 6x + c = 0$$

9. Find the general solution of Legendre's differential equation using series solution method. 10

Or

10. (a) Show that x = 0 is a regular singular point of D.E 2

$$2x^2 \frac{d^2y}{dx^2} + 3x \frac{dy}{dx} + (x^2 - 4)\, y = 0$$

(b) Find solution about x = 0 of the D.E 8

$$3x \frac{d^2y}{dx^2} + 2 \frac{dy}{dx} + y = 0$$

using series solution method.

★★★

UG (CBCS) EVEN SEMESTER EXAMINATION, 2023

EDUCATION (B.Sc. B.Ed.)

PHYSICS (HONOURS)

6th Semester

Course No. : BSPH - 601

(Theory of Relativity, Computational Physics & Mathematical Physics II)

Full Marks : 50

Pass Marks : 20

Time : 2 hours

The figures in the margin indicate full marks for the questions

1. (a) State two fundamental postulates? Special theory of relativity. 2

(b) Show that the Lorentz transformation reduces to Galilean transformation when $v << c$. 2

(c) Using the Lorentz transformation equations derive the relation $L = L_o \sqrt{1-\beta^2}$ 6

where L_0 = proper length and $\beta = \frac{v}{c}$

Or

2. (a) Derive the transformation equations of velocities:

$$u_x{}' = \frac{u_x - v}{1 - \frac{vu_x}{c^2}}$$

(Turn Over)

$$u_y{}' = \frac{u_y\sqrt{1-\beta^2}}{1-\frac{vu_x}{c^2}}$$

$$u_z{}' = \frac{u_z\sqrt{1-\beta^2}}{1-\frac{vu_x}{c^2}}$$

(b) Two spacecrafts A and B are moving away from earth in the same direction with speed 0.8c and 0.6c respectively. Find the velocity of B with respect to A. 2

3. (a) Show that the maximum relative error in the measurement of acceleration due to gravity using Kater's pendulum is 8

$$\frac{\Delta g}{g} = \frac{\Delta l_1 + \Delta l_2}{l_1 + l_2} + \frac{2(T_1\,\Delta\,T_1 + T_2\,\Delta\,T_2)}{{T_1}^2 + {T_2}^2}$$

(b) If $\Delta l_1 = \Delta l_2 = 0.1$cm, $\Delta T_1 = \Delta T_2 = 0.001$ sec, T_1=1.51 sec, T_2=1.50 sec and l_1+l_2=56.2 cm, then calculate the maximum relative error and percentage error. 2

Or

4. (a) What is conditional probability? Explain with diagram. 3

(b) Define continuous random variable. Find the constant a such that the function

$$f(x) = \begin{cases} \lambda x^2, & 0 < x < 3 \\ 0, & otherwise \end{cases}$$

is a probability density function. 4

(c) Find the probability that a single toss of a die will result in a number less than 4 if (i) no other information is given (ii) it is given that toss resulted in an odd number. 3

5. (a) Derive the Newton-Raphson method for finding the solution of an equation $f(x) = 0$ 4

(b) Use Newton - Raphson method to find the solution of $x^3 - 5x + 3 = 0$ upto 3rd ituation. [Take $x_0 = 3$] 6

Or

6. (a) Evaluate the integral using the trapezoidal method. 2

$$I = \int_0^3 e^{-x^2} dx$$

(b) Derive Simpson's 1/3 rule of integration. 8

$$I = \frac{h}{3}\,[f(a) + 4\,f(c) + f(b)]$$

$$\text{where } C = \frac{a+b}{2}$$

7. (a) What is an algorithm? Write the advantages of the algorithm. 2+2=4

(b) Write the algorithm to find the largest of three numbers. Also draw its corresponding flowchart. 3+3=6

Or