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**B.Sc. (Part-III) (Semester-V) (CBCS) Examination, October - 2023**  
**ENGLISH (Compulsory)**

**Ability Enhancement Compulsory Course English for  
 Communication (Paper-III)**  
**Sub. Code : 79671**

**Day and Date : Tuesday, 31 -10 - 2023**  
**Time :10.30 a.m. to 12.30 p.m.**

**Total Marks :40**

- Instructions :**
- 1) All questions are compulsory.
  - 2) Figures to the right indicate full marks.

**Q1) A) Rewrite the following, choosing the correct alternative: [3]**

- a) The poem 'Enterprise' describes a \_\_\_\_\_ journey towards a specific goal.
  - i) Strange
  - ii) Happy
  - iii) Metaphorical
  - iv) Adventurous
- b) In the fable 'The Ant and the Grasshopper', the ant stands for\_\_\_\_\_.
  - i) Hard work
  - ii) Idleness
  - iii) Enjoyment
  - iv) kindness
- c) William Morris studied \_\_\_\_\_ for more than thirty years.
  - i) Science fiction
  - ii) Detective fiction
  - iii) Historical fiction
  - iv) Mystery fiction

**B) Answer the following questions in one word/ phrase /sentence each. [3]**

- a) Which award did Sudha Murty receive from Bhopal?
- b) What did the butterfly cover under its wings?
- c) How does, according to the poet Faiz Ahmad Faiz, the devotee go to the Pilgrims?

**P.T.O.**

**Q2) A)** Answer the following questions in 3 to 4 Sentences each. (2 out of 3)[4]

- a) How was the end of the journey in the poem 'Enterprise'?
- b) What was the cause of George's worry in the story?
- c) How did William Morris work closely with Miss. Suskind and Mr. Regnier to solve the problem?

**B)** Write a short note on the following in about 7 to 8 sentences. (1 out of 2) [4]

- a) Significance of the title 'Forgetting Our Own History'.
- b) Theme of the poem, 'For Your Lanes, My Country'.

**C)** Do as directed. [2]

- a) Write Noun form of the following word.

Exalt

- b) Give the synonyms of the following word.

Pleasure

**Q3) a)** Imagine that you are going to attend the interview for the post of a sales manager in a well reputed company. Prepare a mock interview of it. [8]

OR

Write a note on different stages of preparation for the interview.

- b) Write an email to the municipal corporation complaining about the bad condition of the roads in your area. [8]

OR

Share your experiences about participation in a NSS residential camp.

**Q4)** Write a well organized paragraph on "My first experience of Voting".[8]

OR

Write a report about your participation in a cultural event.



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**B.Sc. (Part-III) (Semester-V) (CBCS) Examination, October - 2023**  
**PHYSICS**

**DSE-E1 : Mathematical Physics (Paper-IX)**

**Sub. Code : 79677**

**Day and Date : Monday, 23 - 10- 2023**

**Total Marks : 40**

**Time : 10.30 a.m. to 12.30 p.m.**

- Instructions :
- 1) All questions are compulsory.
  - 2) Use of Scientific calculator is allowed.

**Q1) Select the correct alternatives: [8]**

- a) Every partial differential equation involves at least \_\_\_\_ independent variables.
- i) 2
  - ii) 1
  - iii) 3
  - iv) None of these
- b) To solve the equation  $\frac{\partial^2 u}{\partial x^2} = k \frac{\partial u}{\partial t}$  by method of separation variables we assume the solution in the form \_\_\_\_\_
- i)  $u(x,t) = X(x)Y(y)$
  - ii)  $u(x,t) = X(x)T(t)$
  - iii)  $u(x,t) = \frac{X(x)}{T(t)}$
  - iv)  $u(x,t) = kX(x)T(t)$
- c) The Bessel's equation  $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$  has regular singularity at \_\_\_\_\_
- i)  $x = \infty$
  - ii)  $x = 0$
  - iii)  $x = 1$
  - iv)  $x = n$
- d) Legendre's differential equation has general solution in the form \_\_\_\_\_
- i)  $y = AP_n(x)$
  - ii)  $y = BQ_n(x)$
  - iii)  $y = AP_n(x) + BP_n(x)$
  - iv)  $y = AP_n(x) - BP_n(x)$

**P.T.O.**

e) Which of the following is false?

i)  $\Gamma(1) = 1$

ii)  $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$

iii)  $\beta(3,4) = \beta(4,3)$

iv)  $\Gamma(n) = n!$

f)  $\beta(m, n+1) + \beta(m+1, n) = \underline{\hspace{2cm}}$

i)  $\frac{m}{m+n} \beta(m, n)$

ii)  $\frac{n}{m+n} \beta(m, n)$

iii)  $\beta(m, n)$

iv) 1

g) The modulus of complex number  $2(\sqrt{3} + i)$  is  $\underline{\hspace{2cm}}$

i) 2

ii) 4

iii)  $2\sqrt{3}$

iv) 5

h) Cauchy-Riemann conditions for a function  $f(z) = u + iv$  to be analytic are  $\underline{\hspace{2cm}}$

i)  $\frac{\partial u}{\partial x} = \frac{\partial u}{\partial y}, \frac{\partial v}{\partial x} = \frac{\partial v}{\partial y}$

ii)  $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}, \frac{\partial u}{\partial y} = \frac{\partial v}{\partial x}$

iii)  $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}, \frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$

iv)  $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial x}, \frac{\partial u}{\partial y} = \frac{\partial v}{\partial y}$

Q2) Attempt any two of the following.

[16]

a) Solve Wave Equation  $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$  in two dimension by variable separable method.

b) Define error function and complementary error function. Show that:

i)  $erf(x) = 0$

ii)  $erf(\infty) = 1$

iii)  $erf(x) = -erf(-x)$

c) If  $Z_1$  and  $Z_2$  are two complex numbers then explain  $Z_1 \times Z_2$  and  $\frac{Z_1}{Z_2}$  by geometry.

Q3) Attempt any four of the following. [16]

- a) Define order and degree of partial differential equation. Find the degree and order of following equations.

i)  $x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} = z$

ii)  $\frac{\partial^2 z}{\partial x^2} = k \frac{\partial z}{\partial y}$

- b) Define linear and nonlinear partial differential equation. Give suitable example of either linear or nonlinear.  
c) Find the singularities of following differential equation.

i)  $2x^2 \frac{d^2 y}{dx^2} + 7x(x+1) \frac{dy}{dx} + 3y = 0$

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

- d) Derive Legendre's Polynomial of first kind of first four polynomial.  
e) Prove any two properties of gamma function.  
f) Prove that  $\log z = \log |z| + i \arg z$ , hence find the value of  $\log i$ .



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**B.Sc. (Part-III) (Semester - V) (CBCS) Examination, October - 2023**  
**PHYSICS**

**Quantum Mechanics (Paper-X)**

**Sub. Code : 79678**

**Day and Date : Wednesday, 25- 10 - 2023**

**Total Marks :40**

**Time :10.30 a.m. to 12.30 p.m.**

- Instructions :**
- 1) All questions are compulsory.
  - 2) Figures to the right indicate full marks.
  - 3) Neat diagrams should be drawn wherever necessary.

**Q1) Select correct alternative: [8]**

- a) The Principle that all microscopic particles have both wave and particle nature is called the wave-particle\_\_\_\_\_
  - i) Singularity
  - ii) Duality
  - iii) Triality
  - iv) Infinitality
- b) In the probabilistic interpretation of wave function ( $\psi$ ), the quantity  $(\psi)^2$  is \_\_\_\_\_
  - i) a probability density
  - ii) a probability amplitude
  - iii) a negative probability
  - iv) a probability current density
- c) The quantum mechanical properties of \_\_\_\_\_ must be single-valued, finite and continuous
  - i) Observables
  - ii) Expectation values
  - iii) Wavelengths
  - iv) Wave functions
- d) If two operators  $\hat{A}$  and  $\hat{B}$  commute then\_\_\_\_\_
  - i)  $\hat{A} \hat{B} + \hat{B} \hat{A} = 0$
  - ii)  $\hat{A} \hat{B} - i \hat{B} \hat{A} = 0$
  - iii)  $\hat{A} \hat{B} - \hat{B} \hat{A} = 0$
  - iv)  $\hat{A} \hat{B} / \hat{B} \hat{A} = 1$
- e) The concept of matter wave was suggested by \_\_\_\_\_
  - i) Heisenberg
  - ii) de Broglie
  - iii) Schrodinger
  - iv) Newton

**P.T.O.**

- f) The ladder lowering operator ( $L_-$ ). is defined as \_\_\_\_\_
- i)  $L_x + iL_y$                       ii)  $L_x + L_y$   
 iii)  $L_x - iL_y$                       iv)  $iL_x + iL_y$
- g) In Hydrogen atom, the potential energy is \_\_\_\_\_ dimensional.
- i) one                                      ii) two  
 iii) three                                      iv) n
- h) If there exist more than one eigen function corresponding to same energy eigen value, then the energy level is said to be \_\_\_\_\_
- i) Non degenerate                      ii) Degenerate  
 iii) Discrete                                      iv) Continuum

**Q2)** Attempt any two of the following: **[16]**

- a) Derive Schrodinger's time dependent wave equation for matter wave in one dimension.
- b) Obtain expressions for operators  $L_x$ ,  $L_y$  and  $L_z$  in cartesian co-ordinates.
- c) Using Schrodinger's wave equation derive the energy eigen values for a particle in one dimensional rigid box.

**Q3)** Attempt any four of the following: **[16]**

- a) Write a note on: Barrier Penetration.
- b) Explain the concept of wave packet.
- c) State and explain uncertainty principle.
- d) Obtain relation between group velocity and particle velocity.
- e) Write a note on: Normalization of wave functions.
- f) Define an operator and obtain derivation for linear momentum operator.



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**B.Sc. (Part - III) (Semester - V) (CBCS)**  
**Examination, October - 2023**  
**PHYSICS (Paper - XI)**  
**Classical Mechanics and Classical Electrodynamics**  
**Sub. Code : 79679**

Day and Date : Friday, 27 - 10 - 2023

Total Marks : 40

Time : 10.30 a.m. to 12.30 p.m.

- Instructions :
- 1) All questions are compulsory.
  - 2) Figures to the right indicate full marks.
  - 3) Draw neat labelled diagrams wherever necessary.
  - 4) Use of calculator or logarithmic table is allowed.

**Q1) Select the correct alternative : [8]**

- a) For a system of  $N$  particles moving independent of each other, the number of degrees of freedom is \_\_\_\_\_.
- |           |          |
|-----------|----------|
| i) $N$    | ii) $2N$ |
| iii) $3N$ | iv) $4N$ |
- b) When constraints are introduced into a system, its number of degrees of freedom \_\_\_\_\_.
- |                   |                                   |
|-------------------|-----------------------------------|
| i) decreased      | ii) increased                     |
| iii) remains same | iv) either increased or decreased |
- c) The Lagrangian function  $L$  is defined by \_\_\_\_\_.
- |            |           |
|------------|-----------|
| i) $T+V$   | ii) $T-V$ |
| iii) $V-T$ | iv) $T/V$ |

**P.T.O.**



- d) \_\_\_\_\_ constraints are time independent constraints.
- a) scleronomous
  - b) rheonomous
  - c) holonomic
  - d) nonholonomic
- e) Hamilton's principle is \_\_\_\_\_ principle.
- a) differential
  - b) algebraic
  - c) integral
  - d) virtual
- f) The inertial frame of reference is \_\_\_\_\_.
- a) an accelerated
  - b) an unaccelerated
  - c) a rotating
  - d) an oscillating
- g) According to Einstein, velocity of light in free space is \_\_\_\_\_.
- a) dependent of direction of propagation
  - b) variable
  - c) constant
  - d) infinite
- h) Laplace's equation is valid in \_\_\_\_\_.
- a) charge free region
  - b) uniform charge distribution
  - c) nonuniform charge distribution
  - d) polarised charges

Q2) Attempt any two.

[16]

- a) Obtain Lagrange's equation from D'Alembert's principle.
- b) Explain Brachistochrone problem.
- c) Describe Michelson Morley experiment.

Q3) Attempt any four.

[16]

- a) Derive formula for law of relativistic addition of velocities.
- b) Derive Mass Energy relation.
- c) Derive Poisson's and Laplace's equation.
- d) Write a note on Atwood's machine.
- e) Show that shortest distance between any two points is straight line.
- f) Deduce an expression for variation of length with velocity.



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**B.Sc. (Part-III) (Semester-V) Examination, October - 2023**

**PHYSICS**

**Digital and Analog Circuits and Instrumentation (Paper-XII)**

**Sub. Code : 79680**

**Day and Date : Monday 30 - 10- 2023**

**Total Marks : 40**

**Time : 10.30 a.m. to 12.30 p.m.**

- Instructions :**
- 1) All questions are compulsory.
  - 2) Figures to the right indicate full marks.
  - 3) Draw the neat diagrams wherever necessary.
  - 4) Use of Scientific calculator is allowed.

**Q1) Select the Correct Alternative.**

**[8]**

- a) Ideal Op-Amp has \_\_\_\_\_ output impedance.
  - i) zero
  - ii) finite
  - iii) large
  - iv) infinite
- b) The frequency at which voltage gain becomes one is called as \_\_\_\_\_ frequency.
  - i) unit
  - ii) average
  - iii) unit gain
  - iv) standard
- c) Astable multivibrator is called as \_\_\_\_\_ multivibrator.
  - i) one shot
  - ii) free running
  - iii) monostable
  - iv) bistable
- d) In differential amplifier, the input is applied between \_\_\_\_\_.
  - i) two bases
  - ii) two emitters
  - iii) base and ground
  - iv) collector and base
- e) Tank circuit produces \_\_\_\_\_ oscillations.
  - i) sinusoidal
  - ii) square
  - iii) undamped
  - iv) damped

**P.T.O.**

