Jabalpur Engineering College, Jabalpur

(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) III Semester (Artificial Intelligence & Data Science)

w.e.f. July 2023

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	MA33	BSC	Mathematics-III	70	20	10	-	-	100	3	1	-	4
2	CH32	HSMC	Energy & Environmental Engineering	70	20	10	-	-	100	3	1	-	4
3	AI33	PCC	Data Structure and Algorithm	70	20	10	30	20	150	3	-	2	4
4	AI34	PCC	Object Oriented Programming Using JAVA	70	20	10	30	20	150	3	-	2	4
5	AI35	PCC	Digital Logic Design & Computer Organization	70	20	10	30	20	150	3	-	2	4
6	AI36	ESC	Software Lab-I (Python)	-	-	-	30	20	50	-	-	4	2
			Total	**350**	**100**	**50**	**120**	**80**	**700**	**15**	2	**10**	**22**
7	AI37	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	8
8	AI38	MC	NSS/NCC/Swatchhata Abhiyan/Rural Outreach	Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum two additional MOOC courses in subject code AI37 for the award of Honours (Minor Specialization).									

Note: MOOC/NPTEL subjects shall be taken with permission of HOD/Coordinator

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

BSC: Basic Science Course, HSMC: Humanities & Social Sciences including Management Course, PCC: Professional Core Course, ESC: Engineering Science Course, MC: Mandatory Course, DLC: Distance Learning Course

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(AICTE Model Curriculum Based Scheme and Syllabus)

Bachelor of Technology (B.Tech.) III Semester, Branch (CS/IT/AI&DS)

COURSE CONTENT **w.e.f. July 2023**

Subject Code	Subject Name	Maximum marks Allotted			Total marks	Hours/Week			Total Credit
MA33	MATHEMATICS-III	Theory			100	L	T	P	4
		End Sem	Mid-Sem Exam	Quiz/ Assignment		3	1	0	
		70	20	10					

Module 1: Numerical Methods-I (08 hours)

Solution of polynomial and transcendental equations – Bisection method, Newton –Raphson method and Regula – Falsi method. Finite differences, Relation between operators, interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

Module 2: Numerical Methods-II (10 hours)

Numerical differentiation, Numerical integration: Trapezoidal rule and Simpson's $1/3^{rd}$ and 3/8 rules. Solution of simultaneous Linear Algebraic equations by Gauss's Elimination, Gauss's Jordan, Crout's methods, Jacobi's Method, Gauss-Seidal, and Relaxation method. Solution of Ordinary differential equations: Taylor's series, Euler and modified Euler's method, Runge-Kutta method of fourth order Milne's and Adam's predicator – corrector methods.

Module 3: Basic Probability (08 hours)

Probability spaces, Counting techniques, Probability measure, Conditional probability and Baye's theorem, Random variable and distribution function, Moment, Expected value and Variance of Random variables, Chebychev Inequality, Moment generating function. Bivariate discrete and continuous random variables, Independence of random variables.

Module 4: Probability Distribution (08 hours)

Measures of Central tendency: Moments, Skewness and Kurtosis. Discrete Distributions (Binomial, Poisson's distribution), Continuous Distributions (Normal, Exponential Distribution.

Module 5: Applied Statistics (06 hours)

Curve fitting by the method of least squares- Fitting of straight lines, Second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, Difference of proportions, Single mean, Difference of means and difference of standard deviations.

Books References:

1. B. S. Grewal, Numerical Method in Engineering and Sciences, Khanna Publishers
2. B. V. Ramanna, Higher Engineering Mathematics, TMH Publishers.
3. Prasanna Sahoo, Probability and Mathematical Statistics, Louisville KY40292 USA.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3^{rd} Edition, Wiley 1968. Statistics.
5. Introductory Statistics, Vol.1 of 2, ISBN: 978-1-304-89164-8, Open Stax College Rice University Houston, texax77005.
6. B.S.Grewal,Higher Engineering Mathematics,Khanna Publishers,35^{th}Edition, 2010.

Course Outcomes:

At the end of the course the students will able to :

1. Understand mathematical tools for numerical solution of algebraic & transcendental equations.
2. Estimate the numerical values of function by interpolation techniques.
3. Determine derivative and integrals by various numerical methods.
4. Understand the concept of basic probability.
5. Apply probability distribution and statistics in various techniques dealing with engineering problems.

Dr. O.P. Chauhan
H.O.D.
Deptt. of App. Mathematics

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Bachelor of Technology (B.Tech.) III Semester
Branch- Common to (CE/EE/EC/CSE/IT/IP/AI&DS /MT)
COURSE CONTENTS

w.e.f. July 2023

Subject Code	Subject Name	Maximum Marks Allotted			Total Marks	Hours/Week			Total Credits
CH32	Energy & Environmental Engineering	Theory							
		End Sem	Mid-sem Exam	Quiz/ Assignment		L	T	P	4
		70	20	10	100	3	1	-	

Module 1:

A. **Introduction to Energy Science:**
World & Indian Energy Scenario, Overview to Energy Systems, Energy sustainability and Environment. Fossil Fuels. Alternatives for fossil fuels: biomass, wind, solar, nuclear, wave, tidal, hydrogen & geothermal energy.

B. **Batteries:**
Classification of Batteries, Important Applications, Lead-Acid battery, Ni-Cd battery & Li battery. Fuel Cell: Hydrogen-Oxygen Fuel cell.

Module2: Environmental Pollution A:

I. **Air Pollution**
Causes, Effects & Control Measures of Air Pollution: Primary and Secondary air pollutants and photo-chemical smog. Climate changes, Global warming, Ozone layer depletion. Pollution case studies: Bhopal gas Disaster and London smog Disaster.

II. **Water Pollution**
Definition, Causes, Effects and Control Measures (Primary & Secondary waste water treatment), Acid Rain and Marine pollution. Pollution case studies: Minamata Tragedy, Ganga Action Plan, Major oil spills of the 20^{th} & 21^{st} century. Water conservation, Rain water harvesting and Water Shed Management.

III. **Noise Pollution**
Causes, Effects & Control Measures.

Module3: Environmental Pollution B:

I. Sources, Adverse effects and Control measures of Soil Pollution, Thermal Pollution, Nuclear Pollution & Nuclear hazards. Major case studies.

II. Solid waste management: Municipal Solid Waste (MSW), Collection and disposal methods. Disaster Management.

III. Introduction to carbon footprint, ways to reduce carbon footprint, Carbon trading.

Module 4: Ecosystem & Biodiversity:

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 ecosystem (a.)Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Introduction ,Definition: genetic, species and ecosystem diversity; Bio-geographical classification of India; Value of biodiversity: Biodiversity at global & National levels; India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and Endemic species of India; Conservation of Biodiversity: In-situ and Ex-situ conservation of biodiversity. Environment Protection Act.

Module 5: Corrosion & its prevention:

Theories of Corrosion and Mechanism – Dry (Direct Chemical attack), Wet (Electro Chemical Theory) Atmospheric corrosion, Galvanic Series, Galvanic and Concentration Cell Corrosion, Corrosion by sea water. Factors Influencing and Control of Corrosion – Proper Design, Use of pure metal and metal alloys, passivity, cathodic protection – Sacrificial anode and Impressed Current. Modifying the environment, Use of inhibitors.

Protective coatings:

Hot dipping, Electroplating, Metal spraying metal cladding & cementation.

TEXT BOOKS

1. A text book of Engineering Chemistry by Jain & Jain, Dhanpat Rai Publishing Company, New Delhi
2. Chemistry of Engineering Materials by C.P. Murthy, C.V. Agarwal and A. Naidu BS Publication Hyd.
3. A text book of Environmental Chemistry and Pollution control by S.S. Dara & Dr. D. D. Mishra, S. Chand & Co, New Delhi
4. Energy,Environment Ecology and Society by Dr.Pushpendra,Vayu Education of India New Delhi
5. Energy, Environment Ethics and Society, by Dr.S.Deswal & Dr.A.Deswal Dhanpat Rai Publishing Company, New Delhi

REFERENCE BOOKS

1. J.C. Kuriakose and J. Rajaram, "Chemistry in Engineering and Technology", Vol.1 & 2, Tata Mcgraw Hill Publishing Company (P) Ltd., New Delhi
2. Mars G. Fontana, "Corrosion Engineering", Tata Mcgraw Hill Publishing Company (P) Ltd., New Delhi.
3. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
4. J.P.Gupta, A Text book of Energy, Environment Ethics & Society" Dhanpat Rai Publishing Company.

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COURSE OUTCOME: At the end of the course the student will be able to

CO1	Apply the concept of sustainability of renewable energy to overcome the shortcoming of energy from non-renewable sources. Understanding of Energy devices.
CO2	Develop an understanding related to Water, Air and Noise pollution.
CO3	Understand the importance of Soil, Thermal and Nuclear pollution. Illustrate municipal practices in solid waste management. Define carbon footprints.
CO4	Understand the interrelationship of different species in variety of ecosystems. Conservation of Biodiversity & awareness of Environmental protection Act.
CO5	Recognize the origin as well as types of corrosion and apply appropriate protection mechanism to control corrosion.

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COURSE CONTENTS **w. e. f. July 2023**

Subject Code	Subject Name & Title	Maximum Marks Allocated						Hours/ Weeks			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI33	Data Structures and Algorithms	70	20	10	30	20	150	3	-	2	4

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

Module-II: Stacks and Queues:
ADT Stack and its operations: Algorithm and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation-corresponding algorithms, ADT Queue, Types of queue: Simple Queue, Circular Queue, Priority Queue. Operations on each Type of Queues: Algorithms and their analysis.

Module-III: **Linked Lists:**
Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Doubly Linked list: operations on it. Circular Linked list: operations on it.

Module-IV: Trees:
Basic tree Terminologies, Different types of Trees : Binary Tree , Threaded Binary Tree , Binary Search Tree , AVL Tree , Tree operations on each of the trees and their algorithm with complexity analysis. Applications of Binary Trees , B+ Tree : definitions and operations .

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

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Reference Books:

Fundamentals of data structures in C"2nd edition,by S Sahni,Universities Press.
How to Solve it by Computer",2nd Impression by R.G. Dromey ,Pearson Education.
"Data Structures using C and C++"2nd edition, Tenenbaum, P HI publication.
"Introduction to algorithms "3rd edition by Cormen , MIT press.

Listof Experiment AI33Lab

1. Write a program to implement Linear Search and Binary search algorithms. Print the number comparisons done by the algorithms for the input list.
2. Write a program to implement Stack. Implement its push, pop, peek and display operations.
3. Write a program to implement Queue. Implement its insert, delete and display operations.
4. Write a program to implement Singly Linked List and its operations like insertion and deletion of elements from head and tail.
5. Write a program to implement Circular Linked List and its operations like insertion and deletion of elements from head and tail.
6. Write a program to implement Doubly Linked List and its operations like insertion and deletion of elements from head and tail.
7. Write a program to implement Binary Search Tree and Print the number of comparison required to search an element in it.
8. Write a program to implement Insertion Sort Algorithm.
9. Write a program to implement Quick Sort Algorithm
10. Write a program to implement Knapsack problem using Greedy approach.
11. Write a program to implement All-Pair-Shortest-Path problem.
12. Write a program to implement n-queen problem using Backtracking approach.

Course Outcomes:

After completion of course the students will be able to:

CO1:	Describe various data structures such as arrays, linked lists, stacks, queues, trees and Graphs and the operations performed on them.
CO2:	Apply the concepts of various data structures such as linked lists, stacks, queues, trees and graphs to write algorithms and programs to implement them.
CO3:	Analyse various searching and shorting algorithms such as Linear search, Binary search, Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort to estimate their time and space complexity.
CO4:	Develop solution of the given problem using appropriate data structures.

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Subject Code	Subject Name & Title	Maximum Marks Allocated						Hours/ Weeks			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI34	Object Oriented Programming Using Java	70	20	10	30	20	150	3	-	2	4

Module-I: Introduction
Introduction to Object Oriented Thinking & Object Oriented Programming: Comparison with Procedural Programming, features of Object oriented paradigm–Merits and demerits of methodology; Object model; Elements of OOPS, processing.

Module-II: Encapsulation and Data Abstraction-
Concept of Objects: State, Behavior &Identity of an object; Classes: identifying classes and candidates for Classes Attributes and operations, Access modifiers, Static member sofa Class, Instances, Message passing, and Construction and destruction of Objects.

Module-III: Relationships –
Inheritance: purpose and its types, 'is a' relationship; Association, Aggregation. Concept of Abstract classes, interface.

Module-IV: Polymorphism:
Introduction, Method Overriding & Overloading, static and run time Polymorphism.

Module-V: Multithreading in Java:
Difference between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter thread communication.
Java Exception Handling: Try, catch, throw, throws and finally. Types of exceptions: user defined and built-in exceptions.

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Reference Books:

An Introduction to Object-Oriented Programming, Timothy Budd Addison Wesley Publication.
Understanding Object-Oriented Programming with Java, T. Budd, Pearson Education.
Object-Oriented Programming through Java, P. Radha Krishna, Universities Press.
Thinking in Java, Bruce Eckel, Prentice Hall.
Java the complete reference, Herbert schildt, McGraw Hill
Programming in Java, S. Malhotra and S. Choudhary, Oxford University.
Object Oriented Analysis & Design, Booch, Addison Wesley.
Principles of Object Oriented Analysis and Design, James Martin, PrenticeHall/PTR.

List of Experiment AI34 Lab

1. Write a program to demonstrate the encapsulation and data hiding capabilities of classes
2. Write a program to demonstrate the use of constructors and destructor.
3. Write a program to implement Function Overloading using member function
4. Write a program to implement Function Overloading using friend function
5. Write a program to overload + operator to add two time objects.
6. Write a program to overload + operator to concatenate two strings.
7. Write a program to implement Single Inheritance
8. Write a program to implement Multiple Inheritance
9. Write a program to implement Stack using object oriented approach.
10. Write a program to implement Queue using object oriented approach.
11. Write a program to implement Singly Linked List using object oriented approach.

Course Outcomes:

After completion of course the students will be able to:

CO1:	Explain the concepts of Object Oriented Programming, and the Java's concepts of Multithreading and Exception Handling.
CO2:	Apply the concepts of OOP to solve the given problem via Java Program.
CO3:	Implement the concepts of OOP, Multithreading and Exception Handling Using Java Program.

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COURSE CONTENTS **w. e. f. July 2023**

Subject Code	Subject Name & Title	Maximum Marks Allocated						Hours/ Weeks			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI35	Digital Logic design & Computer Organization	70	20	10	30	20	150	3	-	2	4

Module-I: Basic Structure of Computers:
Computer types, Functional units , Basic operational concepts , Bus structures, Software Performance, multi processor and multi computers , computer generations, data representation: binary numbers , fixed point representation , Floating point representation. Number Base conversions , octal and hexadecimal numbers, complements, Signed binary numbers, Binary codes.

Module II: Digital Logic Circuits - I:
Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions .Flip-flops, Combinational Circuits.
Digital Logic Circuits - II: Registers, Shift Registers, Binary counters, Decoders, Multiplexers, Programmable Logic Devices.

Module III: Computer Arithmetic:
Algorithms for fixed point and floating point addition, subtraction, multiplication and division operations .Hardware Implementation of arithmetic and logic operations, High performance arithmetic.
Instruction Set & Addressing: Memory Locations and Addresses, Machine addresses and sequencing , Various Addressing Modes, Instruction Formats ,Basic Machine Instructions. IA32 Petium example .

Module IV: Processor organization:
Introduction to CPU , Register Transfers, Execution of Instructions, Multiple Bus Organization, Hardwired Control, Micro programmed Control Memory Organization: Concept of Memory, RAM, ROM memories, memory hierarchy, Cache memories, virtual memory, secondary storage ,memory management requirements. : Introduction to I/O Organization , Direct memory access,

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buses, interface circuits standard I/O Interfaces.

Module V: Computer Network:
Basic Terminologies of computer network, LAN, WAN, MAN, PAN, Network Devices- Routers, HUB, Switches, Bridge ,Ethernet, etc ,Network topology, Basic OSI model and its applications

Reference BOOKS:
Computer Organization– CarlHamacher, ZvonkoVranesic,SafwatZaky ,fifthedition,McGrawHill.
Computer Architecture and Organization An Integrated Approach Miles Murdocca, Vincent Heuring, Second Edition, WileyIndia.
Computer Systems Architecture – M. Moris Mano, IIIrd Edition, Pearson.
Computer Organization and Architecture–William Stallings Sixth Edition,Pearson
.Computer- organization and Design- David A. Paterson and John L.Hennessy Elsevier.
Fundamentals or Computer Organization and Design,-SivaramaDandamudi Springer Int.Edition.
DigitalDesign–Third Edition ,M.Morris Mano, Pearson Education/PHI.
FundamentalsofLogicDesign,Roth,5th Edition,Thomson.

List of Experiment AI35 Lab

1. To study and verify the truth-table of logic gates.
2. Realization of a Boolean function.
3. Design and implementation using nand gate.
4. To study and verify adders and subtractors.
5. To study and verify binary to gray generator
6. To study and verify multiplexer and demultiplexer.
7. Realization of a boolean function using logisim.
8. To study and verify flip-flops.
9. To study and verify binary counters.

Course Outcomes:
At the end of the course the students will be able to:

CO1	Understand basic structure of computers and data representation, number base conversion, binary codes etc
CO2	Design develops and test different combinational, sequential circuits and their role in the digital system design
CO3	Solve and implement different arithmetic and logical operations. Interpret different Instruction set and addressing modes.
CO4	Analyze execution of instructions by CPU and understand concept of memories and Bus organization
CO5	Analyze interrupts and data transfer through I/O Interfaces.

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Subject Code	Subject Name & Title	Maximum Marks Allocated						Hours/ Weeks			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI36 Lab	SoftwareLab-I (Python)	-	-	-	30	20	50	-	-	4	2

List of Experiments AI36 Lab

1). Introduction to Python , its installation and working with python understanding ,python variables, python operators, Understanding python Blocks
2).Python data types declaring and using numerical data types : int, float, complex using string data type and string operations defining list and list slicing use of Tuple data types.
3).Python program flow control conditional block using if else and slse if , simple for loops in python ,for loop using ranges. Use of while loops in python , Loop manipulation using pass, continue break and else.
4). Python functions, modules and package organizing , python code using functions, Organizing python projects in to modules, Importing own modules as well as external modules, Understanding Packages, Powerful lamda function, Programming using functions modules and external packages.
5). Python string , list and dictionary manipulations , understanding string in-build functions.
6). Python file operation on reading config files in python, writing log files in python understanding read functions, read (), readline() and readlines (), Understanding write functions, write() and writelines() , manipulating file pointer using seek programming using file operations.
7). Use of numpy package.
8). Use of pandas package
9). Programming with Matplotlib package.

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