



গড়গাঁও মহাবিদ্যালয়
GARGAON COLLEGE

**Student-Centric Methods Used For
Enhancing Learning Experiences
(2022-23)**



Student Centric Methods

The student-centric approach aims to provide a classroom environment in which students can learn to think critically and solve real-world problems. It is one of the best ways to prepare learners for the future and has led to an increase in experiential, participative learning, and problem-solving methods.



**EXPERIENTIAL
LEARNING**



**PARTICIPATIVE
LEARNING**



**PROBLEM-
SOLVING**

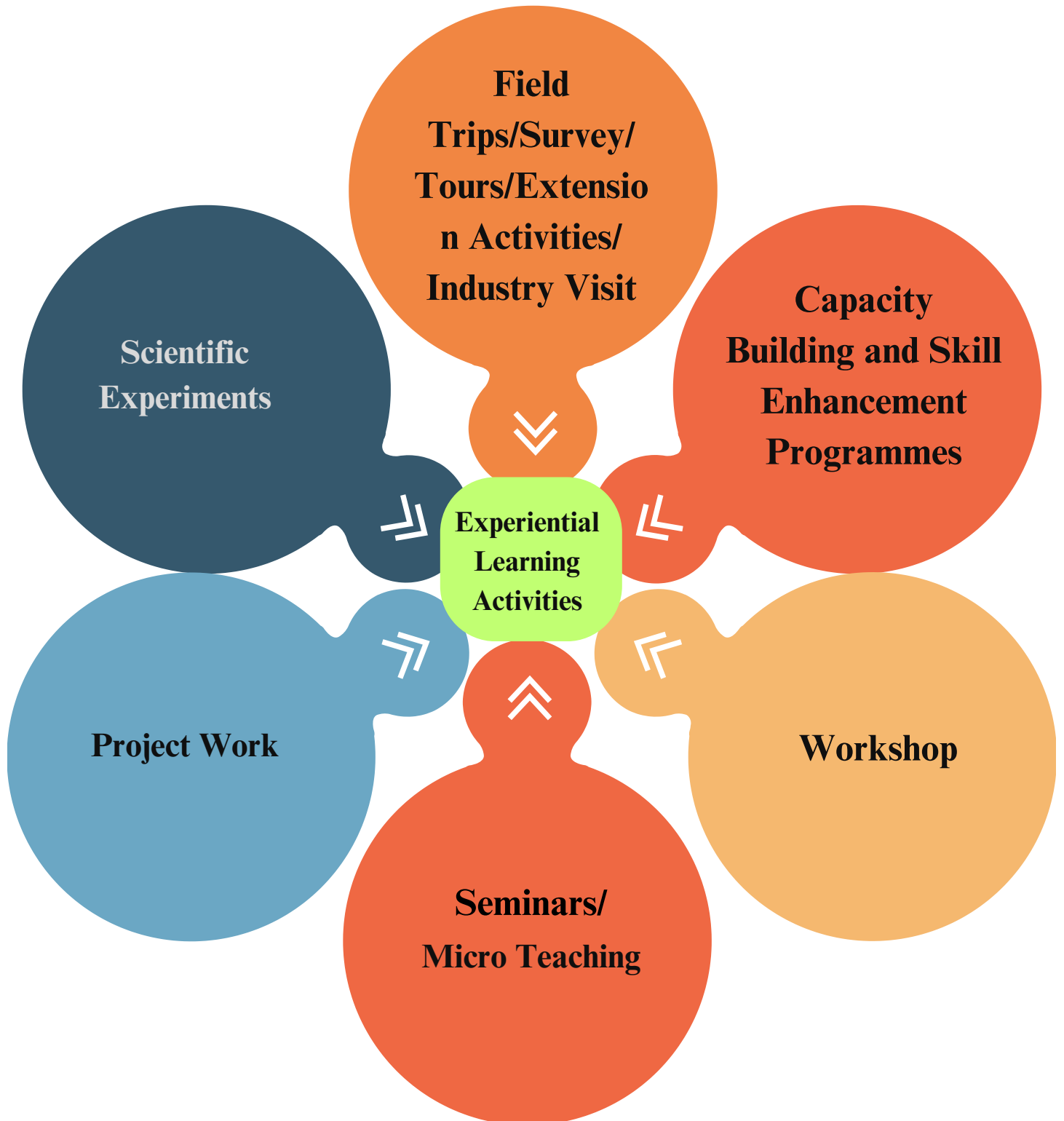


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EXPERIENTIAL LEARNING

Experiential learning is the process of learning through hands-on experience. The main idea behind the phrase experiential learning is building upon what one knows to expand that knowledge into action. Experiential learning is one of the most beneficial types of learning because :

- It can allow students to immediately apply things they are learning to real-world experiences.
- It allows students to practice teamwork.
- It allows students to better retain information.
- Students can greatly benefit from learning that helps them prepare for the real world.





Field Trips/Survey/ Tours

Botany

Sunderban National Park and Kolkata

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Field%20botany%20%20Kolkata%20and%20Sunderban%20Report.pdf>

Field study to Charaideo

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Field%20botany%20Charaideo.pdf>

Chemistry

Educational Trip to Kakochang

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/chemistry_EDUCATIONAL%20TRIP%20TO%20KAKOCHANG.pdf

Commerce

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/commerce_Field_visit.pdf

Education

1. Field Visit

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/edu%20final%20Field%20%20visit.pdf>

2. Field Visit under Project: DSEED 604

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/edu_final_Project_DSEED%20604.pdf

3. Field Visit under Project MA 1

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/edu_final_Project_MA%201.pdf

Geography

Field study to Majuli River Island

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Field%20study%20to%20Majuli%20River%20Island.pdf>

Geology

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/geo_fied_visit.pdf

Sociology

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Soc%20report%20of%20field%20study.pdf>

Zoology

Field Study to Kaziranga National Park

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Zoo_FieldStudytoKazirangaNationalPark.pdf

Animal Behaviour & Chronobiology

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/zoo_Animal%20Behaviour%20%26%20Chronobiology.pdf

Diversity of Insects

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Zoo_Project%20_Diversity%20of%20Insects.pdf

World Wetland Day

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Zoo_Wetland%20Day.pdf



Capacity Building and Skill Enhancement Programmes

Commerce

Entrepreneurial Eco-system: Challenges and Opportunities

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/comm_Entrepreneurial%20Eco-system.pdf

Three-Day Online Seminar Series

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/comm_Three-Day%20Online%20Seminar%20Series.pdf

Economics

Workshop on Union Budget 2023-24

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/ONE%20DAY%20WORKSHOP%20ON%20UNION%20BUDGET-2023-24%20Feb%2016%20C%202023%20%282%29.pdf>

Career Prospects after Graduation: Exploring Opportunities & Facing Challenges

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Mr-%20Unmilan%20Kalita%20%20Career%20Prospects%20after%20Graduation%20%20Exploring%20Opportunities%20%26%20Facing%20Challenges%20%282%29%20%281%29.pdf>

Career Avenues After Graduation: Overview of Banking Exams

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Mr-%20Jyotisaman%20Lahon%20Career%20Prospects%20after%20Graduation%20%20Exploring%20Opportunities%20%26%20Facing%20Challenges%20%281%29%20%281%29.pdf>

Education

Popular Talk on Life Skills for Coping with Disabilities

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Edu_Popular%20talk%20on%20life%20skills%20for%20coping%20with%20disabilities.pdf

Geography

Life Skill Program

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Geography%20Life%20Skill%20Programs.pdf>
Soft Skill Development Program: <https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Geography%20Soft%20Skill%20Program.pdf>

History: Career Counseling and job opportunity for Degree Student

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/History_Career%20Counseling%20and%20job.pdf



Capacity Building and Skill Enhancement Programmes

Mathematics

Life Skill Program

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/math_LIFE%20SKILL%20PROGRAM.pdf

World Cancer Day

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/math_WORLD%20CANCER%20DAY.pdf

National Mathematics Day

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/math_NATIONAL%20MATHEMATICS%20%20DAY.pdf

International Mathematics Day 2023

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Math_INTERNATIONAL%20MATHEMATICS%20DAY.pdf

World Computer Literacy Day

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Math_World%20Computer%20Literacy%20%20Day.pdf

Extension Activity to Adopted School

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/MATH_EXTENSION_ADOPTED%20SCHOOL.pdf

Extension Activity to Nazira Bortala H. S. School

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Math_EXTENSION_NAZIRA%20BORTALA%20%20H-S-SCHOOL.pdf

Sociology

Training program on Gardening

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Socio_TRAINING%20PROGRAM%20ON%20GARDENING.pdf

World Environmental Day

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Soc_World%20Environmental%20Day.pdf

Talk on Wall Magazine

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Soc%20Talk%20On%20Wall%20Magazine.pdf>

Book Release Programme

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Socio_Book%20Release.pdf

World Mental Health Day

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Soci0_World%20mental%20health%20day.pdf

Zoology

Prospect of Entrepreneurship in Aquarium Trade

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Prospect%20of%20Entrepreneurship%20in%20Aquarium%20Trade.pdf>



Workshops Organized

Assamese

‘Gabeshana Pakalpa Prastutkaran : Pradhati Aru Koushal’

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/workshop%20Gabeshana%20Pakalpa%20Prastutkaran_Pradhati%20Aru%20Koushal.pdf

Botany

Collection and Development of Indigenous Seed Bank

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/botany%20Indigenous%20seed%20collection.pdf>

Lecture Series on Different Aspects related to Botany

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Botany%20Lecture%20Series.pdf>

Chemistry

Workshop on IIT-JAM

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/chemistry_WORKSHOP%20FOR%20IIT-JAM.pdf

Commerce

Entrepreneurial Eco-system: Challenges and Opportunities

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/comm_Entrepreneurial%20Eco-system.pdf

Economics

Workshop on Union Budget 2023-24

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/ONE%20DAY%20WORKSHOP%20ON%20UNION%20BUDGET-2023-24%20Feb%2016%20C%202023%20%282%29.pdf>

Geology

Career Planning: Exploring the Recent Trends in the Ocean of Science

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/geo_Workshop_Career%20planning%20Exploring%20the%20Recent%20Trends%20in%20the%20Ocean%20of%20Science.pdf

History

Workshop on Research Methodology

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/History_Workshop%20on%20Research%20Methodology.pdf



Workshops Organized

Sociology

One-Day Workshop on Yoga

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/soc_One%20day%20Workshop%20on%20Yoga.pdf

One-Day Workshop on Make up

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Socio_Workshop%20on%20Make%20Up.pdf

One-Day Workshop on Pickle making

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Socio_WORKSHOP%20ON%20PICKLE%20MAKING.pdf

Workshop on Research Methodology

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Soc%20WORKSHOP%20ON%20RESEARCH%20METHODOLOGY.pdf>

Statistics

One-Day National Workshop On Use of Statistical Software in Research

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/stats_Workshop_Use%20of%20Statistical%20Software%20in%20Research.pdf

Zoology

Prospect of Entrepreneurship in Aquarium Trade

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Prospect%20of%20Entrepreneurship%20in%20Aquarium%20Trade.pdf>

Tools and Techniques of Molecular Biology

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Workshop%20on%20Molecular%20Tools%20and%20Techniques.pdf>



Department Wise List of Students Seminar

Assamese

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Assamese%20student%20seminar.pdf>

Botany

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/botany%20Record%20of%20student%20Seminar.pdf>

Chemistry

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/chemistry_STUDENT%20SEMINAR.pdf

Economics

Students Seminars

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/economics%20Students%20Seminar.pdf>

Seminar On "G-20 Presidency and India's Prospects"

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/economics%20Seminar%20on%20G-20.pdf>

Education

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/edu%20student%20seminar.pdf>

Geography

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Geography%20Students%20Seminar.pdf>

Geology

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/geo_seminar.pdf

History

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/History_student%20seminar.pdf

Mathematics

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/math_seminar.pdf

Physics

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Report%20on%20Student%20Seminar.pdf>

Statistic

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Stats%20Student%20Seminar.pdf>

Zoology

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Zoo_Seminar%20report_Group%20Discussion.pdf



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Micro Teaching (Sample Snapshots): Department of Education





Project Work

Assamese

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Assamese%20project.pdf>

Education

Project DSEED 604

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/edu_final_Project_DSEED%20604.pdf

Project MA 1

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/edu_final_Project_MA%201.pdf

Sociology

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Project%20report%20of%20Nimatighat.pdf>

Statistics

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Stats_Project.pdf

Zoology

Project Report on Non-Chordates I_ Protista to Pseudocoelomates

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Final_Project%20Report%20on%20Non-Chordates-I%2C%202022-23.pdf

Project report based on the paper Non-chordates II: Coelomates

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Final_Project%20Report%20on%20Non-Chordates-II%2C%202022-23.pdf

Field Study to Kaziranga National Park

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Zoo_FieldStudytoKazirangaNationalPark.pdf

Project Report based on Developmental stages of chick embryo

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Project%20on%20Development%20stages%20of%20Chick%20embryo.pdf>

Animal Behaviour & Chronobiology

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/zoo_Animal%20Behaviour%20%26%20Chronobiology.pdf

Visit a local fish farm

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Project%20on%20Visit%20to%20a%20local%20fish%20farm.pdf>

Diversity of Insects

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Zoo_Project%20Diversity%20of%20Insects.pdf



Scientific Experiments

Scientific learning through student-centered instruction engages students in a variety of scientific practices.

Link of Full Report on Scientific Experiments

[https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Scientific%20Experiments 2022-23.pdf](https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Scientific%20Experiments%202022-23.pdf)

GLIMPSES OF SCIENTIFIC EXPERIMENTS





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PARTICIPATIVE LEARNING

Participative learning is a student-centric approach that emphasizes active participation and engagement from students in the learning process. It increases student engagement and understanding of the concepts and also helps promote social interactions and collaborations among them.



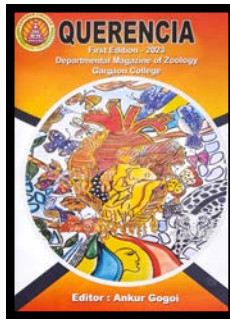
Some of the ways in which the students of the college are engaged in participative ways of learning include:

1. Peer learning
2. Learning by Doing
3. Student Seminars
4. Extra-curricular activities
5. Sports Activities
6. Preparation of Magazine/Wall Magazine
7. Participation in Cultural Rally
8. NCC / NSS / Volunteering

Link of Full Report on Participative learning:

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Participative%20Learning%202022-23.pdf>

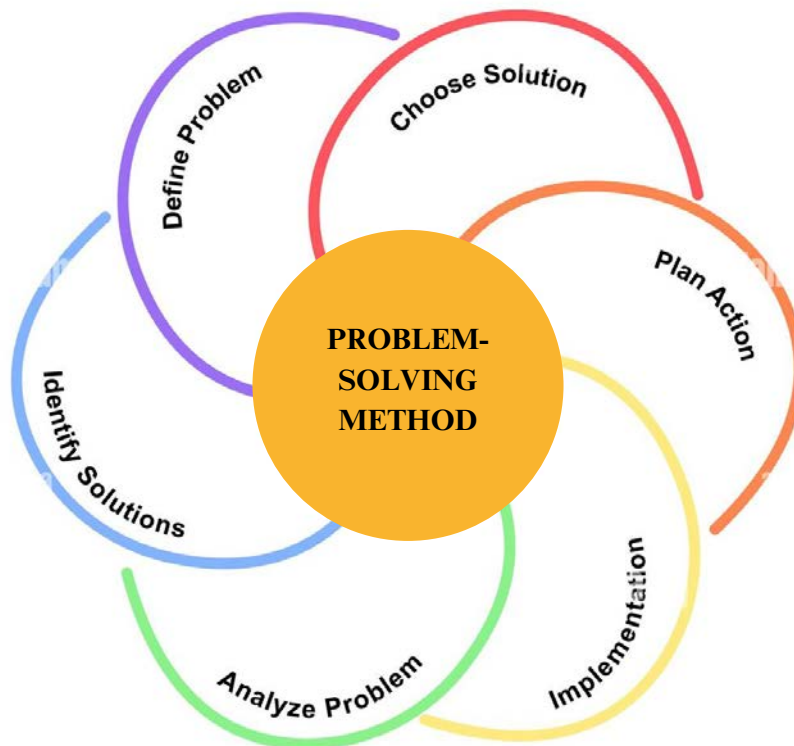
Some Glimpses





PROBLEM-SOLVING METHOD

Problem-solving method is the process of identifying an existing problem, determining the root cause or causes of the problem, deciding the best course of action to solve the problem, and then finally implementing it to solve the problem. The college encourages the students to gain and increase problem-solving skills and motivates them to participate in various activities like field studies, project work, etc. and submit report of the same.





Field Trips/Survey/ Tours

Botany

Sunderban National Park and Kolkata

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Field%20botany%20%20Kolkata%20and%20Sunderban%20Report.pdf>

Field study to Charaideo

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Field%20botany%20Charaideo.pdf>

Chemistry

Educational Trip to Kakochang

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Commerce

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Education

1. Field Visit

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2. Field Visit under Project: DSEED 604

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3. Field Visit under Project MA 1

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Geography

Field study to Majuli River Island

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Field%20study%20to%20Majuli%20River%20Island.pdf>

Geology

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Sociology

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Soc%20report%20of%20field%20study.pdf>

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https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Zoo_FieldStudytoKazirangaNationalPark.pdf

Animal Behaviour & Chronobiology

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/zoo_Animal%20Behaviour%20%26%20Chronobiology.pdf

Diversity of Insects

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Zoo_Project%20Diversity%20of%20Insects.pdf

World Wetland Day

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Project Work

Assamese

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Education

Project DSEED 604

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/edu_final_Project_DSEED%20604.pdf

Project MA 1

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/edu_final_Project_MA%201.pdf

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Statistics

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Stats_Project.pdf

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https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Zoo_FieldStudytoKazirangaNationalPark.pdf

Project Report based on Developmental stages of chick embryo

<https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Project%20on%20Development%20stages%20of%20Chick%20embryo.pdf>

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Diversity of Insects

https://gargaoncollege.ac.in/pdf/iqac/aqar-data/2022-23/Zoo_Project%20_Diversity%20of%20Insects.pdf



Practical

The Department of Mathematics, Gargaon College does practicals as per the Dibrugarh University syllabus provided for the undergraduate courses. The Department uses Matlab and Mathematica software to solve the problems. The areas that we cover in the practical classes are:

- Developing algorithms
- Performing linear algebra that is linear
- Graph plotting for larger data sets
- Data visualization and analysis
- Numerical Matrix Computation
- Solving Differential Equations
- 3D Graph plotting etc.

The details of the syllabus for all the semesters are given below:

C4.1 Numerical Methods	
Total Marks: 100, Theory: 60, IA: 20, Practical: 20	
Credit: 4+2=6;	
(L=4, P=4, T=0)	
Objectives: After going through this course the students will be able to	
<ul style="list-style-type: none">• Discuss various numerical methods and interpolation formulae• Apply numerical techniques for solving differential equation.	
(Use of Scientific Calculator is allowed)	
Unit-1	Marks: 5, Contact hrs: 5
Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation.	
Unit-2	Marks: 10, Contact hrs:10
Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method. Rate of convergence of these methods.	
Unit-3	Marks: 10, Contact hrs:10
System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis.	
Unit-4	Marks: 10, Contact hrs:10
Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.	
Unit-5	Marks: 15, Contact hrs:15
Numerical Integration: Trapezoidal rule, Simpson's 1/3 rd rule, Simpson's 3/8 th rule, Boole's Rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule.	
Unit-6	Marks: 10, Contact hrs:10
Ordinary Differential Equations: Euler's method. Runge-Kutta methods of orders two and four.	
List of Practicals (using any software)	Marks: 20 Contact hrs. 30
<ul style="list-style-type: none">(i) Calculate the sum $1/1 + 1/2 + 1/3 + 1/4 + \dots + 1/N$.(ii) To find the absolute value of an integer.(iii) Enter 100 integers into an array and sort them in an ascending order.(iv) Bisection Method.(v) Newton Raphson Method.	



C3.3 PDE and Systems of ODE

Total Marks: 100, Theory: 60, IA: 20, Practical: 20

Credit: 4+2=6;

(L=4, P=4, T=0)

Objectives: After going through this course the students will be able to

- make mathematical formulations and their solutions of various physical problems;
- design mathematical models used in heat, wave.
- Describe the Laplace equation and their solutions.

Unit-1

Marks: 25, Contact hrs: 25

Partial Differential Equations – Basic concepts and Definitions, Mathematical Problems. First- Order Equations: Classification, Construction and Geometrical Interpretation. Method of Characteristics for obtaining General Solution of Quasi Linear Equations. Non-linear partial differential equations, Charpit's method & Jacobi's method Canonical Forms of First-order Linear Equations. Method of Separation of Variables for solving first order partial differential equations.

Unit-2

Marks: 12, Contact hrs: 10

Classifications of second order linear equations as hyperbolic, parabolic or elliptic. Derivations of Heat equation, Wave equation and Laplace equation and their solutions Reduction of second order Linear Equations to canonical forms.

Unit-3

Marks: 8, Contact hrs: 10

Method of separation of variables, Solving the Vibrating String Problem, Solving the Heat Conduction problem

Unit-4

Marks: 15, Contact hrs: 15

Systems of linear differential equations, types of linear systems, differential operators, an operator method for linear systems with constant coefficients, Basic Theory of linear systems in normal form, homogeneous linear systems with constant coefficients: Two Equations in two unknown functions, The method of successive approximations, the Euler method, the modified Euler method, The Runge-Kutta method upto fourth order approximation.

List of Practicals (using any software)

Marks: 20

Contact hrs. 30

- Solution of Cauchy problem for first order PDE.
- Finding the characteristics for the first order PDE
- Plot the integral surfaces of a given first order PDE with initial data.
- Solution of the wave equation $\frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated conditions.
 - $u(x, 0) = \varphi(x), u_t(x, 0) = \psi(x), x \in R, t \rightarrow 0;$
 - $u(x, 0) = \varphi(x), u_t(x, 0) = \psi(x), u(0, t) = 0, x \in (0, \infty), t > 0;$
 - $u(x, 0) = \varphi(x), u_t(x, 0) = \psi(x), u_x(0, t) = 0, x \in (0, \infty), t > 0;$
 - $u(x, 0) = \varphi(x), u_t(x, 0) = \psi(x), u(0, t) = 0, u(l, t) = 0, 0 < x < l, l > 0.$
- Solution of wave equation $\frac{\partial u}{\partial t} - k^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associate conditions
 - $u(x, 0) = \varphi(x), u(0, t) = a, u(l, t) = b, 0 < x < l, t > 0;$
 - $u(x, 0) = \varphi(x), x \in R, T > t > 0;$
 - $u(x, 0) = \varphi(x), u(0, t) = a, x \in (0, \infty), t \geq 0;$



4. Decay model (exponential case only).
5. Lake pollution model (with constant/seasonal flow and pollution concentration).
6. Case of single cold pill and a course of cold pills.
7. Limited growth of population (with and without harvesting).
8. Predatory-prey model (basic Volterra model, with density dependence, effect of DDT, two prey one predator).
9. Epidemic model of influenza (basic epidemic model, contagious for life, disease with carriers).
10. Battle model (basic battle model, jungle warfare, long range weapons).
11. Plotting of recursive sequences.
12. Study the convergence of sequences through plotting.
13. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.
14. Study the convergence/divergence of infinite series by plotting their sequences of partial sum.
15. Cauchy's root test by plotting n^{th} roots.
16. Ratio test by plotting the ratio of n^{th} and $(n+1)^{\text{th}}$ term.



C2.2 Differential Equations

Total Marks: 100, Theory: 60, IA: 20, Practical: 20

Credit: 4+2=6;

(L=4, P=4, T=0)

Objectives:: After going through this course the students will be able to

- Use the techniques to solve differential equations.
- Apply these techniques in various mathematical models used in real life problems.

Unit-1

Marks: 15, Contact hrs: 15

Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

Unit-2

Marks: 10, Contact hrs: 10

Introduction to compartmental model, exponential decay model, lake pollution model (case study of Lake Burley Griffin), drug assimilation into the blood (case of a single cold pill, case of a course of cold pills), exponential growth of population, limited growth of population, limited growth with harvesting.

Unit-3

Marks: 25, Contact hrs: 25

General solution of homogeneous equation of second order, principle of super position for homogeneous equation, Wronskian: its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters.

Unit-4

Marks: 10, Contact hrs: 10

Equilibrium points, Interpretation of the phase plane, predatory-prey model and its analysis, epidemic model of influenza and its analysis, battle model and its analysis.

List of Practical (using any software)

Marks: 20, Contact hrs: 30

1. Plotting of second order solution family of differential equation.
2. Plotting of third order solution family of differential equation.
3. Growth model (exponential case only).



C1.1 Calculus

Total Marks: 100, Theory: 60, IA: 20, Practical: 20

Credit: 4+2=6;

(L=4, P=4, T=0)

Objectives: After going through this course the students will be able to

- Apply Calculus in real life problems
- Formulate mathematical models

Unit-1

Marks: 20, Contact hrs: 20

Hyperbolic functions, higher order derivatives, Leibniz rule and its applications to problems

of type $e^{ax+b} \sin x$, $e^{ax+b} \cos x$, $(ax+b)^n \sin x$, $(ax+b)^n \cos x$, concavity and inflection points, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications of maxima and minima.

Unit-2

Marks: 15, Contact hrs: 10

Reduction formulae, derivations and illustrations of reduction formulae of the type

$\int \sin nx \, dx$, $\int \cos nx \, dx$, $\int \tan nx \, dx$, $\int \sec nx \, dx$, $\int (\log x)^n dx$, $\int \sin^n x \cos^m x \, dx$, volume by slicing, disks and washer methods, volumes by cylindrical shells.

Unit-3

Marks: 15, Contact hrs: 20

Parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution. Techniques of sketching conics, reflection properties of conics, rotation of axes and second degree equations, classification into conics using the discriminant, polar equations of conics.

Unit-4

Marks: 10, Contact hrs: 10

Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration,

List of Practical (using any software)

Marks : 20,

Contact hrs: 30

- Plotting of graphs of function e^{ax+b} , $\log(ax+b)$, $1/(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $|ax+b|$ and to illustrate the effect of a and b on the graph.
- Plotting the graphs of polynomials of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
- Sketching parametric curves (E.g., Trochoid, cycloid, epicycloids, hypocycloid).



DSE2.1 Mathematical Modeling

Total Marks: 100, Theory: 60, IA: 20, Practical: 20

Credit: 4+2=6;

(L=4, P=4, T=0)

Objectives:: After going through this course the students will be able to solve differential equations and linear programming problems used in mathematical modelling

Unit-1

Marks: 25, Contact hrs: 30

Power series solution of a differential equation about an ordinary point, solution about a regular singular point, Bessel's equation and Legendre's equation, Laplace transform and inverse transform, application to initial value problem up to second order.

Unit-2

Marks: 35, Contact hrs: 30

Monte Carlo Simulation Modeling: simulating deterministic behavior (area under a curve, volume under a surface), Generating Random Numbers: middle square method, linear congruence, Queuing Models: harbor system, morning rush hour, Overview of optimization modeling, Linear Programming Model: geometric solution algebraic solution, simplex method, sensitivity analysis

List of Practical (using any software)

Marks: 20 Contact hrs: 30

- (i) Plotting of Legendre polynomial for $n = 1$ to 5 in the interval $[0,1]$. Verifying graphically that all the roots of $P_n(x)$ lie in the interval $[0,1]$.
- (ii) Automatic computation of coefficients in the series solution near ordinary points.
- (iii) Plotting of the Bessel's function of first kind of order 0 to 3 .
- (iv) Automating the Frobenius Series Method.
- (v) Random number generation and then use it for one of the following (a) Simulate area under a curve (b) Simulate volume under a surface.
- (vi) Programming of either one of the queuing model (a) Single server queue (e.g. Harbor system) (b) Multiple server queue (e.g. Rushhour).
- (vii) Programming of the Simplex method for $2/3$ variables.



- (vi) Secant Method.
- (vii) Regular Falsi Method.
- (viii) LU decomposition Method.
- (ix) Gauss-Jacobi Method.
- (x) SOR Method or Gauss-Seidel Method.
- (xi) Lagrange Interpolation or Newton Interpolation.
- (xii) Simpson's rule.

Note: For any of the CAS (Computer aided software) Data types-simple data types, floating data types, character data types, arithmetic operators and operator precedence, variables and constant declarations, expressions, input/output, relational operators, logical operators and logical expressions, control statements and loop statements, Arrays should be introduced to the students.

Text Books:

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 6th Ed., New age International Publisher, India, 2007.
2. K. Atkinson, *An Introduction to Numerical Analysis* (2nd Edition), Wiley Publications, 1978

Reference Books:

1. B. Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007.
2. C.F. Gerald and P.O. Wheatley, *Applied Numerical Analysis*, Pearson Education, India, 2008.
3. U. M. Ascher and Chen Greif, *A First Course in Numerical Methods*, 7th Ed., PHI Learning Private Limited, 2013.
4. J. H. Mathews and Kurtis D. Fink, *Numerical Methods using Matlab*, 4th Ed., PHI Learning Private Limited, 2012.



Some Glimpses



