Modules of Classes and Examinations, Even Semester - January to June (2023-'24)

Curriculum and Credit Framework for Undergraduate Programme (CCFUP)
As per NEP 2020

3-Year UG Degree in Mathematics
Hiralal Bhakat College
Nalhati, Birbhum, WB.

Semester-II
Course Type: Major
Course No.: 2
Course Title: Introductory Algebra and Number Theory
Course Code: MATH2011

Evaluation process of this Major Course is divided into three (3) components, viz. **C1, C2, and C3.**

Total Marks: **75** (10+5+60), Credits: 4, Lecture Hours: 60

10 Marks for Internal Assessment (will be organized by the College in general and Department in Particular), that is **C1**. 10 Marks will be evaluated through **Class Test** or Assignment or Seminar. Appearance in **C1** is mandatory.

Marks division of Class Test will be 10 or **5+5** or 2+2+2+2+2 or 2+2+2+4.

Tentative **Date** and **Time** of Class Test or Assignment or Seminar: During the end of the 10^{th} week of the semester when approximately 60% of the syllabus of course is to be completed.

5 Marks for Attendance that is **C2**.

Attendance: 50% & above but below 60% - 2 Marks
Attendance: 60% & above but below 75% - 3 Marks
Attendance: 75% & above but below 90% - 4 Marks
Attendance: 90% & Above - 5 Marks

60 Marks for Semester-end-Examination (will be organized by University), that is **C3**.
Syllabus: Whole
Duration: Three Hours
Question Pattern:

Answer 10 questions out of 15 carrying 02 marks each = 10 x 02 = 20 marks.
Answer 04 questions out of 06 carrying 05 marks each = 04 x 05 = 20 marks.
Answer 02 questions out of 04 carrying 10 marks each = 02 x 10 = 20 marks.

Topic List

Unit-I: **Algebra**

Sl. No.	Topic	Lecture Hours	Name of Teacher(s)
1	Complex Numbers: De Moivre's theorem for rational indices and its applications. Theory of equations: Fundamental Theorem of Algebra (Statement), Relation between roots and coefficients, Transformation of equation, Descarte's rule of signs, Cubic and biquadratic equations, Reciprocal equation, separation of the roots of equations, Strum's theorem. Inequality: The inequality involving AM≥GM≥HM, Cauchy-Schwartz inequality.	L-10H & T-4H	Dr. Banshidhar Sahoo
2	Partial order, total order relations, partitions of a set and its connection with equivalence relation, greatest lower bound, least upper bound, maximal, minimal elements, lattice, bounded lattice, modular lattice, distributive lattice, complemented lattice, statement of Zorn's lemma.	L-5H & T-2H	
3	Semigroups, Monoids, Groups – examples including permutation group, Matrix groups ($Mn\times n$ ($\mathbb{R}$),GLn ($\mathbb{R}$), SLn ($\mathbb{R}$)), Zn, elementary properties of groups, generators and relations, order of an element of a group, Subgroups and examples of subgroups, cosets, normal subgroup, center of a group, cyclic groups, Lagrange's theorem, Rings, subrings, Ideals (left, right and two sided), integral domain, field, subfield – examples and basic properties, characteristic of a ring and field.	L-10H & T-4H	

Unit-II: **Number Theory**

Sl. No.	Topic	Lecture Hours	Name of Teacher(s)
1	Well ordering principle of set of natural numbers, pigeon-hole principle, division algorithm, greatest common divisor (gcd), Euclidean algorithm, least common multiple (lcm), Linear Diophantine equation, prime numbers, relatively prime numbers and related properties including Euclid's lemma, fundamental theorem of arithmetic and its applications, perfect square and square free integers, congruences, solution of congruences, Binary and decimal representation of integer, Chinese remainder theorem and its	L-20H & T-5H	Dr. Banshidhar Sahoo

	application. Fermat's little theorem, Wilson's theorem, sum of two squares, Arithmetic function-$\phi(n)$, $d(n)$, $\sigma(n)$.		

Semester-II
Course Type: Minor
Course No.: 2
Course Title: Introductory Algebra and Number Theory
Course Code: MATH2021

Evaluation process of this Minor Course is divided into three (3) components, viz. **C1, C2, and C3.**

Total Marks: **75** (10+5+60), Credits: 4, Lecture Hours: 60

10 Marks for Internal Assessment (will be organized by the College in general and Department in Particular), that is **C1**. 10 Marks will be evaluated through **Class Test** or Assignment or Seminar. Appearance in **C1** is mandatory.

Marks division of Class Test will be 10 or **5+5** or 2+2+2+2+2 or 2+2+2+4.

Tentative **Date** and **Time** of Class Test or Assignment or Seminar: During the end of the 10^{th} week of the semester when approximately 60% of the syllabus of course is to be completed.

5 Marks for Attendance that is **C2**.

Attendance: 50% & above but below 60% - 2 Marks
Attendance: 60% & above but below 75% - 3 Marks
Attendance: 75% & above but below 90% - 4 Marks
Attendance: 90% & Above - 5 Marks

60 Marks for Semester-end-Examination (will be organized by University), that is **C3**.
Syllabus: Whole
Duration: Three Hours
Question Pattern:

Answer 10 questions out of 15 carrying 02 marks each = 10 x 02 = 20 marks.
Answer 04 questions out of 06 carrying 05 marks each = 04 x 05 = 20 marks.
Answer 02 questions out of 04 carrying 10 marks each = 02 x 10 = 20 marks.

Topic List

Unit-I: **Algebra**

Sl. No.	Topic	Lecture Hours	Name of Teacher(s)
1	Complex Numbers: De Moivre's theorem for rational indices and its applications. Theory of equations: Fundamental Theorem of Algebra (Statement), Relation between roots and coefficients, Transformation of equation, Descarte's rule of signs, Cubic and biquadratic equations, Reciprocal equation, separation of the roots of equations, Strum's theorem. Inequality: The inequality involving AM≥GM≥HM, Cauchy-Schwartz inequality.	L-10H & T-4H	Dr. Banshidhar Sahoo
2	Partial order, total order relations, partitions of a set and its connection with equivalence relation, greatest lower bound, least upper bound, maximal, minimal elements, lattice, bounded lattice, modular lattice, distributive lattice, complemented lattice, statement of Zorn's lemma.	L-5H & T-2H	
3	Semigroups, Monoids, Groups – examples including permutation group, Matrix groups ($Mn\times n$ ($\mathbb{R}$),GLn ($\mathbb{R}$), SLn ($\mathbb{R}$)), Zn, elementary properties of groups, generators and relations, order of an element of a group, Subgroups and examples of subgroups, cosets, normal subgroup, center of a group, cyclic groups, Lagrange's theorem, Rings, subrings, Ideals (left, right and two sided), integral domain, field, subfield – examples and basic properties, characteristic of a ring and field.	L-10H & T-4H	

Unit-II: **Number Theory**

Sl. No.	Topic	Lecture Hours	Name of Teacher(s)
1	Well ordering principle of set of natural numbers, pigeon-hole principle, division algorithm, greatest common divisor (gcd), Euclidean algorithm, least common multiple (lcm), Linear Diophantine equation, prime numbers, relatively prime numbers and related properties including Euclid's lemma, fundamental theorem of arithmetic and its applications, perfect square and square free integers, congruences, solution of congruences, Binary and decimal representation of integer, Chinese remainder theorem and its application. Fermat's little theorem, Wilson's theorem, sum of two squares, Arithmetic function-ϕ(n), $d(n)$, σ(n).	L-20H & T-5H	Dr. Banshidhar Sahoo

Semester-II
Course Type: Skill Enhancement Course (SEC)
Course No.: 2
Course Title: : Programming in C
Course Code: MATH2051

Evaluation process is divided into three (3) components, viz. C1, C2, and C3.

Total Marks: **50** (10+40), Credits: 3, Lecture Hours: 90

10 Marks for Internal Assessment (will be organized by the College in general and Department in Particular), that is **C1**. 10 Marks will be evaluated through **Class Test** or Assignment or Seminar. Appearance in C1 is mandatory.

Marks division of Class Test will be 10 or **5+5** or 2+2+2+2+2 or 2+2+2+4.

Tentative **Date** and **Time** of Class Test or Assignment or Seminar: During the end of the 10^{th} week of the semester when approximately 60% of the syllabus of course is to be completed.

C2 is not applicable for SEC.

40 Marks for Semester-end-Examination (will be organized by University) that is **C3**.
Syllabus: Whole
Duration: Four Hours
Question Pattern:
Laboratory Notebook – 05 marks
Viva-voce – 10 marks
Experiments – 25 marks

Topic List

Sl. No.	Topic	Lecture Hours	Name of Teacher(s)
1	Introduction, basic structures, character set, keywords, identifiers, constants, variable-type declaration, operators: arithmetic, relational, logical, assignment, increment, decrement, conditional.	L-8H & T-4H	Sk Abdul Hanif
2	Operator precedence and associativity, arithmetic expression, evaluation and type conversion, character reading and writing, formatted input and output statements.	L-9H & T-4H	
3	Decision making (branching and looping): Simple and nested if, if – else, switch, while, do-while, for statements.	L-5H & T-3H	
4	Concept of array variables, string handling with arrays – reading and writing, string handling functions.	L-4H & T-2H	

5	User defined functions, call-by-value, call-by-reference functions and their uses, return values and their types, nesting of functions, recursion.	L-5H & T-3H	
6	Structures: Declaration, initialization, nested structures, array of structures, array within structures.	L-4H & T-2H	
7	Pointers: Declaration, initialization, accessing variables through pointer, pointer arithmetic, pointers and arrays.	L-6H & T-3H	

Modules of Classes and Examinations, Even Semester- January to June (2023-'24)
B.Sc General in Mathematics
Hiralal Bhakat College, Nalhati

Details of Courses of B.Sc. General under CBCS

Semester-IV

Core Course (CC 1D): Algebra

- Total 75 Marks
- 60 Marks for Semester-end-Examination[#] (will be organized by University)
- 10+5=15 Marks for Internal Assessment (will be organized by College in general andDepartment in Particular)
- 10 Marks for Class Test/ Assignment/ Seminar
- 5 Marks for Attendance

Attendance: 50% & above but below 60% - 2 Marks
Attendance: 60% & above but below 75% - 3 Marks
Attendance: 75% & above but below 90% - 4 Marks
Attendance: 90% & Above - 5 Marks

Internal Assessment	**Component 1 (C_1)**
Weightage	10 Marks (Class test)
Number of Questions	5
Date	To be announced
Time	30 Minutes

Syllabus	Definition and examples of Groups, examples of abelian and non-abelian groups, the group Z_n of integer under addition modulo n and the group U9n) of units under multiplication module n. cyclic groups from number systems, complex roots of unity, circle group, the general lineargroup $GL_n(n, R)$, groups of symmetric of 9i) an isosceles triangle, (ii) an equilateral triangle, (iii) a rectangle, and (iv) a square, the permutation group Sym (n), Group of quaternions. Subgroups, cyclic subgroup, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the centre of a group.
Name of Teacher	Dr. Banshidhar Sahoo
Number of Classes	64 (Tentative)

** Component 2 (C_2):

- 60Marks for Semester-end-Examination (will be organized by University)
- Answer 10 questions out of 15 carrying 02 marks each = 10 x 02 = 20 marks
- Answer 04 questions out of 06 carrying 05 marks each = 04 x 05 = 20 marks
- Answer 02 questions out of 04 carrying 10 marks each = 02 x 10 = 20 marks

** Syllabus:

Definition and examples of Groups, examples of abelian and non-abelian groups, the group Z_n of integer under addition modulo n and the group U9n) of units under multiplication module n. cyclic groups from number systems, complex roots of unity, circle group, the general lineargroup $GL_n(n, R)$, groups of symmetric of 9i) an isosceles triangle, (ii) an equilateral triangle, (iii) a rectangle, and (iv) a square, the permutation group Sym (n), Group of quaternions.

Subgroups, cyclic subgroup, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the centre of a group. Cosets. Index of subgroup. Lagrange's theorem, order of an element. Normal subgroups; their defintions and properties. Quotient group.

Definition and example of rings, examples of commuitative and non-commutative rings: rings from number systems, Z_n, the ring of integers modulo n, ring of real quaternions, ring of matrices, polynomial rings and rings of continuous functions. Subrings and ideals. Integral domain and fields, examples of fields. Field of rational functions.

Skill Enhancement Course (SEC 2): Vector Calculus

- Total 50 Marks
- 40 Marks for Semester-end-Examination** (will be organized by University)
- 10 Marks for Internal Assessment (will be organized by College in general and Department in Particular)
- 10 Marks for Class Test/ Assignment/ Seminar

Internal Assessment	Component 1 (C_1)
Weightage	10 Marks (Assignment)
Number of Questions	5
Date	To be announced.
Time	30 Minutes
Syllabus	Differentiation and partial differentiation of a vector function. Derivative of sum, dot product and cross product of two vectors.
Name of Teacher	Dr. Banshidhar Sahoo
Number of Classes	30 (Tentative)

**** Component 2 (C_2):**

- 40Marks for Semester-end-Examination (will be organized by University)
- Answer 10 questions out of 15 carrying 02 marks each = 10 x 02 = 20 marks
- Answer 04 questions out of 06 carrying 05 marks each = 04 x 05 = 20 marks

**** Syllabus:**

Differentiation and partial differentiation of a vector function. Derivative of sum, dot product and cross product of two vectors.
Gradient, divergent and Curl.

Semester-VI

Core Course (DSE 1B): Linear Programming

- Total 75 Marks
- 60 Marks for Semester-end-Examination# (will be organized by University)
- 10+5=15 Marks for Internal Assessment (will be organized by College in general andDepartment in Particular)
- 10 Marks for Class Test/ Assignment/ Seminar
- 5 Marks for Attendance

Attendance: 50% & above but below 60% - 2 Marks
Attendance: 60% & above but below 75% - 3 Marks
Attendance: 75% & above but below 90% - 4 Marks
Attendance: 90% & Above - 5 Marks

Internal Assessment	Component 1 (C_1)
Weightage	10 Marks (Seminar)
Date	To be announced
Time	15 Minutes
Syllabus	Linear Programming Problem, Graphical Approach for solving some Linear Programms. Convex Sets, Supporting and separting Hyperplanes. Theory of simplex method, optimality and unboundedness, the simplex method, algorithm, simplex method in tableau format, introduction to artificial variables, two-phase

	method, Big-M method and their comparison.
Name of Teacher	Dr. Banshidhar Sahoo
Number of Classes	75 (Tentative)

** Component 2 (C_2):

- 60Marks for Semester-end-Examination (will be organized by University)
- Answer 10 questions out of 15 carrying 02 marks each = 10 x 02 = 20 marks
- Answer 04 questions out of 06 carrying 05 marks each = 04 x 05 = 20 marks
- Answer 02 questions out of 04 carrying 10 marks each = 02 x 10 = 20 marks

** Syllabus:

Linear Programming Problem, Graphical Approach for solving some Linear Programms. Convex Sets, Supporting and separting Hyperplanes. Theory of simplex method, optimality and unboundedness, the simplex method, algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method, Big-M method and their comparison.
Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual.

Skill Enhancement Course(SEC 4):Transportation & Game Theory

- Total 50 Marks
- 40 Marks for Semester-end-Examination** (will be organized by University)
- 10 Marks for Internal Assessment (will be organized by College in general and Department in Particular)
- 10 Marks for Class Test/ Assignment/ Seminar

Internal Assessment	Component 1 (C_1)
Weightage	10 Marks (Assignment)
Number of Questions	5
Date	To be announced.
Time	30 Minutes
Syllabus	Transportation problem and its mathematical formulation. North-west corner method, least cost matrix method and Vogel's approximation method for determination of starting basic solution. Algorithm for solving transportation problem. Assignment problem and its mathematical formulation. Hungarian method for solving assignment problem.
Name of Teacher	Dr. Banshidhar Sahoo
Number of Classes	30 (Tentative)

** Component 2 (C_2):

- 40Marks for Semester-end-Examination (will be organized by University)
- Answer 10 questions out of 15 carrying 02 marks each = 10 x 02 = 20 marks
- Answer 04 questions out of 06 carrying 05 marks each = 04 x 05 = 20 marks

** Syllabus:

Transportation problem and its mathematical formulation. North-west corner method, least cost matrix method and Vogel's approximation method for determination of starting basic solution. Algorithm for solving transportation problem. Assignment problem and its mathematical formulation. Hungarian method for solving assignment problem.

Game Theory: function of two-person zero sum games, solving two-person zero sum games, games with mixed strategies, graphical solution procedure.

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