Industry Partner

SINCE : 2011

NEXCORE ALLIANCE

Bachelors(B.Voc) - Artificial Intelligence & Machine Learning

Session: 2025-26

Department of Computer Science & Engineering

Sem: 2

S emester: II						
C ourse Code	**C ourse Title**	**T ype of Course**	**L**	**T**	**P**	**C redits**
BMA201	Mathematics-II	Compulsory	4	0	0	4
BMA202	Object Oriented Programming Using C++	Foundation Skill based	3	0	0	3
BMA203	Web Technology	Skill based	3	0	0	3
BMA204	Data Structure & Algorithms	Compulsory	4	0	0	4
BMA205	Digital Electronics	Foundation Skill based	4	0	0	4
BMA206	Web Technology Lab	Skill based	0	0	2	1
BMA207	Object Oriented Programming Using C++ Lab	Skill based	0	0	2	1
V alue Added Course						
BMA208	Environmental Science	VAC	2	0	0	2
T otal			**2 0**	**0**	**0 4**	**2 2**

S emester: II

C ourse Title: MATHEMATICS –II

C ourse Code: BMA201

L	T	P	C redits
4	0	0	4

T otal Hours: 60

L earning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate the methods of forming and solving Ordinary differential equations and solve linear differential equations with constant and variable coefficients
2. Explain the concept of differential equation and classifies the differential equations with respect to their order and linearity.
3. Solve first-order ordinary and exact differential equations and converts separable and homogeneous equations to exact differential equations by integrating factors.
4. Apply the method of undetermined coefficients to solve the non-homogeneous linear differential equations with constant coefficients.

C ourse Content

U NIT I **1 4 Hours**

F irst o rder o rdinary d ifferential e quations:

Exact, linear and Bernoulli's equations, Euler's equations. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

O rdinary d ifferential e quations o f h igher o rders Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

U NIT II **1 5 Hours**

C omplex V ariable – D ifferentiation:

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

U NIT III **1 5 Hours**

C omplex V ariable – I ntegration:

Contour integrals, Cauchy-Goursat theorem (without proof),
Cauchy Integral formula (without proof), Liouville's theorem and Maximum- Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

U NIT IV **1 6 Hours**

T ransform C alculus:

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions.

Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of Integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method, Fourier transforms.

T ransaction Modes

Self-Learning, Collaborative Learning and Cooperative Learning **S uggested Readings**
Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching,

- *T homes, G.B.and Finney, R.L. (2010) Calculus and Analytic Geometry; Ninth Edition; Pearson E ducation*
- *K reyszig, E. (1998) Advanced Engineering Mathematics; Eighth Edition, John Wiley and sons.*
- *G rewal, B.S. (1965) Higher Engineering Mathematics; Khanna Publishers, New Delhi.*
- *B abu R am (2009) A dvance E ngineering M athematics; F irst E dition; P earson E ducation.*
- *R ichard Courant and Fritz John (2012) Introduction to Calculus and Analysis, Volume II, V Springer P ublica*

C ourse Title: OBJECT ORIENTED PROGRAMMING USING C++

C ourse Code: BMA202

L	T	P	C redits
3	0	0	3

T otal Hours: 45 Learning

O utcomes:

After completion of this course, the learner will be able to:

1. Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects.
2. Illustrate dynamic memory management techniques using pointers, constructors, destructors, etc.
3. Construct the concept of function overloading, operator overloading, virtual functions and polymorphism
4. Classify inheritance with the understanding of early and late binding, usage of exception handling and generic programming.

U NIT I **1 0 Hours**

C ourse Content

O bject-Oriented P rogramming C oncepts:

Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, interface and implementation of a class, operations on objects, relationship among objects, abstraction, encapsulation, data hiding, inheritance, overloading, polymorphism, messaging.

U NIT II **1 5 Hours**

S tandard I nput/output:

Concept of streams, hierarchy of console stream classes, input/output using overloaded operators >> and << and member functions of i/o stream classes, formatting output, formatting using ions class functions and flags, formatting using manipulators.

C lasses a nd O bjects:

Specifying a class, creating class objects, accessing class members, access specifies, and static members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes, bit fields and classes.

U NIT III **1 1 Hours**

P ointers a nd D ynamic M emory M anagement:

Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and dynamic), dynamic memory management using new and delete operators, pointer to an object, this pointer, pointer related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures. Constructors/Destructors and

Operator Overloading and Type Conversion: Need for constructors and destructors, copy constructor, dynamic constructors, explicit constructors, destructors, constructors and destructors with static members, initialize lists. Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.

9 Hours

U NIT IV

I nheritance a nd V irtual f unctions & P olymorphism:

Introduction, defining derived classes,

forms of inheritance, ambiguity in multiple and multipath inheritance, virtual base class, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors. Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes, virtual destructors

T ransaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching,

Self-Learning, Collaborative Learning and Cooperative Learning.

S uggested Readings

- *L afore R. (1992). Object Oriented Programming in C++. WaiteGroup.*
- *B jarneStroustrup. (1985). The C++ Programming Language. AddisonWesley.*
- *H erbert Schildt. (1994). The Complete Reference to C++ Language. McGrawHill- Osborne.*

L ippman F. B. (1997). C++ Primer. AddisonWesle

C ourse Title: WEB TECHNOLOGY

C ourse Code: BMA203

L	T	P	C redits
3	0	0	3

L earning Outcomes:

After completion of this course, the learner will be able to:

1. History and development of the World Wide Web and associated technologies.
2. The client-server architecture of the World Wide Web and its communication protocol HTTP/HTTPS.
3. Formats and languages used in modern web-pages: HTML, XHTML, CSS, XSLT, JavaScript, DOM
4. Programming web pages with JavaScript/DOM (client) and Good design, universal design, multi-platform web applications

C ourse Content

U NIT I **1 0 Hours**

I ntroduction t o W eb T echnologies:

Web Fundamentals: Overview of the World Wide Web, client-server architecture, and HTTP/HTTPS protocols. Web Development Languages: Introduction to HTML, CSS, and JavaScript. Web Browsers and Servers: Functions and components of web browsers and web servers.

Web Standards and Accessibility: Importance of web standards (W3C) and practices for web accessibility. **1 0 Hours**

H TML a nd C SS:

HTML Basics: Structure of HTML documents, common HTML tags, and attributes, HTML Forms: Creating forms, form elements, and validation,

CSS Basics: Introduction to CSS, selectors, properties, and values, Layout Techniques: Using CSS for layout design, including box model, flexbox, and grid layout. **1 0 Hours**

J avaScript a nd D OM M anipulation:

JavaScript Basics: Variables, data types, operators, and control structures, Functions and Events: Defining functions, event handling, and DOM events, DOM Manipulation: Accessing and modifying the Document Object Model (DOM) using JavaScript, AJAX and Fetch API: Making asynchronous requests and handling responses using AJAX and the Fetch API.

U NIT IV **1 5 Hours**

W eb D evelopment F rameworks:

Introduction to Web Frameworks: Overview of client- side and
server-side frameworks, Client-Side Frameworks: Introduction to frameworks like React, Angular, or Vue.js., Server-Side Technologies: Basics of server-side frameworks such as Node.js, Express, or Django.

T ransaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

S uggested Readings

- Jackson, J. C. (2006). Web Technologies. Pearson India.
- Gopalan, N. P., & ADIKESAVAN, T. (2014). Web Technology: A Developer's Perspective. PHI Learning Pvt. Ltd.
- Allsopp, J. (2009). Developing with web standards. New Riders.
- Wilde, E. (2012). Wilde's WWW: technical foundations of the World Wide Web. Springer Science & Business Media.

C ourse Title: DATA STRUCTURE & ALGORITHMS

C ourse Code: BMA204

L	T	P	C redits
4	0	0	4

T otal H ours: 6 0

L earning Outcomes:

After completion of this course, the learner will be able to:

1. Describe how arrays, records, linked structures, stacks, queues, trees and graphs are represented in memory and used by algorithms
2. Design a program that use arrays, records, linked structures, stacks, queues and trees.
3. Develop knowledge of applications of data structures including the ability to implement algorithms for the creation, insertion, deletion, searching and sorting of each data structure.
4. Classify the concept of recursion, give examples of its use, describe how it can be implemented using a stack

C ourse Content

U NIT I **1 0 Hours**

I ntroduction:

Basic Terminologies, Elementary Data Organizations, Data Structure Operations insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

U NIT II **2 0 Hours**

S tacks a nd A DT S tack a nd i ts o perations:

Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queues: Simple Queue, Circular Queue, Priority Queue; Operations on each Types Of Queues: Algorithms and their analysis.

L inked L ists:

Singly linked lists, Representation in memory, Algorithms of several operations, Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, doubly linked list, operations on it and algorithmic analysis; Circular Linked Lists, all operations their algorithms and the complexity analysis.

U NIT III **1 5 Hours**

T rees:

Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their

algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree, definitions, algorithms and analysis.

U NIT IV **1 5 Hours**

S orting a nd H ashing:

Objective and properties of different sorting algorithms, Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

T ransaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

S uggested Readings

- *A ddison-Wesley.*
- *R. G Dromey (2006). How to Solve it by Computer. Pearson Educatio*
- *M ark Allen Weiss. (1995). Algorithms, Data Structures, and Problem Solving with C++ Algorithms.*

C ourse Title: DIGITAL ELECTRONICS

C ourse code: BMA205

L	T	P	C redits
4	0	0	4

T otal Hours: 60

L earning Outcomes:

After completion of this course, the learner will be able to:

1. Understand the used of fundamentals concepts and techniques in digital electronics
2. Examine the structure of various number systems and its application in digital design.
3. Analyze and design various combinational and sequential circuits.
4. Categorize a digital logic and apply it to solve real life problems.

C ourse Content

U NIT I **1 2 Hours**

F undamentals of D igital Systems and logic f amilies: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive OR operations, Boolean algebra, examples officiate, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lcs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

U NIT II **1 8 Hours**

S tandard r epresentation f or l ogic f unctions: K-map representation and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Sub-tractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

U NIT III **1 8 Hours**

S equential circuits and systems : A 1-bit memory, the circuit properties of Bus table latch, the clocked SR flip flop, J- K-T and D- Types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, application counters, A/D and D/Converters **D igital to analog converters:** weighted resistor/converter, R-2R Ladder D/A converter, Specifications for D/A converters, examples of D/A converter lcs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator

A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converters

UNIT IV **12 Hours**

Semiconductor memories and Programmable logic devices:

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Transaction Modes

Self-Learning, Collaborative Learning and Cooperative Learning **Suggested Readings**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching,

- *R . P. Jain. (2009). Modern Digital Electronics. McGraw Hill Education.*
- *M . M. Mano. (2016). Digital logic and Computer design. Pearson Education India.*
- *A . Kumar. (2016). Fundamentals of Digital Circuits. Prentice Hall India.*

C ourse Title: WEB TECHNOLOGY LAB

C ourse Code: BMA206

L	T	P	C redits
0	0	2	1

T otal Hours-15

L earning Outcomes:

After completion of this course, the learner will be able to:

1. To gain the knowledge, usage and applicability of various scripting languages.
2. To attain the knowledge of connecting to a database and then by implementing simple projects.
3. To use various scripting approaches depending upon the time to complete, cost reduction and reliability of the software project.

C ourse Content

1. Advanced HTML & CSS: Create responsive web layouts using advanced HTML5 and CSS3features, including Flex box and CSS Grid.
2. JavaScript and Front-End Frameworks: Develop interactive web applications using modern JavaScript (ES6+) and front-end frameworks like React or Angular.
3. Server-Side Development: Build and integrate server-side applications using Node.js or another server-side technology, implementing RESTful APIs.
4. Database Integration: Design and connect web applications to databases using SQL or NoSQL databases, handling data storage and retrieval.

C ourse Title: OBJECT ORIENTED PROGRAMMING USING C++ LAB

C ourse Code: BMA207

L	T	P	C redits
0	0	2	1

T otal Hours- 15

L earning Outcomes:

After completion of this course, the learner will be able to:

1. Develop solutions for a range of problems using objects and classes.
2. Implement the concept of constructors, destructors and operator overloading
3. Apply algorithmic problems including type casting,
4. Understand the concept of Inheritance and polymorphism.

C ourse Content

1. Program to show the of use cin, cout practical
2. Program to implement the operators
3. Program based on decision making statement (if else)
4. Program based on the loops(while,do while)
5. Program based on loops(for),switch statement
6. Program based on structures and enumerated data types
7. Program based functions, overloaded functions
8. Program to show usage of storage classes.
9. Program to show usage of function overloading, default arguments
10. Program to show usage of classes, objects
11. Program to show usage of constructors, destructors
12. Program to manipulate arrays and array of objects
13. Program to manipulate strings.
14. Program to show usage of inheritance of various type (multiple, multilevel etc.)
15. Program to show usage of unary operator overloading
16. Program to show usage of binary operator overloading
17. Program for conversion from basic to user defined data type
18. Program for conversion from user defined to basic
19. Program to show usage of basics of pointers
20. Program to show usage of pointers and arrays.
21. Program to show usage of pointers, function arguments
22. Program to show usage of new, delete, memory management
23. Program to show usage of virtual function
24. Program to show usage of friend, static function
25. Program to show usage of overloaded assignment operator, this pointer

26. Program to read & write contents of a text file
27. Program to show usage of file pointers.
28. Program to show usage of command line arguments
29. Program to show usage of overloading of right & left shift operators.
30. Program to show usage of exception handling mechanism
31. Program to show usage of uncaught exception (), the exception and bad exception classes
32. Program to show usage of templates
33. Program to show usage of generic classes
34. Implementation of File handling
35. Implementation of Wrapper classes
36. Implementation of container classes

C ourse Title: ENVIRONMENTAL SCIENCES
C ourse Code: BMA208

L	T	P	C redits
2	0	0	2

T otal hours: 30 Learning

O utcomes:

After completion of this course, the learner will be able to:

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Estimate the population - economic growth, energy requirement and demand
3. Analyze material balance for different environmental systems.
4. Realize the importance of ecosystem and biodiversity for maintaining ecological balance.

Identify the major pollutants and abatement devices for environmental management and sustainable development

C ourse Content

U NIT-I **5 Hours**

I ntroduction:

Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness.

N atural R esources:

Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources.

1 0 Hours

U NIT-II

E cosystems:

Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity.

E nvironmental P ollution:

Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, nuclear hazards. Solid waste Management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management: Floods, earthquake, cyclone and landslides.

1 0 Hours

U NIT-III

Social Issues and the Environment from Unsustainable to Sustainable development, urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns.

Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness.

U NIT-IV **5 Hours**

Human Population and the Environment, Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies.

T ransaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *G oyal, A. (2020) Environmental Studies. Notion Press, New Delhi.*
- *K aur, N & Goyal, A. (2014) Disaster Management. PBS Education, Jalandhar.*
- *A garwal, K. C.(1998) Environment Biology, Nidi Publ. Ltd. Bikaner.*
- *J adhav, H & Bhosale, V.M. (2001) Environment Protection and Laws. Himalaya Pub House, D elhi*
- *R ao M. N. & Datta A.K.(1997) Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd.*