DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

NAAC- 'A $^{+}$' Grade

CIRCULAR NO.SU/Engg./College/NEP/83/2025

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies and recommended by the Dean, Faculty of Science & Technology, ***Academic Council at its meeting held on 09 May 2025 has been accepted*** the following Syllabi and Second Year Open Elective Basket for B. E. & B. Tech. under the Faculty of Science & Technology as per Norms of National Education Policy – 2020 as appended herewith.

Sr.No.	*Syllabi*
1.	*Second Year B. E./B. Tech. Civil Engineering*
2.	*Second Year B.E./B.Tech. Mechanical Engineering*
3.	*Second Year B. E./B. Tech. Information Technology*
4.	*Second Year B. E./B. Tech. Electronics & Telecommunication Engineering/ Electronics Engineering /Electronics & Communication Engineering.*
5.	*Second Year B. E./B. Tech. Electrical and Electronics Engineering/ Electrical Engineering/ Electrical, Electronics and Power*
6.	*Second Year B. E./B. Tech. Computer Science and Engineering/ Computer Science/ Computer Engineering*
7.	*Second Year B. E./B. Tech. Artificial Intelligence/ Artificial Intelligence and Machine Learning / Artificial Intelligence and Data Science*

This is effective from the Academic Year 2025-26 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar
- 431 004.
REF.NO.SU/NEP/2025/ 856-61
Date:- 29/ 05/ 2025.

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Deputy Registrar,
Syllabus Section

Copy forwarded and necessary action to :-

1] **The Principal of all Affiliated Colleges,** Dr. Babasaheb Ambedkar Marathwada University
2] The Director, University Network & Information Centre, UNIC, Dr.Babasaheb Ambedkar Marathwada University with a request to upload this Circular on University Website
3] The Director, Board of Examinations & Evaluation, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

Copy to :-

1] PA to the Hon'ble Vice-Chancellor,
2] PA to the Pro. Vice-Chancellor,
3] PA to the Registrar,
Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

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Dr. BabasahebAmbedkarMarathwada University
ChhatrapatiSambhajinagar- 431001

Four Year UG Engineering / Technology Programme
(B.E. / B. Tech)

Structure and Syllabus of 2nd Year B.E./B.Tech Programme (Artificial Intelligence/ Artificial Intelligence and Machine Learning / Artificial Intelligence and Data Science)

(AS PER NEP-2020)

Effective from 2025-26

Dr. B.S. Sonawane

Dr. R.R. Deshmukh

Dr. Sunita Kasar

HEAD OF DEPARTMENT
Computer Science & Engineering
MIT Aurangabad

MCA Department
Govt. College of Engg. Aurangabad

FACULTY OF SCIENCEAND TECHNOLOGY
Syllabus Structure w.e.f. 2025-26 (As per NEP-2020)

Semester–III

Sr. No.	Course Category	Course Code	Course Title	Contact Hours per week		Credits		Scheme of Examination		
				Theory	Practical	Theory	Practical	CIA	SEE	Total
1	Program Core Course (PCC)	PCCT-1	Data Structures	3	----	3	----	40	60	100
		PCCP-1	Lab. Data Structures		2		1	20	30	50
		PCCT-2	OOP using JAVA	2	----	2	----	20	30	50
		PCCP-2	Lab. OOP using JAVA	—	2	--	1	20	30	50
		PCCT-3	Discrete Mathematics	2	----	2	----	20	30	50
		PCCP-3	Lab. Python Programming	---	2	--	1	20	30	50
2	Multidisciplinary Minor (MDM)	MDMT-1	Student will have to choose any one course from the Basket of minor	2	----	2	----	20	30	50
3	Open Elective (OE)to be chosen compulsorily from the faculty other than Major Discipline	OET-1	Student will have to choose any one course from the Basket of OE	2	----	2	----	20	30	50
		OET-2	Student will have to choose any one course from the Basket of OE	2	----	2	----	20	30	50
4	Entrepreneurship/ Economics/ Management Courses		Theory-7 One Theory course form the following Basket 1) Engineering Economics 2) Entrepreneur Development 3) Industrial Management	2	----	2	----	20	30	50
5	Value Education Course (VEC)	VECT-1	Theory-8 (Universal Human Values/ Environmental Studies)	2	—	2	--	20	30	50
6	Comm. Engg. Project/Field Project(FP)	FP-1	Field Project	—	4	—	2	20	30	50
				17	**10**	**17**	**5**	**260**	**390**	**650**

Option 2 : Student can choose option 2 to get B.E./B.Tech Honors with Multidisciplinary Minor (above structure + following additional Honors degree course

7	One additional Couse from core program for Honors Degree	HT-1	AI Knowledge Representation & Reasoning	3	----	3	----	40	60	100

Please note that the course listed under Sr. No. 7 is optional and specifically designed for students pursuing a Bachelor's Degree Honors with Multidisciplinary Minor. Only those students who have secured a minimum of 7.5 CGPA (equivalent to 75% marks) in their first year will be eligible to opt for this option

8	One additional Minor Couse (for Double Minor)	DMT-1	Object Oriented Programming	3	----	3	----	40	60	100

Please note that the courses listed under Sr. No. 8 is optional and specifically designed for students pursuing a Bachelor's Degree with Double Minor. Only those students who have secured a minimum of 7.5 CGPA (equivalent to 75% marks) in their first year will be eligible to opt for this option.

Exit Option: Students may choose to exit the program at the end of the second year and be awarded an UG Diploma in the Mechanical Engineering, provided they have earned additional 8 credits through skill-based vocational courses, internships, or mini project undertaken during the summer vacation, after second year.

Semester–IV										
Sr. No.	Course Category	Course Code	Course Title	Contact Hours per week		Credits		Scheme of Examination		
				Theory	Practical	Theory	Practical	CIA	SEE	Total
1	Program Core Course(PCC)	PCCT-1	Introduction to AI	3	----	3	----	40	60	100
		PCCP-1	Lab Introduction to AI		2		1	20	30	50
		PCCT-2	Statistics for Data Science	2	----	2	----	20	30	50
		PCCP-2	Lab Statistics for Data Science	---	2	--	1	20	30	50
		PCCT-3	Computer Networks	2	----	2	----	20	30	50
		PCCP-3	Lab Computer Networks	---	2	--	1	20	30	50
2	(MDM) Multidisciplinary Minor	MDMT-2	Student will have to choose any one course from the Basket of Minor	2	----	2	----	20	30	50
3	(OE)to be chosen compulsorily from the faculty other than Major Discipline Open Elective	OET-3	Student will have to choose any one course from the Basket of OE	2	----	2	----	20	30	50
4	Vocational and Skill Enhancement Course (VSEC)	VSECP-2	(Programme specific Skills) Web Technologies	--	4	--	2	20	30	50
5	Ability Enhancement Course (AEC)	AEC-2	Theory-6 Modern Indian Languages (Marathi, Hindi, Sanskrit, Urdu, Pali, Arabic)	2	----	2	----	20	30	50
6	Economics/ Management Courses/ Entrepreneurship		Theory-7 One Theory course form the following Basket 1) Engineering Economics 2) EntrepreneuripDevelopment 3) Industrial Management	2	----	2	----	20	30	50
7	Value Education Course (VEC)	VECT-2	Theory-8 (Universal Human Values/ Environmental Studies)	2	---	2	--	20	30	50
				17	**10**	**17**	**5**	**260**	**390**	**650**
Option 2 : Student can choose option 2 to get B.E./B.Tech Honors with Multidisciplinary Minor (above structure + following additional Honors degree course)										
7	One additional Course from core program for Honors Degree	HT-2	Applied Accelerated AI	3	----	3	----	40	60	100
Please note that the course listed under Sr. No. 7 is optional and specifically designed for students pursuing a Bachelor's Degree Honors with Multidisciplinary Minor. Only those students who have secured a minimum of 7.5 CGPA (equivalent to 75% marks) in their first year will be eligible to opt for this option										
Option 3 : Student can choose option 3 to get B.E./B.Tech with Double Minor (Option I structure + following additional Double Minor course)										
8	One additional Minor Course (for Double Minor)	DMT-2	Python Programming	3	----	3	----	40	60	100
Please note that the courses listed under Sr. No. 8 is optional and specifically designed for students pursuing a Bachelor's Degree with Double Minor. Only those students who have secured a minimum of 7.5 CGPA (equivalent to 75% marks) in their first year will be eligible to opt for this option.										

List of Courses offered for MDM

Semester	Courses offered
III MDMT-1	Data Structures
IV MDMT-2	Computer Algorithms

Syllabus of 3rd Semester
B.E./B.Tech Programme (Artificial Intelligence/ Artificial Intelligence and Machine Learning / Artificial Intelligence and Data Science)

Course Code :PCCT-1
(Semester III)
Course Title : Data Structures

Total Credits : 3 **Total Contact Hours** : 03Hrs/week ; 45 Hrs / Semester :III
Maximum Marks : 100

Learning Objectives of the Course:

i) To understand and implement fundamental data structures such as arrays, stacks, queues, linked lists, trees, and graphs.
ii) To analyze the performance of various data structures.
iii) To apply suitable data structures for problem solving in software development.

Course Outcomes (COs) :

After completion of the course, students will be able to -
i) Understand basic data structures and asymptotic notations.
ii) Apply data structures to algorithmically design efficient computer programs that will cope with the complexity of actual applications.
iii) Design and implementation of data structures
iv) Analyze data structures using asymptotic analysis.
v) Develop algorithms for sorting and searching problems.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	A. **Introduction Data structure(7Hrs)**Data structures, data structure operations, abstract data types (ADT), Arrays, Structures, pointers, dynamic memory management, asymptotic notations– Big-Oh, Theta, Omega. Stacks - Primitive operations in stack, array representation of stacks, linked representation of stacks, Application of stacks, example-infix, postfix and prefix. B. **Queues and Link List(8 Hrs)** linked representation of queues, queue as ADT, circular queues, deques, priority queues, applications of queues. Linked lists – Linked lists, representation of linked list in memory, traversing a linked list, searching a linked list, insertion, deletion, header linked list, circularly linked list, doubly linked lists, buddy systems.	**15Hrs**
II	A. **Trees(8Hrs)-** Binary trees, representing binary tree in memory, traversing binary trees, header nodes, threaded binary trees, binary search trees, searching and inserting in binary search tree, deleting from a binary search tree, applications of trees. B. **Sorting(7Hrs)-**: bubble sort, merge sort, quick sort, radix sort, insertion sort, selection sort, heap sort, Performance analysis and comparison of all sorting methods.	**15Hrs**

III	A. **Searching and Hashing algorithms(7Hrs)-:**.Search algorithms – Sequential Search, Ordered lists, binary search, Searching using Hashing, Hash tables, Hash functions, Some examples of hash functions. Collision resolution methods, complexity analysis of searching methods. B. **Graphs(8Hrs) –** graph theory terminology, sequential representation of graphs; adjacency matrix, path matrix, graph traversal – DFS, BFS, Warshall's algorithm, Dijkstra's Algorithm; shortest path, linked representation of graph, operations on graph, topological sorting, spanning trees: Prim's and Kruskal's algorithm	**15Hrs**

TextBooks(If Any):

1.Aaron M. Tanenbaum, "Data Structures using C and C++"

2.E. Horowitz, S. Sahni, S.Anderson-freed, "Fundamentals of Data Structures in C", Second Edition, University Press, ISBN 978-81-7371-605-8

Reference Books:

1. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C*, Pearson Education.
2. Robert Lafore, *Data Structures and Algorithms in C++*, Sams Publishing.

Course Code: PCCP-1
(Semester III)
Course Title: Lab. Data Structures

Total Credits: 1 **Practical:** 2 Hrs/week ; 30 Hrs / Semester

Maximum Marks : 50

Learning Objectives of the Course:

i) To teach the student to write programs in C and to solve the problems.

ii) Implement the data Structures using C language

Course Outcomes (COs) :

After completion of the course, students will be able to -

CO 1 Implement data structures like stacks, queues, linked lists etc. using array and dynamic variables and compare these methods.

CO 2 Implement complex data structures like trees & graphs in High level language.

CO 3 Implement searching & sorting methods.

Topics / actual contents of the syllabus	Contact Hours
1 Write a program for implementation of Stack. 2 Write a program for implementation of Queue. 3 Write a program for Singly Linked List. 4 Write a program for Creation of Binary Tree and operations on it. 5 Write a program for Creation of Binary Threaded Tree. 6 Write a program for Depth First search and Breadth First search. 7 Write a program for Bubble Sort. 8 Write a program for Merge Sort. 9 Write a program for Heap Sort. 10 Write a program for Insertion Sort 11 Write a program for Binary Search to search an element in the given sequence.	**30 Hrs**

Students should undertake at least 08 to 10 experiments during the semester from above list

Course Code :PCCT-2
(Semester III)
Course Title : OOP using JAVA

Total Credits : 2 **Total Contact Hours :** 02Hrs/week ; 30 Hrs / Semester
Maximum Marks : 50

Learning Objectives of the Course:

i) To learn object oriented concept in Java
ii) To study inheritance, polymorphism concept.
iii) To understand the exception and multithreading.

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) **CO1**Describe the fundamental concepts of Java, including OOP principles, JVM architecture, and basic syntax structures like variables, data types, and control statements.
ii) **CO2**Apply object-oriented programming concepts such as classes, objects, constructors, overloading, and access modifiers in Java.
iii) **CO3**Implement inheritance, abstract classes, and method overriding to promote code reuse and polymorphic behavior in Java programs.
iv) **CO4**Design and implement programs using interfaces and packages for modular and extensible software development.
v) **CO5**Handle errors and exceptions effectively using Java's exception handling mechanisms to build robust programs.
vi) **CO6**Demonstrate the use of multithreading to develop concurrent programs in Java, managing thread lifecycle and synchronization.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**A.Introduction to OOP and Java(4 Hrs)**Futures of java, difference between procedural oriented and approach oriented, Java Virtual Machine, Data types, Variables, Operators, Control Statements, String & Array in Java. **B.OOP in Java (6 Hrs)**Class fundamental, introducing method, declaring object, accessing class members, method overloading, constructor, constructor overloading, static member, access modifiers, this references, introducing final.	**10 Hrs**
II	**C. Inheritance(5 Hrs)** Inheritance in java, super and sub-classes, defining subclass, type of inheritance method overloading, using super, finalizers,abstract class and method, visibility control, using final with inheritance. **D. Interfaces & Packages (5Hrs)**Interface in Java, Defining interfaces, Extending & Implementing Interfaces, Polymorphism, Packages: Defining a Packages, Class Path Variable, Creation of Package, Importing Packages	**10 Hrs**

III	C. **Exceptional Handling (6 Hrs)**Exceptional Handling fundamentals, Java Built in exceptions, Try Catch & Finally, Throws, Throws Keywords, User defined Exception D. **Multi-Threading (4Hrs)**Definition of Threads, States of Threads, Common Threads method,Creation of Threads, Creation of Multiple Threads, Thread priorities, Synchronization	**10 Hrs**

TextBooks(If Any):

1. Richard L. Halterman, "***Object-Oriented Programming in Java***", 1st Edition, Southern Adventist University, 2011...

2.Kathy Sierra, Bert Bates, "*Head First Java*", 2nd Edition, O'Reilly Media, 2005.

3. Paul Deitel, Harvey Deitel, "*Java: How to Program*", 10th Edition, Pearson Education, 2015.

ReferenceBooks:

3. Kathy Sierra, Bert Bates , " *Head First Java* ", 2nd Edition , O'Reilly Media
4. Herbert Schildt, "***Java: A Beginner's Guide***", 8th Edition, McGraw-Hill Education
5. Bruce Eckel , "***Thinking in Java***", 4th Edition, Prentice Hall
6. Joshua Bloch,, "***Effective Java***", 3rd Edition, Addison-Wesley
7. Herbert Schildt, "***Java: The Complete Reference",*** 12th Edition, McGraw-Hill Education
8. Robert C. Martin, "***Clean Code: A Handbook of Agile Software Craftsmanship***", 1st Edition, Prentice Hall
9. Eric Freeman, Elisabeth Robson, "***Head First Design Patterns***", 2nd Edition(2020), O'Reilly Media

Course Code: PCCP-2
(Semester III)
Course: Lab. : OOP Using JAVA

Credits: 1 **Practical:** 2 Hrs/week ; 30 Hrs / Semester

Maximum Marks : 50

Learning Objectives of the Course:

i) To teach the student to write programs in JAVA and to solve the problems.

ii) Implement the Object Oriented Program using JAVA language

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. Implement basic Java programs using variables, data types, operators, arrays, and strings
2. Apply object-oriented programming concepts such as classes, objects, methods, and constructors
3. Demonstrate constructor overloading and method overloading in Java.
4. Illustrate inheritance (single and multilevel) and use of keywords like `this`, `super`, and `final`.
5. Implement access control, encapsulation, and use of static members in Java classes.

Topics / actual contents of the syllabus	Contact Hours
1. Write a program that input word & a sentence. Find the given word in sentence entered. 2.Write a program to store Five student's marks along with roll number in an array. Display marks of particular roll number. 3.Write a stack to Push Numbers, pop numbers and also to check stack empty or full.(use OOP's concepts and Constructor Overloading to assign default size of stack of 5 or user can change the stack size while creating object) 4.Create a class, Bank of Account, with fields account number, account Holder Name, Balance and internal Rate and a method deposit() that adds an amount to the balance. 5.Write a program to demonstrate use of 1D and 2D arrays and String operations 6.Write a Java program to demonstrate use of data types, variables, and operators 7.Implement a class with methods and object creation, access members 8.Write a Java program to demonstrate method overloading 9.Implement constructor and constructor overloading in Java 10.Demonstrate the use of static data and methods, and the `this` keyword 11.Create a program to demonstrate use of access modifiers and the `final` keyword 12.Implement single and multilevel inheritance using classes	**30 Hrs**

13.Demonstrate the use of super keyword and call super class constructor 14.Implement and use Java Interfaces with `implements` and `extends` 15.Create and use user-defined packages and `import` them in another class 16.Demonstrate polymorphism using method overriding 17.Write a program to handle built-in exceptions using `try`, `catch`, `finally` 18.Create a program with user-defined exceptions 19.Demonstrate thread synchronization using `synchronized` method 20.Mini project combining OOP, Exception Handling, Threads, and Packages	
Students should undertake at least 08 to 10 experiments during the semester from above list	

Course Code: PCCT-3
(Semester III)
Course Title : Discrete Mathematics

Total Credits : 02
Maximum Marks : 50

Total Contact Hours : 2 Hrs/week 30 Hrs / Semester

Learning Objectives of the Course:

1. To develop a strong foundation in set theory, logic, relations, and functions, enabling students to model and analyze mathematical structures.
2. To apply combinatorial principles, recurrence relations, and generating functions in solving counting and algorithmic problems.
3. To understand and analyze graphs and trees, and apply related algorithms in solving real-world and computational problems.
4. To explore fundamental algebraic structures such as groups, rings, and fields, and understand their relevance in computer science and engineering applications.

Course Outcomes (COs) :

After completion of the course, students will be able to -

I. CO1: Apply the concepts of set theory, logic, and functions to model and solve mathematical problems.
II. CO2: Use combinatorial techniques, recurrence relations, and generating functions to analyze and solve counting and algorithm-based problems.
III. CO3: Analyze graphs and trees, and apply relevant algorithms to solve the problems.
IV. CO4: Understand and apply fundamental algebraic structures such as groups, rings, and fields in mathematical and computational contexts.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Set Theory**: Basic concepts of set theory, Operations on Sets, the power set. Finite, infinite and uncountable infinite sets, Cardinality of finite sets, principle of inclusion and exclusion. **Introduction to Logic**. Propositional Logic, Truth tables, Predicates and Quantifiers, Propositional equivalence, Mathematical Proofs. Infinite sets, well-ordering. Mathematical Induction. **Relations**: Ordered pairs and n-tuples, Product Sets and Partitions, Relations and Digraphs, Matrix of Relation, Properties of Relations, Equivalence Relations & Partitions, Manipulation of Relations, Composition of Relations, Transitive Closure of a relation, Partial order relation, Partially ordered set, HasseDiagrams. **Functions:** Definition, Composition of functions, Types of Functions, Invertible Function, Pigeonhole Principle with Simple Applications.	**10 Hrs**
II	**Counting Principles** The Basics of Counting, rule of Sum and Product, Permutations and	**10 Hrs**

	Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Algorithms for generating Permutations and Combinations. **Discrete numeric functions and generating function:** Introduction, manipulation of numeric functions, Asymtotic-behaviour of numeric functions, generating function. **Recurrence Relations and Recursive Algorithms:** Introduction, recurrence relations, linear recurrence relations with constant coefficients, homogeneous solutions, particular solutions, total solution. Solution by the method of generating functions.	
III	**Graph:** Basic terminology, multi-graph and weighted graphs, path and circuits, short path in weighted graphs- Dijkstra algorithm. Eulerian path and circuits, Hamiltonian path and circuits. Factors of a graph, planer graph, graph coloring. **Trees:** Trees, rooted trees, path lengths in rooted trees, pre-fixed codes, spanning trees and cut sets. **Algebraic Structures** The structure of algebra, Algebraic Systems, semigroups, Monoids, Groups, Homomorphism and Normal Subgroups, Rings, Integral Domains and Fields.	**10 Hrs**

TextBooks(If Any):

1. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", 3rd Edition, Tata McGraw-Hill, 2008.
2. Peter J. Cameron, "Combinatorics: Topics, Techniques, Algorithms", Cambridge University Press, 1994.
3. Ronald Graham, Donald Knuth, and Oren Patashnik, "Concrete Mathematics: A Foundation for Computer Science", 2nd Edition, Addison–Wesley, 1994.
4. NarsinghDeo, "Graph Theory with Applications to Engineering and Computer Science", Prentice-Hall, 1974.
5. N. Biggs, "Discrete Mathematics", 3rd Edition, Oxford University Press, 2002.

ReferenceBooks:

10. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", 7th Edition, Tata McGraw-Hill, 2011.

Course Code: PCCP-3
(Semester III)
Course Code : Lab: Python Programming

Total Credits : 01
Maximum Marks : 50

Total Contact Hours : 2 Hrs/week ; 30 Hrs / Semester

Learning Objectives of the Course:

1. To provide hands-on experience in Python programming.
2. To develop problem-solving skills using Python.
3. To implement algorithms using functions, loops, and data structures in Python
4. To understand the use of modules, file handling, and exception handling

Course Outcomes (COs) :
After completion of the course, students will be able to -

1. Write basic Python scripts using variables, operators, and input/output.
2. Use control structures such as loops and conditional statements.
3. Create functions and use built-in and user-defined modules.
4. Work with strings, lists, tuples, dictionaries, and sets.
5. Handle files and exceptions in Python programs.

Topics / actual contents of the syllabus	Contact Hours
1. Basics of Python: Variables, Data Types, and Operators 2.Control Structures: if, if-else, nested if-else 3.Loops: for and while loops with examples 4.Functions: Built-in functions and user-defined functions 5.Recursion and Lambda functions 6.Working with Strings 7.Lists, Tuples, and Dictionaries 8.Sets and their operations 9.File Handling: Read and write operations 10.Exception Handling in Python	**30 Hrs**
Students should undertake at least 08 to 10 experiments during the semester from above list	

Course Code :MDMT-1
(Semester - III)
Course Title : Data Structures

(This course will be available for the students from other discipline and AI, AL-ML, AIDS Engineering students will choose minor course from other discipline)

Total Credits : 2

Maximum Marks : 50 **Total Contact Hours :** 02Hrs/week ; 30Hrs / Semester

Learning Objectives of the Course:

- To understand and implement fundamental data structures such as arrays, stacks, queues, linked lists, trees, and graphs.
- To analyze the performance of various data structures.
- To apply suitable data structures for problem solving in software development.

Course Outcomes (COs) :

After completion of the course, students will be able to -

- Understand basic data structures and asymptotic notations.
- Apply data structures to algorithmically design efficient computer programs that will cope with the complexity of actual applications.
- Design and implementation of data structures
- Analyze data structures using asymptotic analysis.
- Develop algorithms for sorting and searching problems.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	C. **Introduction Data structure**Data structures, data structure operations, abstract data types (ADT), Arrays, Structures, pointers, dynamic memory management, asymptotic notations– Big-Oh, Theta, Omega. Stacks - Primitive operations in stack, array representation of stacks, linked representation of stacks, Application of stacks, example- infix, postfix and prefix. D. **Queues and Link List**linked representation of queues, queue as ADT, circular queues, deques, priority queues, applications of queues. Linked lists – Linked lists, representation of linked list in memory, traversing a linked list, searching a linked list, insertion, deletion, header linked list, circularly linked list, doubly linked lists, buddy systems.	**10Hrs**
II	E. **Trees)-** Binary trees, representing binary tree in memory, traversing binary trees, header nodes, threaded binary trees, binary search trees, searching and inserting in binary search tree, deleting from a binary search tree, applications of trees. F. **Sorting)-**: bubble sort, merge sort, quick sort, radix sort, insertion sort, selection sort, heap sort, Performance analysis and comparison of all sorting methods.	**10Hrs**

III	E. **Searching and Hashing algorithms**(Search algorithms – Sequential Search, Ordered lists, binary search, Searching using Hashing, Hash tables, Hash functions, Some examples of hash functions. Collision resolution methods, complexity analysis of searching methods. F. **Graphs–** graph theory terminology, sequential representation of graphs; adjacency matrix, path matrix, graph traversal – DFS, BFS, Warshall's algorithm, Dijkstra's Algorithm; shortest path, linked representation of graph, operations on graph, topological sorting, spanning trees: Prim's and Kruskal's algorithm	**10Hrs**

TextBooks(If Any):

1.Aaron M. Tanenbaum, "Data Structures using C and C++"

2.E. Horowitz, S. Sahni, S.Anderson-freed, "Fundamentals of Data Structures in C", Second Edition, University Press, ISBN 978-81-7371-605-8

Reference Books:

1. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C*, Pearson Education.
2. Robert Laforc, *Data Structures and Algorithms in C++*, Sams Publishing.

Entrepreneurship/ Economics/ Management Courses (EEM)

Course Code: EEM-I
(Semester III)
Course Title: Engineering Economics

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours:**2 Hrs/week ; 30 Hrs / Semester

Learning Objectives of the Course:

1. Understand the Time Value of Money
2. Evaluate Engineering Alternatives
3. Analyze Public Sector Projects
4. Understand and Apply Depreciation and Taxation
5. Perform Break-even and Sensitivity Analysis
6. Understand Cost Concepts for Decision-Making

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. To evaluate Time Value of Money
2. To enable students to perform economic comparisons between different projects or assets
3. To introduce benefit-cost analysis for evaluating the economic feasibility of projects
4. To apply break-even analysis using both linear and non-linear models
5. To develop skills in cost estimation, cost control, cost reduction, and identify relevant costs for decision-making.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Time value of money:** Simple and compound interest, Time value equivalence, Compound interest factors, Cash flow diagrams, Calculation, Calculation of time –value equivalences. Present worth comparisons, Comparisons of assets with equal, unequal and infite lives, comparison of deferred investments, Future worth comparison, payback period comparison.	10 Hrs
II	Use and situations for equivalent annual worth comparison, Comparison of assets of equal and unequal life. Rate of return, Internal rate of return, comparison of IIR with other methods, IRR misconceptions. Analysis of public Projects: Benefit/ Cost analysis, quantification of project, cost and benefits, benefit/ cost applications, Cost effectiveness analysis.	10 Hrs
III	**Depreciation**, Computing depreciation charges, after tax economic comparison, Break-even analysis; linear and non-linear models. Sensitivity analysis: single and multiple parameter sensitivity. **Fixed and variable cost,** Product and Process Costing, Standard Costing, Cost estimation, Relevant Cost for decision making, Cost estimation, Cost control and Cost reduction Techniques.	10 Hrs

Reference Books:

1. Riggs, J.L., Dedworth, Bedworth, D.B., Randhawa, S.U., "Engineering Economics", Vol. 1, Latest Edition, McGraw Hill International, 1996.
2. James L. Riggs, David D. Bedworth, Sabah U. Randhawa, "Economics for Engineers", Vol. 1, 4th Edition, McGraw-Hill, 2004.

3. Donald Newnan, Ted Eschembach, Jerome Lavelle, "Engineering Economic Analysis", Vol. 1, 8th Edition, Oxford University Press, 2012.
4. John A. White, Kenneth E. Case, David B. Pratt, "Principles of Engineering Economic Analysis", Vol. 1, 6th Edition, John Wiley, 2010.
5. R. Panneerseelvam, "Engineering Economics", Vol. 1, 2nd Edition, PHI, 2008.
6. Michael R. Lindeburg, "Engineering Economics Analysis", Vol. 1, Latest Edition, Professional Publications, 1993.
7. V. Mote, S. Paul, G. Gupta, "Managerial Economics", Vol. 1, Latest Edition, Tata McGraw Hill, 2004.

Course Code: EEM-II
(Semester III)
Course Title: Entrepreneurship Development

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours**:2 Hrs/week ; 30 Hrs / Semester

Learning Objectives of the Course:

1. Understand the fundamentals of entrepreneurship and its significance in engineering.
2. Identify business opportunities and develop innovative ideas.
3. Create a basic business plan and understand key entrepreneurial strategies.

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. Explain the concept of entrepreneurship and its importance in the modern economy.
2. Identify and evaluate business opportunities in engineering and technology sectors.
3. Develop a comprehensive business plan including financial, operational, and marketing strategies.
4. Assess the challenges and risks in entrepreneurship and develop strategies to mitigate them.
5. Demonstrate entrepreneurial thinking through case studies, projects, and presentations.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Entrepreneurship** Definition, meaning, and characteristics of an entrepreneur, Evolution of entrepreneurship Types of entrepreneurs, Role of entrepreneurship in economic development, Key traits of successful entrepreneurs.	10 Hrs
II	**Opportunity Recognition and Idea Generation** Identifying business opportunities, Creativity and innovation in entrepreneurship, Techniques for idea generation, Feasibility analysis (technical, market, financial).	10 Hrs
III	**Business Planning** Components of a business plan, Business models and strategy formulation, Legal requirements for starting a business, Intellectual Property Rights (IPR) and patents.	10 Hrs

Reference Books:

1. C.B. Gupta, Srinivasan, "Entrepreneurship Development", Vol. 1, Latest Edition, Sultan Chand & Sons, 2020.
2. Donald F. Kuratko, "Entrepreneurship: Theory, Process, Practice", Vol. 1, Latest Edition, Cengage, Eric Ries, "The Lean Startup", Vol. 1, Latest Edition, Anonymous, 2011.
3. Alexander Osterwalder, Yves Pigneu, "Business Model Generation", Vol. 1, Latest Edition, Wiley, 2011.
4. Peter F. Drucker, "Innovation and Entrepreneurship", Vol. 1, Latest Edition, Taylor & Francis, 2014.

Course Code: EEM-III
(Semester III)
Course Title: Industrial Management

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours:**2 Hrs/week ; 30 Hrs / Semester

Learning Objectives of the Course:

1. To understand concept of management, administration, Organization, Industrials Laws.

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. Understand the fundamental principles of management.
2. Describe different forms of business organizations and organizational structures.
3. Apply theoretical knowledge to real-world management and organizational challenges.
4. Analyze the impact of organizational, environmental factors.
5. Explain the role of economics in management decision-making.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Management:** Managing and Manager, organizations and need for management, the managing process, types of managers, the challenge of management, the evolution of Management theory. **Management in the 21st century:** The importance of organizational and natural environment, elements of direct action environment, managing multiple stock holder relationship, elements of the indirect action environment, Natural Environment management 2000 and beyond, social responsibility and ethics, globalization. Evaluation of case studies related to above concept.	10 Hrs
II	**Business Organization** Forms of business organization, individual proprietorship, joint stock company, co-operative enterprise, co-operative enterprise and public sector undertakings. Organization structure in industries, Line organization, functional organization, line and staff organization, committee organization, project organization matrix organization. **Nature and Significance of Economics.** Science, engineering and technology, their relationship with economic development. Basic economic concepts, human wants economic goods, utility value, price cost, wealth and capital. Demand supply, elasticity of demand and supply. Concept of profit and revenues.	10 Hrs
III	**Accidents and safety** Classification of accidents, according to nature of industries; i.e. fatal, temporary, according to event and place. Causes of accidents , psychological, and other industrial hazards. Effects of accidents. Accident-prone workers, accident to be taken incase of accidents with machines, electric shock, road accident fires and erection and construction accidents **Personnel Management:** Man power, sources of recruitment, selection and training, job evaluation,	10 Hrs

	performance appraisal, wages and incentives, self and time management.	

Reference Books:

1. James A. F., "Management", Vol. 1, 6th Edition, PHI.
2. Claude S. George, Jr., "Management for Business and Industry", Vol. 1, Revised Edition, Prentice-Hall of India Private Limited.
3. McConnell, Gupta, "Economics: Principles, Problems, and Policies", Vol. 1, 18th Edition, The McGraw-Hill.
4. T.R. Banga, S.C. Sharma, "Industrial Organisation and Engineering Economics", Vol. 1, Latest Edition, Khanna Publishers, Jan-2006.
5. O.P. Khanna, "Industrial Engineering & Management", Vol. 1, Latest Edition, Dhanpat Rai Publication, Jan-2018.

Value Education Course (VEC)

Course Code: VECT-1
(Semester III)
Course Title: Universal Human Values

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours:** 2 Hrs/week ; 30 Hrs / Semester

Learning Objectives of the Course:

1. To appreciate the essential complementarities between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings,
2. To facilitate the development to a holistic perspective among students to lead their Personal and professional lives in an ethical way.
3. To highlight plausible implications of such a holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour, and mutually enriching interaction with nature.

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. Define key terms related to human values.
2. Explain the concept of happiness as related to right understanding and relationship.
3. Apply the principles of right understanding in their daily interactions.
4. Analyze the impact of their values on their behaviour and decisions.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**IntroductiontoValue Education and HarmonyintheHumanBeing** • Understanding Value Education • Self-exploration as the Process for Value Education • Continuous Happiness and Prosperity - the Basic Human Aspirations and their fulfillment • Right Understanding, Relationship and Physical Facility • Happiness and Prosperity - Current Scenario • Method to Fulfill the Basic Human Aspirations • Harmony in the Human Being • Understanding Human being as the Co-existence of the Self and the Body • Distinguishing between the Needs of the Self and the Body • the Body as an instrument of the Self • Understanding Harmony in the Self • Harmony of the Self with the Body • Programme to ensure self-regulation and Health.	**10 Hrs**
II	**HarmonyintheFamily and Society** • Harmony in the Family - the Basic Unit of Human Interaction "Trust' - the Foundational Value in Relationship • 'Respect' - as the Right Evaluation Values in Human-to-Human Relationship • Harmony in the Society • Other Feelings, Justice in Human-to-Human Relationship • Understanding Harmony in the Society • Vision for the Universal Human Order	**10 Hrs**
III	**Harmony in the Nature (Existence) and Implications of the Holistic**	**10 Hrs**

	Understanding • Understanding Harmony in the Nature • Interconnectedness, self-regulation, and Mutual Fulfillment among the Four Order of Nature • Realizing Existence as Co-existence at All Levels • The Holistic Perception of Harmony. Implications of the Holistic Understanding - a Look at Professional Ethics • Basis for Universal Human Values • Definitiveness of (Ethical) Human Conduct • Professional Ethics in the light of Right Understanding • A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order • Holistic Technologies, Production Systems and Management Models, Typical Case Studies Strategies for Transition towards Value-based Life and Profession.	

Reference Books:

1. P.L. Dhar, R.R. Gaur, "Science and Humanism", Vol. 1, 1st Edition, Commonwealth Publishers.
2. Nagaraj, "Jeevan Vidya: EkPariehaya", Vol. 1, Latest Edition, Jeevan VidyaPrakashan, Amarkantak, 1999.
3. A.N. Tripathy, "Human Values", Vol. 1, Latest Edition, New Age International Publishers, 2003.
4. E.G. Seebauer, Robert L. Berry, "Fundamentals of Ethics for Scientists & Engineers", Vol. 1, 1st Edition, Oxford University Press.
5. M. Govindrajan, S. Natrajan, V.S. Senthil Kumar, "Engineering Ethics and Human Values", Vol. 1, 1st Edition, Prentice Hall of India Ltd.
6. B.P. Banerjee, "Foundations of Ethics and Management", Vol. 1, Latest Edition, Excel Books, 2005.
7. B.L. Bajpai, "Indian Ethos and Modern Management", Vol. 1, Reprinted Edition, New Royal Book Co., Lucknow, 2008.

E-resources:

1. http://madhyasth-darshan.info/postulations/knowledge/knowledge-of-humane-conduct/
2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
3. https://youtu.be/OgdNx0X9231
4. https://fdp-si.aicte-india.org/UHV-II%20Practice%20Sessions.php
5. https:/Ifdp-si.aicte-india.org/download.php#1/

Course Code: FP-I
(Semester III)
Course Title: Field Project

Total Credits: 2

Maximum Marks: 50 **Total Contact Hours:**4 Hrs/week ; 60 Hrs / Semester

Prerequisites: Basic knowledge of Computer Science engineering principles, exposure to technical writing and research methods

Learning Objectives of the Course:

1. To enable students to identify a relevant Computer Science engineering problem.
2. To conduct a comprehensive literature survey using authentic research sources.
3. To formulate a well-defined problem statement.
4. To understand and define project objectives, scope, methodology, and expected outcomes.
5. To develop a strategic plan and timeline for execution in field project.

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. Identify a relevant and feasible Computer Science engineering problem through field interaction, experimentation, or simulation.
2. Conduct a comprehensive literature review to establish the state of the art in the chosen domain.
3. Formulate a clear and specific problem statement with well-defined objectives and scope.
4. Choose appropriate tools and methodologies suited to the project requirements.
5. Develop a comprehensive project execution plan including resource allocation and risk mitigation.
6. Prepare and present effective interim and final project reports, demonstrating clarity of thought and technical writing skills.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Engineering Research** Nature and scope of research in mechanical engineering Types of projects (Experimental, Computational, Design-based, Review, Industrial)Case studies of past projects **Identifying the Problem Statement** How to select a relevant and feasible problem Techniques for problem identification (e.g., field visits, industry interaction, lab experimentation, simulation need)Problem relevance and innovation **Literature Survey** Understanding scholarly sources (journals, conference proceedings, patents)How to read, analyze, and summarize research papers Using databases: Google Scholar, ScienceDirect, IEEE Xplore, ASME Digital LibraryTools: Reference managers (Zotero, Mendeley)	**20 Hrs**
II	**Problem Statement Formulation** Structuring a strong and specific problem statement Defining objectives and scope Identifying research gaps Setting measurable goals and expected outcomes **Strategy & Methodology Planning** Overview of research and design methodologies (experimental, analytical, simulation) Tool selection and planning, Resource planning: Materials, lab access, software, Risk assessment and	**20 Hrs**

	mitigation strategies	
III	**Project Planning & Timeline Development** Work breakdown structure (WBS) Gantt chart preparation Milestones and deliverables Roles and responsibilities in team projects **Interim Reviews and Final Reporting** Presentation of problem statement, literature review, and methodology Interim report preparation Peer and faculty feedback	**20 Hrs**

Deliverables:

- Problem Identification Report
- Literature Review Summary
- Finalized Problem Statement with Objectives and Scope
- Methodology and Strategy Document
- Timeline (Gantt Chart or similar)
- Final Project Phase-I Report and Presentation

Honors Degree Course

Please note that this course is optional and specifically designed for students pursuing a Bachelor's Degree Honors with Multidisciplinary Minor. Only those students who have secured a minimum of 7.5 CGPA (equivalent to 75% marks) in their first year will be eligible to opt for this option

Course Code: HT-1
(Semester III)
Course Title: AI: Knowledge Representation & Reasoning

Total Credits: 3
Maximum Marks: 100 **Total Contact Hours:** 3 Hrs/week ; 45Hrs / Semester

Prerequisites Basics of Artificial Intelligence / Discrete Mathematics / Logic

Learning Objectives of the Course:

- To introduce formal methods for representing knowledge in AI systems.
- To explore various reasoning techniques that allow machines to infer new knowledge.
- To develop logical models and apply them to real-world problem solving.

Course Outcomes (COs) :

- Understand the foundational concepts of knowledge representation in AI.
- Apply logical reasoning techniques to infer knowledge.
- Develop formal models for rule-based and semantic knowledge representation.
- Evaluate reasoning strategies for intelligent systems and knowledge-based agents.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Knowledge Representation** • Need for knowledge in AI • Types of knowledge: Declarative, procedural, semantic • Representation schemes: Propositional logic, predicate logic • Syntax and semantics, knowledge base • Inference and entailment	15Hrs
II	**Logic-Based Reasoning** • Resolution and unification in predicate logic • Forward and backward chaining • Rule-based systems and production rules • Non-monotonic reasoning • Default logic and circumscription	15Hrs
III	**Structured Representation and Ontologies** • Semantic networks and frames • Description logic • Conceptual dependency and scripts • Ontologies: Components, structure, use in knowledge sharing • Reasoning with uncertainty: Fuzzy logic and probabilistic reasoning (overview))	15Hrs

Textbooks / Reference Books :

- Elaine Rich and Kevin Knight – *Artificial Intelligence*
- Stuart Russell and Peter Norvig – *Artificial Intelligence: A Modern Approach*
- Ronald Brachman and Hector Levesque – *Knowledge Representation and Reasoning*

Double Minor Course

Please note that this course is optional and specifically designed for students pursuing a Bachelor's Degree with Double Minor. Only those students who have secured a minimum of 7.5 CGPA (equivalent to 75% marks) in their first year will be eligible to opt for this option.

Course Code: DMT-1
(Semester - III)
Course: Object Oriented Programming

Total Credits: 3
Maximum Marks: 100 **Total Contact Hours**:3 Hrs/week ; 45Hrs / Semester

Prerequisites:

- Good knowledge of basic programming (C/Python basics).
- Understanding of variables, control structures, functions.

Learning Objectives of the Course:

- Understand Object-Oriented Programming (OOP) concepts, design, and implementation.
- Develop programs using classes, objects, constructors, and destructors.
- Apply object-oriented techniques to solve real-world problems.

Course Outcomes (COs) :

After completion of the course, students will be able to -

- Explain OOP concepts and their advantages over procedural programming.
- Explain the causes and effects of major environmental problems.
- Implement inheritance, polymorphism, encapsulation, and abstraction.
- Apply concepts of operator overloading, exception handling, and file handling.
- Design object-oriented applications using real-world case studies.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to OOP and Classes** - Procedural vs. Object-Oriented Programming - Principles of OOP: Encapsulation, Abstraction, Inheritance, Polymorphism - Basics of Classes and Objects , Constructors and Destructors , Access Specifiers (Public, Private, Protected) , Static Members (variables andfunctions)	15Hrs
II	**Advanced OOP Concepts** - Inheritance: Single, Multiple, Multilevel, Hierarchical, Hybrid - Polymorphism: Compile-time (Function Overloading, Operator Overloading) and Run-time (Virtual Functions) - Abstract Classes and Interfaces - Templates (Class and Function Templates) - Friend Functions and Friend Classes	15Hrs
III	**OOP Applications and Exception Handling** - Exception Handling: Try, Catch, Throw Mechanisms - File Handling: Stream Classes, File Read/Write Operations - Object-Oriented Design Principles: Class Diagrams, Use Case Diagrams (Basic Introduction to UML) - Mini Project Development using OOP Concepts (ex: Bank Management, Library System, Student Management)	15Hrs

Reference Books:

1 Object-Oriented Programming with C++ E. Balagurusamy McGraw Hill Latest

2 Object Oriented Programming in C++ Robert Lafore SAMS Publishing Latest

3 The C++ Programming Language Bjarne Stroustrup Addison-Wesley Latest 4 Java: The Complete Reference Herbert Schildt McGraw Hill Latest

Syllabus of 4th Semester
B.E./B.Tech Programme (Artificial Intelligence/ Artificial Intelligence and Machine Learning / Artificial Intelligence and Data Science)

Course Code: PCCT 1
(Semester IV)
Course Title: Introduction to AI

Total Credits: 3
Maximum Marks: 100 **Total Contact Hours:** 3 Hrs/week ; 45Hrs / Semester

Prerequisites: Introduction to AI

Learning Objectives of the Course:

i) Explain the fundamentals of Artificial Intelligence and intelligent agent design.
ii) Apply State Space and Heuristic Search Strategies for Problem Solving
iii) Implement optimal path finding and game-playing strategies using classical AI techniques.
iv) Solve constraint satisfaction problems using backtracking and consistency techniques

Course Outcomes (COs) :

i) Explain the foundational concepts of Artificial Intelligence, including intelligent agents, environments, and problem formulating
ii) Implement and analyze uninformed and heuristic search techniques for solving complex problems
iii) Apply optimal path finding algorithms and game-playing strategies to AI-driven decision-making scenarios
iv) Solve constraint satisfaction problems using appropriate algorithms such as backtracking and constraint propagation
v) Identify and evaluate machine learning approaches and demonstrate their application in real-world domains like healthcare, finance, and robotics.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Fundamentals of Artificial Intelligence and Problem Solving:** **Introduction to Artificial Intelligence** • Definition, history, applications • Intelligent Agents and Environments • Structure of agents, rationality, types of agents and environments • The Turing Test • Problem-solving agents and problem formulation **Search Strategies** • Generate and Test, Simple Search • Depth-First Search (DFS), Breadth-First Search (BFS), Depth-Bounded DFS • Iterative Deepening DFS, Quality of Solution Heuristic Search: Heuristic functions, Hill Climbing, Local Maxima, Solution Space Search	**15Hrs**
II	**Advanced Search Techniques and Game Playing** **Optimal Path Finding** • Brute Force, Branch & Bound • Dijkstra's Algorithm • A* Algorithm, Admissible A*, Iterative Deepening A* • Beam Search, Tabu Search **Game Playing and Decision Making** • Minimax Algorithm	**15Hrs**

	• Optimal decisions in multiplayer games • Challenges in Game Playing • Alpha-Beta Pruning Evaluation Functions	
III	**Constraint Solving and AI Applications** **Constraint Satisfaction Problems (CSPs)** • N-Queens Problem • Constraint Propagation, Scene Labeling • Higher Order Consistency • Backtracking Algorithms • Look-ahead Strategies, Strategic Retreat **Applications of AI and Learning Paradigms** • Learning from Observation, Inductive Learning • Machine Learning Basics • Types of Learning: Supervised, Unsupervised, Reinforcement Learning • Case Studies: AI in Healthcare, Finance, Robotics	**15Hrs**

Textbooks / Reference Books

Text Books(If Any):

1. Name Authors (as appear on the book), "Title of text Book", Vol…, Edition, Name of Publisher, Year of Publications

Reference Books:

3. Stuart J. Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson Education, 2010.
4. LavikaGoel, Artificial Intelligence: Concepts and Applications, Wiley Publications. (Year not specified)
5. Elaine Rich, Kevin Knight, Shivashankar B. Nair, Artificial Intelligence, 3rd Edition, McGraw Hill Education, 2009.

Course Code: PCCP-1
(Semester IV)
Course: Lab. Introduction to Artificial Intelligence

Total Credits : 01 **Total Contact Hours** : 2 Hrs/week ; 30 Hrs / Semester
Maximum Marks : 50

Objectives/Course Outcomes (COs) :	• Understand and implement basic AI search algorithms using Python. • Apply backtracking techniques to solve constraint satisfaction problems like N-Queens. • Develop problem-solving skills through classical AI problems such as Tower of Hanoi and 8-Puzzle. • Design interactive AI-based games like Hangman and Tic-Tac-Toe using logical reasoning and algorithms. • Analyze and apply pathfinding algorithms like Dijkstra's and TSP to real-world scenarios. **Course Outcomes (COs) :** • After completion of the course, students will be able to - • Apply logical programming using PROLOG for AI-based applications. • Develop AI solutions using search algorithms like DFS, BFS, and heuristic-based techniques. • Solve classic AI problems (e.g., 4-Queens, 8-Puzzle, TSP) using Python programming. • Implement game strategies using AI techniques such as the minimax algorithm. • Demonstrate the ability to translate AI concepts into functional Python programs for real-world problem solving.	
List Of Experiments	1. Implementation of PROLOG Programming Concepts and Functions 2. Python Program to Solve the Tower of Hanoi Problem 3. Python Implementation of Breadth-First Search (BFS) Traversal 4. Python Implementation of Depth-First Search (DFS) Traversal 5. Python Program to Develop a Hangman Game 6. Python Program to Solve the 4-Queens Problem Using Backtracking	**30Hrs**

	7. Python Implementation of Dijkstra's Shortest Path Algorithm 8. Python Program to Implement Tic-Tac-Toe Using Minimax Algorithm 9. Python Program to Solve the 8-Puzzle Problem Using Heuristic Search 10. Python Program to Solve the Traveling Salesman Problem (TSP)	

Course Code: PCCT-2
(Semester IV)
Course Title: Statistics for Data Science

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours**:2 Hrs/week ; 30Hrs / Semester

- **Prerequisites:** Simplifying expressions, solving equations and inequalities

Learning Objectives of the Course:

1. To understand the role of statistics in data science.
2. To describe data using summary statistics and visualizations.
3. To work with common statistical distributions relevant to data science.
4. To employ statistical techniques for data exploration and analysis.

Course Outcomes (COs) :

i. Understand the foundational concepts of data science, types of data, and the role of statistics in data-driven decision making.
ii. Apply appropriate descriptive statistical methods such as measures of central tendency, dispersion, and visualization techniques to summarize and explore data.
iii. Analyze probability distributions and random variables (discrete and continuous) to model and interpret real-world phenomena.
iv. Evaluate relationships between variables using correlation and regression techniques, and assess data distributions using skewness and kurtosis
v. Perform hypothesis testing and advanced statistical methods such as ANOVA and Chi-square tests to draw inferences from data in various data science applications.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Data Science and Statistics** Basics of Data Science, Role of Statistics in Data Science, Types of Data and Data Collection Methods. Introduction to Statistics, Frequency Distribution, Summarizing Data with Measures of Central Tendency (Mean, Median, Mode), Measures of Dispersion (Variance, Standard Deviation), Exploring Data with Visualizations (Histograms, Boxplots, Scatterplots) Random Variables and Distribution Functions: Random Variable, Distribution Function, Properties of Distribution Function, Discrete Random Variable, Probability Mass Function, Discrete Distribution Function, Continuous Random Variable, Probability Density Function	**10Hrs**
II	**Measures of Dispersion** Skewness and Kurtosis: Dispersion, Characteristics for an Ideal Measure of Dispersion, Measures of Dispersion, Range, Quartile Deviation, Mean Deviation, Standard Deviation and Root Mean Square Deviation, Coefficient of Dispersion, Coefficient of Variation, Skewness, Kurtosis Correlation and Regression Introduction, Types of correlation, Correlation and causation, Methods of studying correlation, Karl Pearson's coefficient of correlation, Rank correlation, Regression, Lines of Regression, Regression Coefficients	**10Hrs**

III	**Probability Distribution:** Binomial distribution, Poisson distribution, Normal distribution, Fitting of binomial distributions, Properties of binomial, Poisson and normal distributions, Relation between binomial and normal distributions, Relation between Poisson and normal distributions, Importance of normal distribution, examples. Additional Statistical Methods for Data Science and Applications Correlation Analysis, Analysis of Variance (ANOVA), Chi-Square Test for Categorical Data, Introduction to Non-parametric Statistics	**10Hrs**

TextBooks (If Any):

1. J. Medhi,"Statistical Methods: An Introductory Text", Second , New AgeInternational Ltd.
2. S. C. Gupta, V. K. Kapoor ,"Fundamentals of Mathematical Statistics (A Modern Approach)", Tenth, Sultan Chand & Sons Educational Publishers

ReferenceBooks:

1. G. V. Kumbhojkar, Probability and Random Processes, C. Jamnadas and Co., 14th Edition, 2010.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. G. Haribaskaran, Probability, Queuing Theory and Reliability Engineering, Laxmi Publications,2nd Edition, 2009.
4. Murray Spiegel, John Schiller, R. ALU Srinivasan, Probability and Statistics, Schaum's Outlines,4th Edition, 2013.

Course Code: PCCP-2
(Semester IV)
Course: Lab. Statistics for Data Science

Total Credits : 01 **Total Contact Hours :** 2 Hrs/week ; 30 Hrs / Semester
Maximum Marks : 50

Learning Objectives of the Course:

1. To use core Python functionalities to work with various data types, perform essential operations .
2. To write basic scripts to automate data processing tasks.
3. To acquire data for cleaning and analyzing.

To present insights through visualizations.

Course Outcomes (COs) :

After completion of the course, students will be able to –

1. Demonstrate proficiency in using Python sequence data types (strings, lists, tuples, dictionaries, sets, arrays, ranges) and their associated operations for data handling tasks.
2. Acquire, clean, and manipulate real-world datasets using Python libraries such as Pandas and NumPy to prepare them for analysis.
3. Visualize and interpret data using Matplotlib and Seaborn by generating a variety of plots including scatter, bar, line, histogram, box, and pair plots for exploratory data analysis (EDA).
4. Simulate and analyze the behavior of discrete and continuous random variables, apply statistical tests such as one-way ANOVA and Chi-square to examine group differences and associations.
- Develop data analysis workflows involving web scraping with BeautifulSoup and apply simple linear regression on real-world datasets for predictive analysis..

List Of Experiments	1.Use sequence data types and their associated operations in Python a. Strings b. Lists c. Arrays d. Tuples e. Dictionary f. Sets g. Range 2. Data Ingestion and Cleaning: Acquire data and prepare it for analysis. 3. Data Wrangling with pandas: Manipulate and transform data to suit the analysis needs. 4. Numerical Computation with NumPy: Perform different computations using NumPy library.	**30Hrs**

	5. Data Visualization with Matplotlib: Data visualization on a dataset using matplotlib libraries. a. Scatter plot b. Line plot c. Bar plot d. Histogram e. Box plot f. Pair plot 6. Simulate and visualize discrete and continuous random variables and study their probability mass and density functions. 7. Apply one-way ANOVA and Chi-square test for analyzing statistical differences among groups and associations in categorical data. 8. Exploratory Data Analysis (EDA) with Seaborn: Create advanced visualizations specifically for data exploration using Seaborn. 9. Perform simple linear regression on real-world data 10. Implement Web Scraping in Python with BeautifulSoup.	

Course Code: PCCT-3
(Semester IV)
/Course Title: Computer Network

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours**:2 Hrs/week ; 30Hrs / Semester

Prerequisites: Computer Network

Learning Objectives of the Course:

1. To introduce fundamental concepts and models in computer networking.
2. To understand layered architecture and protocols at each layer.
3. To design and analyze network addressing and routing strategies.
4. To explore modern network tools and simulations for real-time understanding

Course Outcomes (COs) :

CO1 Explain the basic concepts, architectures, and types of computer networks
CO2 Compare and contrast OSI and TCP/IP models and analyze layer-wise operations
CO3 Apply IP addressing, subnetting, and routing algorithms in network design
CO4 Evaluate transport and application layer protocols for data communication
CO5 Use simulation tools (e.g., Packet Tracer) to configure and troubleshoot networks

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Networks**: Definition, types (LAN, WAN, MAN), topology, protocols, standards, network devices.**(6Hrs)** **Layered Architecture**: OSI and TCP/IP models – functions of each layer.**(4Hrs)**	**10Hrs**
II	**Data Link Layer**: Framing, error control, CRC, flow control, MAC – ALOHA, CSMA/CD, Ethernet.**(5Hrs)** **Network Layer**: IPv4/IPv6 addressing, subnetting, CIDR, routing algorithms (RIP, OSPF, Link State, Distance Vector).**(5Hrs)**	**10Hrs**
III	**Transport Layer**: TCP, UDP, congestion and flow control, socket programming basics.**(5Hrs)** **Application Layer & Security**: DNS, HTTP, FTP, SMTP; Basics of encryption, firewalls, IDS.**(5Hrs)**	**10Hrs**

Textbooks / Reference Books

	Sr. No.	Title	Author	Publication	Edition
	1.	*Data Communications and Networking*, McGraw-Hill	Behrouz A. Forouzan	McGraw-Hill Education	**Fifth Edition** (2012)
	2.	*Computer Networks*, Pearson	Andrew S. Tanenbaum	Pearson Education	**Fifth Edition** (2010)

			3.	*Computer Networking: A Top-Down Approach,* Pearson	James Kurose & Keith Ross	Pearson Education	**Seventh Edition** (2017)	
			4.	*Computer Networks: A Systems Approach*	Larry L. Peterson & Bruce S. Davie	Morgan Kaufmann (an imprint of Elsevier)	**Fifth Edition** (2011)	

Course Code: PCCP-3
(Semester IV)
Course: Lab. Computer Network

Total Credits : 01
Maximum Marks : 50

Total Contact Hours : 2 Hrs/week ; 30 Hrs / Semester

	1. To study Network 1. Implement different concepts of Computer Network	
List Of Experiments	**Sr. No. Lab Experiments** 1 Study and classification of LAN, WAN, and MAN. 2 Network topology design and cable creation (straight/crossover). 3 IP addressing and subnetting. 4 Configuration of routers and switches using Packet Tracer. 5 Implementation of static routing and RIP. 6 Use of ping and traceroute commands for network testing. 7 TCP/UDP packet analysis using Wireshark. 8 Simulation of DHCP, DNS, HTTP in Packet Tracer. 9 File transfer simulation using FTP. 10 Mini project: Design and troubleshoot a small office network.	**30Hrs**

Course Code: MDMT-2
(Semester IV)
/Course Title: Computer Algorithms

(This course will be available for the students from other discipline and AI, AL-ML, AIDS Engineering students will choose minor course from other discipline)

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours:**2 Hrs/week ; 30Hrs / Semester

Prerequisites: Computer Network

Learning Objectives of the Course:

- 1Good understanding of Data Structures (Stacks, Queues, Trees, Graphs).
- Programming skills in C/C++/Python.

Course Outcomes (COs) :

CO1 Analyze the complexity (time and space) of algorithms
CO2 Apply divide-and-conquer strategy for solving problems
CO3 Apply greedy strategy to solve optimization problems
CO4 Develop solutions using dynamic programming approach
CO5 Understand and analyze basic graph algorithms.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Algorithms and Complexity Analysis** - Algorithm Definition, Characteristics - Performance Analysis: Space Complexity, Time Complexity - Asymptotic Notations: Big-O, Omega, Theta - Recurrences and Solving Recurrences (Substitution method, Recursion-tree method)	**10Hrs**
II	**Divide and Conquer and Greedy Method** - Divide and Conquer: Binary Search, Merge Sort, Quick Sort - Greedy Algorithms: Activity Selection Problem, Fractional Knapsack, Huffman Encoding - Properties of Greedy Algorithms (Greedy Choice Property, Optimal Substructure)	**10Hrs**
III	**Dynamic Programming and Graph Algorithms** - Dynamic Programming: Matrix Chain Multiplication, 0/1 Knapsack, Longest Common Subsequence (LCS) - Basic Graph Algorithms: Breadth-First Search (BFS), Depth-First Search (DFS) - Introduction to Minimum Spanning Trees (Kruskal's Algorithm Basics)	**10Hrs**

Textbooks / Reference Books

Sr. No.	Title	Author	Publisher	Edition
1	Introduction to Algorithms	Cormen, Leiserson, Rivest, Stein	MIT Press	Latest
2	Design and Analysis of Algorithms	S. Sridhar	Oxford University Press	Latest
3	Algorithm Design	Jon Kleinberg, ÉvaTardos	Pearson	Latest
4	Computer Algorithms	Horowitz, Sahni, Rajasekaran	Universities Press	Latest
5	Fundamentals of Computer Algorithms	Ellis Horowitz, SartajSahni	Galgotia Publications	Latest

Vocational and Skill Enhancement Course (VSEC)

Course Code:VSECT-2
(Semester IV)
/Course Title: Web Technologies

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours:**2 Hrs/week ; 30Hrs / Semester

Prerequisites: Basic Programming Knowledge (C, Python)
Basic Internet Concepts (WWW, Web Browsers)

Learning Objectives of the Course:

- Understand web architecture and protocols.
- Develop static and dynamic websites.
- Learn client-server communication basics and responsive design.

Course Outcomes (COs) :

CO1 Explain web architecture, protocols and basics of Internet
CO2 Develop static web pages using HTML and CSS.
CO3 Create dynamic behavior on web pages using JavaScript.
CO4 Understand basic concepts of server-side scripting and web hosting.
CO5 Apply responsive design principles with modern frameworks

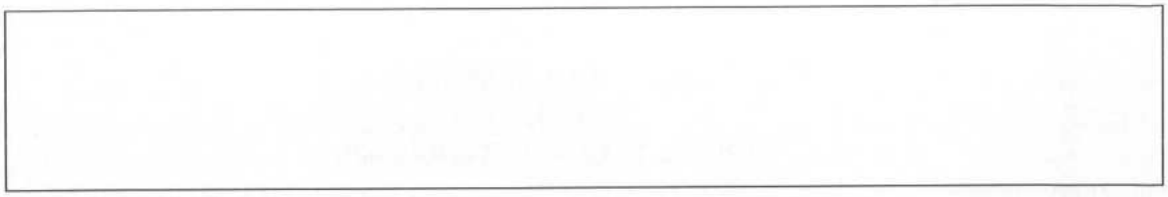
Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Web Technologies** - Internet Basics, WWW, Web Browsers, Servers, URL, HTTP/HTTPS Protocols - Web Architecture: Client-Server Model **HTML5**: Structure of HTML page, Elements, Attributes, Forms, Tables, Lists, Multimedia elements (audio/video), Semantic Tags (header, footer, article, section)	**10Hrs**
II	**SS3 and JavaScript Essentials** **CSS3**: Syntax, Selectors, Box Model, Positioning (relative, absolute, fixed), Layouts using Flexbox and Grid, Responsive Design (Media Queries) **JavaScript**: Introduction, Variables, Data types, Operators, Control Structures (if, loops), Functions, Events, Basic DOM Manipulation (GetElementById, InnerHTML)	**10Hrs**
III	**Advanced Web Concepts and Hosting** - Introduction to Client-side and Server-side Scripting - Overview of Server-side scripting languages (PHP/Node.js) - Web Hosting Basics: Domain Names, Hosting, FTP - Introduction to Front-End Frameworks: Bootstrap Basics (grid system, forms, buttons, navbar)Mini project discussion: Static/Dynamic Web Page Design	**10Hrs**

Reference Books:

1 HTML and CSS: Design and Build Websites Jon Duckett Wiley Latest

2 Web Technologies AchyutGodbole, AtulKahate McGraw Hill Latest

3 Learning Web Design Jennifer Robbins O'Reilly Latest



Course Code: AEC-2
(Semester IV)
Course: Modern Indian Languages

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours:**2 Hrs/week ; 30Hrs / Semester

Basket of Modern Indian Languages is available on University Website

Direct link for syllabus:

http://www.bamu.ac.in/Portals/0/nep-common-AEC-course-sem-I-24-25.pdf

Or
Visit
http://www.bamu.ac.in/NEP-Curriculum.aspx#2024

Entrepreneurship/Economics/Management Courses (EEM)

Students will have to choose any one theory course form the following Basket. Any One course in 3rd semester and another course in 4th semester

1) Engineering Economics (EEM-I)
2) Entrepreneurship Development (EEM-II)
3) Industrial Management (EEM-III)

Course Code: EEM-I
(Semester III/ IV)
Course: Engineering Economics

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours:**2 Hrs/week ; 30Hrs / Semester

Learning Objectives of the Course:

1. Understand the Time Value of Money
2. Evaluate Engineering Alternatives
3. Analyze Public Sector Projects
4. Understand and Apply Depreciation and Taxation
5. Perform Break-even and Sensitivity Analysis
6. Understand Cost Concepts for Decision-Making

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. To evaluate Time Value of Money
2. To enable students to perform economic comparisons between different projects or assets
3. To introduce benefit-cost analysis for evaluating the economic feasibility of projects
4. To apply break-even analysis using both linear and non-linear models
5. To develop skills in cost estimation, cost control, cost reduction, and identify relevant costs for decision-making.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Time value of money:** Simple and compound interest, Time value equivalence, Compound interest factors, Cash flow diagrams, Calculation, Calculation of time –value equivalences. Present worth comparisons, Comparisons of assets with equal, unequal and infite lives, comparison of deferred investments, Future worth comparison, payback period comparison.	10 Hrs
II	Use and situations for equivalent annual worth comparison, Comparison of assets of equal and unequal life. Rate of return, Internal rate of return, comparison of IIR with other methods, IRR misconceptions. Analysis of public Projects: Benefit/ Cost analysis, quantification of project, cost and benefits, benefit/ cost applications, Cost effectiveness analysis.	10 Hrs
III	**Depreciation**, Computing deprcciation charges, after tax economic comparison, Break-even analysis; linear and non-linear models. Sensitivity analysis: single and multiple parameter sensitivity. **Fixed and variable cost,**	10 Hrs

	Product and Process Costing, Standard Costing, Cost estimation, Relevant Cost for decision making, Cost estimation, Cost control and Cost reduction Techniques.	

Reference Books:

8. Riggs, J.L., Dedworth, Bedworth, D.B., Randhawa, S.U., "Engineering Economics", Vol. 1, Latest Edition, McGraw Hill International, 1996.
9. James L. Riggs, David D. Bedworth, Sabah U. Randhawa, "Economics for Engineers", Vol. 1, 4th Edition, McGraw-Hill, 2004.
10. Donald Newnan, Ted Eschembach, Jerome Lavelle, "Engineering Economic Analysis", Vol. 1, 8th Edition, Oxford University Press, 2012.
11. John A. White, Kenneth E. Case, David B. Pratt, "Principles of Engineering Economic Analysis", Vol. 1, 6th Edition, John Wiley, 2010.
12. R. Paneerseelvam, "Engineering Economics", Vol. 1, 2nd Edition, PHI, 2008.
13. Michael R. Lindeburg, "Engineering Economics Analysis", Vol. 1, Latest Edition, Professional Publications, 1993.
14. V. Mote, S. Paul, G. Gupta, "Managerial Economics", Vol. 1, Latest Edition, Tata McGraw Hill, 2004.

Course Code: EEM-II
(Semester III/ IV)
Course: Entrepreneurship Development

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours:** 2 Hrs/week ; 30Hrs / Semester

Learning Objectives of the Course:

1. Understand the fundamentals of entrepreneurship and its significance in engineering.
2. Identify business opportunities and develop innovative ideas.
3. Create a basic business plan and understand key entrepreneurial strategies.

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. Explain the concept of entrepreneurship and its importance in the modern economy.
2. Identify and evaluate business opportunities in engineering and technology sectors.
3. Develop a comprehensive business plan including financial, operational, and marketing strategies.
4. Assess the challenges and risks in entrepreneurship and develop strategies to mitigate them.
5. Demonstrate entrepreneurial thinking through case studies, projects, and presentations.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Entrepreneurship** Definition, meaning, and characteristics of an entrepreneur, Evolution of entrepreneurship Types of entrepreneurs, Role of entrepreneurship in economic development, Key traits of successful entrepreneurs.	**10 Hrs**
II	**Opportunity Recognition and Idea Generation** Identifying business opportunities, Creativity and innovation in entrepreneurship, Techniques for idea generation, Feasibility analysis (technical, market, financial).	**10 Hrs**
III	**Business Planning** Components of a business plan, Business models and strategy formulation, Legal requirements for starting a business, Intellectual Property Rights (IPR) and patents.	**10 Hrs**

Reference Books:

5. C.B. Gupta, Srinivasan, "Entrepreneurship Development", Vol. 1, Latest Edition, Sultan Chand & Sons, 2020.
6. Donald F. Kuratko, "Entrepreneurship: Theory, Process, Practice", Vol. 1, Latest Edition, Cengage, Eric Ries, "The Lean Startup", Vol. 1, Latest Edition, Anonymous, 2011.
7. Alexander Osterwalder, Yves Pigneu, "Business Model Generation", Vol. 1, Latest Edition, Wiley, 2011.
8. Peter F. Drucker, "Innovation and Entrepreneurship", Vol. 1, Latest Edition, Taylor & Francis, 2014.

Course Code: EEM-III
(Semester III/ IV)
Course: Industrial Management

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours**:2 Hrs/week ; 30Hrs / Semester

Learning Objectives of the Course:

1. To understand concept of management, administration, Organization, Industrials Laws.

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. Understand the fundamental principles of management.
2. Describe different forms of business organizations and organizational structures.
3. Apply theoretical knowledge to real-world management and organizational challenges.
4. Analyze the impact of organizational, environmental factors.
5. Explain the role of economics in management decision-making.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Management:** Managing and Manager, organizations and need for management, the managing process, types of managers, the challenge of management, the evolution of Management theory. **Management in the 21st century:** The importance of organizational and natural environment, elements of direct action environment, managing multiple stock holder relationship, elements of the indirect action environment, Natural Environment management 2000 and beyond, social responsibility and ethics, globalization. Evaluation of case studies related to above concept.	10 Hrs
II	**Business Organization** Forms of business organization, individual proprietorship, joint stock company, co-operative enterprise, co-operative enterprise and public sector undertakings. Organization structure in industries, Line organization, functional organization, line and staff organization, committee organization, project organization matrix organization. **Nature and Significance of Economics.** Science, engineering and technology, their relationship with economic development. Basic economic concepts, human wants economic goods, utility value, price cost, wealth and capital. Demand supply, elasticity of demand and supply. Concept of profit and revenues.	10 Hrs
III	**Accidents and safety** Classification of accidents, according to nature of industries; i.e. fatal, temporary, according to event and place. Causes of accidents , psychological, and other industrial hazards. Effects of accidents. Accident-prone workers, accident to be taken incase of accidents with machines, electric shock, road accident fires and erection and construction accidents **Personnel Management:** Man power, sources of recruitment, selection and training, job evaluation,	10 Hrs

	performance appraisal, wages and incentives, self and time management.	

Reference Books:

6. James A. F., "Management", Vol. 1, 6th Edition, PHI.
7. Claude S. George, Jr., "Management for Business and Industry", Vol. 1, Revised Edition, Prentice-Hall of India Private Limited.
8. McConnell, Gupta, "Economics: Principles, Problems, and Policies", Vol. 1, 18th Edition, The McGraw-Hill.
9. T.R. Banga, S.C. Sharma, "Industrial Organisation and Engineering Economics", Vol. 1, Latest Edition, Khanna Publishers, Jan-2006.
10. O.P. Khanna, "Industrial Engineering & Management", Vol. 1, Latest Edition, Dhanpat Rai Publication, Jan-2018.

Value Education Courses (VEC)

Students will have to choose any one theory course form the following Basket. Any One course in 3rd semester and another course in 4th semester

1) Universal Human Values (VECT-I)

2) Environmental Students (VECT-II)

Course Code: VECT-2
(Semester III/ IV)
Course: Universal Human Values

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours**:2 Hrs/week ; 30Hrs / Semester

Learning Objectives of the Course:

1. To appreciate the essential complementarities between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings,
2. To facilitate the development to a holistic perspective among students to lead their Personal and professional lives in an ethical way.
3. To highlight plausible implications of such a holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour, and mutually enriching interaction with nature.

Course Outcomes (COs) :

After completion of the course, students will be able to -

1. Define key terms related to human values.
2. Explain the concept of happiness as related to right understanding and relationship.
3. Apply the principles of right understanding in their daily interactions.
4. Analyze the impact of their values on their behaviour and decisions.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**IntroductiontoValue Education and HarmonyintheHumanBeing** • Understanding Value Education • Self-exploration as the Process for Value Education • Continuous Happiness and Prosperity - the Basic Human Aspirations and their fulfillment • Right Understanding, Relationship and Physical Facility • Happiness and Prosperity - Current Scenario • Method to Fulfill the Basic Human Aspirations • Harmony in the Human Being • Understanding Human being as the Co-existence of the Self and the Body • Distinguishing between the Needs of the Self and the Body • the Body as an instrument of the Self • Understanding Harmony in the Self • Harmony of the Self with the Body • Programme to ensure self-regulation and Health.	10 Hrs

II	**HarmonyintheFamily and Society** • Harmony in the Family - the Basic Unit of Human Interaction "Trust' - the Foundational Value in Relationship • 'Respect' - as the Right Evaluation Values in Human-to-Human Relationship • Harmony in the Society • Other Feelings, Justice in Human-to-Human Relationship • Understanding Harmony in the Society • Vision for the Universal Human Order	**10 Hrs**
III	**Harmony in the Nature (Existence) and Implications of the Holistic Understanding** • Understanding Harmony in the Nature • Interconnectedness, self-regulation, and Mutual Fulfillment among the Four Order of Nature • Realizing Existence as Co-existence at All Levels • The Holistic Perception of Harmony. Implications of the Holistic Understanding - a Look at Professional Ethics • Basis for Universal Human Values • Definitiveness of (Ethical) Human Conduct • Professional Ethics in the light of Right Understanding • A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order • Holistic Technologies, Production Systems and Management Models, Typical Case Studies Strategies for Transition towards Value-based Life and Profession.	**10 Hrs**

Reference Books:

8. P.L. Dhar, R.R. Gaur, "Science and Humanism", Vol. 1, 1st Edition, Commonwealth Publishers.
9. Nagaraj, "Jeevan Vidya: EkPariehaya", Vol. 1, Latest Edition, Jeevan VidyaPrakashan, Amarkantak, 1999.
10. A.N. Tripathy, "Human Values", Vol. 1, Latest Edition, New Age International Publishers, 2003.
11. E.G. Seebauer, Robert L. Berry, "Fundamentals of Ethics for Scientists & Engineers", Vol. 1, 1st Edition, Oxford University Press.
12. M. Govindrajan, S. Natrajan, V.S. Senthil Kumar, "Engineering Ethics and Human Values", Vol. 1, 1st Edition, Prentice Hall of India Ltd.
13. B.P. Banerjee, "Foundations of Ethics and Management", Vol. 1, Latest Edition, Excel Books, 2005.
14. B.L. Bajpai, "Indian Ethos and Modern Management", Vol. 1, Reprinted Edition, New Royal Book Co., Lucknow, 2008.

E-resources:

6. http://madhyasth-darshan.info/postulations/knowledge/knowledge-of-humane-conduct/
7. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
8. https://youtu.be/OgdNx0X9231
9. https://fdp-si.aicte-india.org/UHV-II%20Practice%20Sessions.php
10. https:/fdp-si.aicte-india.org/download.php#1/

Course Code: VECT-2
(Semester III/ IV)
Course: Environmental Studies

Total Credits: 2
Maximum Marks: 50 **Total Contact Hours:**2 Hrs/week ; 30Hrs / Semester

Prerequisites:
Understanding of the Concept of Environment

Learning Objectives of the Course:

1. To study the environment and ecosystems.
2. To study different types of natural resources.
3. Knowledge and concept of biodiversity and its conservation.
4. Basic knowledge and concept of causes, effects, and control of different types of Environmental pollution.
5. To study population growth and its impact on the environment

Course Outcomes (COs) :

After completion of the course, students will be able to -

- Define key environmental terms and concepts (e.g., ecosystem, biodiversity, pollution).
- Explain the causes and effects of major environmental problems.
- Apply environmental principles to analyze real-world scenarios.
- Differentiate between various types of pollution and their impacts.

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to environmental studies and natural resources:** Definition, scope and Importance and need for public awareness. Natural resources: Forest resources: Use and over-exploitation, deforestation. Timber extraction. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using Mineral resourcesFood, energy, and land resources: Food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources, and use of alternate energy sources. Land resources: Land as a resource, land degradation, man-induced landslides, soil erosion, and desertification.	**10 Hrs**
II	**Ecosystems and Biodiversity and its conservation** **Ecosystems:** Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers, and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs, and ecological pyramids. Introduction, types, characteristic features, structure, and function of the following ecosystems: Forest ecosystem, Grassland ecosystem, Desert ecosystem, and Aquatic ecosystems (ponds, streams, lakes, rivers, Oceans, estuaries) **Biodiversity and its conservation:** Introduction Definition: genetic, species, and Ecosystem diversity. Bio geographical classification of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India Conservation of biodiversity: In-situ	**10 Hrs**

	and Ex-situ conservation of biodiversity	
III	**Environmental Pollution and Social issues and the Environment** Environmental Pollution: Definition, Cause, effects, and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, nuclear hazards, Role of an individual in the prevention of pollution. Social issues and the Environment: From Unsustainable to sustainable development Urban problems related to energy. Climate change, global warming, acid rain, ozone layer depletion Environment Protection Act. Public awareness.	**10 Hrs**

Reference Books:

1. Agarwal K.C., "Environmental Biology", Vol. 1, Latest Edition, Nidi Puhl Ltd., Bikaner, 2001.
2. BharuchaErach, "The Biodiversity of India", Vol. 1, First Edition, Mapin Publishing Pvt. Ltd., Ahmedabad.
3. Heywood V.H., Waston, "Global Biodiversity Assessment", Vol. 1, Latest Edition, Cambridge University Press, 1995.
4. Jadhav H., Bhosale V.M., "Environmental Protection and Laws", Vol. 1, First Edition, Himalaya Publishing House, Delhi.
5. Odum E.P., "Fundamentals of Ecology", Vol. 1, First Edition, W.B. Saunders Co., USA.
6. Miller T.G. Jr., "Environmental Science", Vol. 1, First Edition, Wadsworth Publishing Co.

Honor Degree Course

Please note that this course is optional and specifically designed for students pursuing a Bachelor's Degree Honors with Multidisciplinary Minor. Only those students who have secured a minimum of 7.5 CGPA (equivalent to 75% marks) in their first year will be eligible to opt for this option

Course Code: HT-2
(Semester IV)
Course Title : Applied Accelerated AI

Total Credits: 3
Maximum Marks: 100 **Total Contact Hours**:3 Hrs/week ; 45Hrs / Semester

Prerequisites:

- Basics of Machine Learning
- Python Programming
- Fundamentals of Linear Algebra & Neural Networks

Learning Objectives of the Course:

1. To introduce hardware-accelerated platforms for AI applications.
2. To understand and implement AI/ML models using frameworks that leverage GPU/TPU acceleration.
3. To explore optimization techniques for AI inference on edge and cloud hardware.

Course Outcomes (COs) :

After completion of the course, students will be able to -

- Understand the different phases of the compiler and their roles.
- Analyze lexical, syntax, and semantic analysis processes .
- Apply parsing techniques for syntax analysis .
- Understand intermediate code generation, optimization, and target code generation.
- Demonstrate knowledge of runtime environment management and error handling

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	**Introduction to Accelerated AI** • Need for acceleration in AI: Training vs Inference bottlenecks • Overview of hardware: CPUs vs GPUs vs TPUs vs NPUs • Introduction to CUDA, cuDNN, TensorRT, OpenCL • AI frameworks supporting acceleration: TensorFlow, PyTorch, ONNX	15Hrs
II	**Model Optimization and Deployment** • Model compression: Pruning, quantization, and distillation • Conversion to ONNX and optimization pipelines • GPU inference using TensorRT • Acceleration on edge devices: Jetson Nano, Coral, RKNN • Real-time AI applications: Vision, speech, and recommendation	15Hrs
III	**Case Studies & Industry Applications** • Accelerated AI in autonomous vehicles, healthcare, robotics • Distributed and parallel training with Horovod or PyTorch DDP • Real-time video analytics with accelerated deep learning • Edge-cloud collaborative AI systems • Challenges: Power efficiency, deployment, latency trade-offs	15Hrs

Textbooks :Adrian Kaehler & Gary Bradski
Learning Open CV 4: Computer Vision with Python
□ **Adrian Rosebrock**
Deep Learning for Computer Vision with Python
–□ **NVIDIA**
TensorRT Developer Guide & Jetson AI Fundamentals

□ **Ian Pointer**
Programming PyTorch for Deep Learning

□ **Aurélien Géron**
Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (2nd or 3rd Edition)

Recommended Learning Resources:

- NVIDIA Developer Zone (developer.nvidia.com)
- Deep Learning for Computer Vision with Python – Adrian Rosebrock
- TensorRT, Jetson Tutorials – NVIDIA official docs
- PyTorch and TensorFlow official guides

Double Minor Course

Please note that this course is optional and specifically designed for students pursuing a Bachelor's Degree with Double Minor. Only those students who have secured a minimum of 7.5 CGPA (equivalent to 75% marks) in their first year will be eligible to opt for this option.

Course Code: DMT-2
(Semester - IV)
Course: Python Programming

Total Credits: 3
Maximum Marks: 100 **Total Contact Hours:** 3 Hrs/week ; 45Hrs / Semester

Prerequisites:

- Knowledge of 'C' Programming language

Learning Objectives of the Course:

- To effectively use basics of Python Programming.
- To understand how to use and implement object oriented features in python.
- To understand how to deal with strings, files and database using python.

Course Outcomes (COs) :

After completion of the course, students will be able to -

- Understand the basic syntax, data types, and control structures in Python
- Write Python programs using functions, modules, and built-in libraries.
- Implement data structures like lists, tuples, dictionaries, and sets for efficient coding.
- Analyze and solve real-life problems using file handling, exception handling, and OOP.
- Develop simple applications and automate tasks using Python scripting and libraries..

Unit No.	Topics / actual contents of the syllabus	Contact Hours
I	Introduction: Introduction to Python, identifiers, variables, indentation in Python, input- output functions, operators, data types, numbers, stings, list, tuple set, dictionary, data conversion, Case Study: Counting words, Dictionaries, Case study: Occurrence of words Conditional and control statements: Using if, else and elif, Simple forloops in python, For loop using ranges, string, list and dictionaries, Useof while loops in python, Loop manipulation using pass, continue, breakand else, Programming using Python conditional and loops block.	15Hrs
II	Functions: function definition, function calling, function arguments, keyword, default, var length, anonymous function, recursive functions, Built in modules, creating modules, import statement, packages in python, importing modules from packages Object oriented concepts:Classand objects, Constructorand destructors,Inheritance, Overlapping and overloading operators, Organizing pythoncodes using functions, Organizing python projects into modules,Importing own module as well as external modules, UnderstandingPackages, Powerful Lamda function in python	15Hrs
III	Understanding string: In build methods, List manipulation using inbuild methods, Dictionary manipulation Avoiding code break usingexception handling, Safe guarding file operation using exceptionhandling, Handling and helping developer with error code,Programming using Exception handling File and Database Handling:Understanding read functions, read(),readline() and	15Hrs

	readlines(), Understanding write functions, write() andwritelines(), Manipulating file pointer using seek Programming usingfile operations, SQL Database connection using python, Creating andsearching tables, Reading and storing information in Database	

Text Books

The Complete Reference Python, Mc Graw Hill

2. Y. Daniel Liang, Introduction to Programming using Python, Pearson

Reference Books

1 Python Crash Course ,Eric Matthes (No Starch Press, 2016)

2 Learn Python 3 the Hard Way, Zed A. Shaw (Addison-Wesley, 2016)

3 Think Python First Edition, by Allen B. Downey, Green Tea Press

E Books/ Online learning material

1 https://nptel.ac.in/courses/106/106/106106182/

2 https://swayam.gov.in/nd1_noc19_cs41/preview

3 https://docs.python.org/3/tutorial/

4 http://www.codecademy.com/tracks/python

5 http://corepython.com/

6 http://www.python-course.eu/python3_course.php