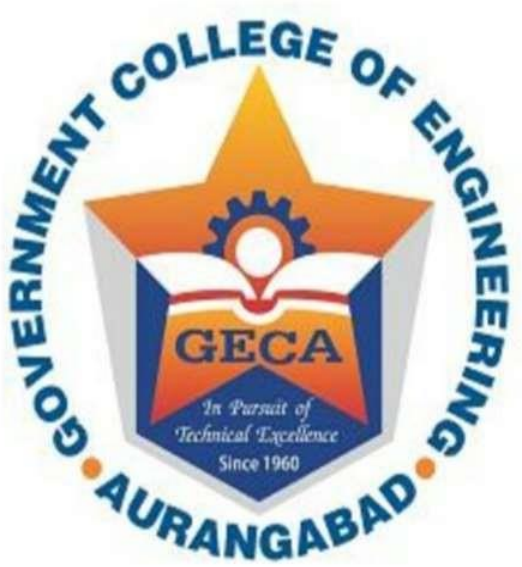

GOVERNMENT COLLEGE OF ENGINEERING AURANGABAD

(An Autonomous Institute of Govt. of Maharashtra)
Station Road, Osmanpura, Aurangabad- 431005 (M.S.)
(0240) 2366101, 2366111, Fax: (0240) 2332835

Open Elective Courses

(UG Program)

(Effective from: A.Y. 2021-2022)

ITOE1010: Computer Organization and Architecture	
Teaching Scheme	**Examination Scheme**
Lectures : 3 Hrs/Week	**Class Test-I : 15 Marks**
Total Credits : 03	**Class Test-II : 15 Marks**
	Teachers Assessment : 10 Marks
	End Semester Exam : 60 Marks

Course Description: Expose the ideas and techniques that define the art of computer architecture, organization, and design. Provide the students with architectural framework and foundation needed to understand future trends in the design.

Course Outcomes expected: On completion of this course student should be able to:

CO1 Discuss various trends in computer design and architecture of advanced processors

CO2 Describe the operation of computer system for Data processing, Data Storage , Data Movement and control

CO3 Summarize internal structure of a computer along with concepts related to design of modern processors, ALU, control unit, memories and I/Os

CO4 Describe addressing modes, instruction format and perform operations using the instruction set.

CO5 Aware issues related to instruction level execution, pipeline, and control unit operations, memory organization & optimization techniques.

Detailed Syllabus:

Unit-I **Basic Concepts and Computer Evolution**: Organization and Architecture of Computer, Structure and Function, Introduction to Gates and Number system, , History of Computers, The Evolution of the Intel x86 Architecture, Embedded Systems, Arm Architecture, Cloud Computing Ahmdahl's Law and Little's Law, Basic Measures of Computer Performance, **Computer Function and Interconnection**: Computer Components, Computer Function, Interconnection Structures, Bus Interconnection **Parallel Processing**: Multiple Processor Organizations, Multicore Computers: Multicore Organization Intel Core i7-990X,Graphic Processing Units: Cuda Basics, GPU versus CPU, GPU Architecture Overview

Unit-II **Computer Memory System**: Principles of Cache Memory, Elements of Cache Design, Pentium 4 Cache Organization **Internal Memory:** Semiconductor Main Memory Error Correction, DDR DRAM, Flash Memory, Newer Non-volatile Solid-State Memory Technologies, **External Memory:** Magnetic Disk, RAID, Solid State Drives, Optical Memory, Magnetic Tape

Unit-III **Input / Output:** External Devices I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, Direct Cache Access, I/O Channels and Processors, External Interconnection Standards, Operating System Support: Operating System Overview, Scheduling, Memory Management, Intel x86 Memory

Unit-IV **Arithmetic and Logic:** Number Systems, Computer Arithmetic, The Arithmetic and Logic Unit, Integer Representation ,Integer Arithmetic, Floating- Point Representation, Floating-Point Arithmetic, Boolean Algebra ,Gates
Central Processing Unit: Instruction Sets: Characteristics and Functions Machine Instruction Characteristics, Types of Operands, Intel x86 Data Types ,Types of Operations, Intel x86 Operation Types

Unit-V **Instruction Sets:** Addressing Modes and Formats, Addressing Modes, , x86 , Instruction Formats, x86 Instruction Formats, Assembly Language, Processor Structure and Function , Processor Organization , Register Organization, Instruction Cycle ,Instruction Pipelining, The x86 Processor Family, Reduced Instruction Set Computers , Instruction Execution Characteristics ,The Use of a Large Register File , Compiler- Based Register Optimization Reduced Instruction Set Architecture RISC Pipelining MIPS R4000 RISC versus CISC Controversy Parallelism and Superscalar Processors

Text and Reference Books:

1. William Stallings, *Computer Organization and Architecture: Designing for Performance*, 11th Edition, Pearson Education,
2. David A. Patterson and John L. Hennessy, *Computer Organization and Design, The Hardware/Software Interface*, Elsevier.
3. Carl Hamachar, Zvonco Vranesic and Safwat Zaky, *Computer Organization*, McGraw Hill.
4. John P. Hayes, *Computer Architecture and Organization*, McGraw Hill.
5. Vincent P. Heuring and Harry F. Jordan, *Computer Systems Design and Architecture*, Pearson Education.

Reference websites:

1. http://nptel.ac.in/courses/106103068/
2. https://nptel.ac.in/courses/106105163
3. https://www.tutorialspoint.com/computer_organization/index.asp
4. http://www.cse.iitm.ac.in/~vplab/courses/comp_org.htm

Mapping of Course outcome with Program Outcomes (Information Technology)

Course Outcome	PO 1	PO2	PO 3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
CO1	1				3							
CO2		2										
CO3			1									
CO4			1									
CO5			2									1

3 – High, 2 – Medium, 1 – Low

Assessment: Assessment:
ISE I- Maximum Marks-15
ISE II- Class Test of Maximum Marks-15
ISE III-Teacher's Assessment of Maximum Marks-10

ISE I and ISE III -May be based on one of the / or combination of few of following

1) Class Test/ Surprise test/ MCQ Test
2) Assignment
3) Quizzes
4) Any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	10	00	00	12
K2	Understand	05	10	05	24
K3	Apply	00	05	05	24
K4	Analyse	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K2**	**K2**	**K3**	**K3**
	CO1	**CO2**	**CO3**	**CO4, CO5**
ISE I(15 Marks)	10	5	00	00
ISEII (15 Marks)	00	5	10	00
ISEIII (10 Marks)	00	00	5	5
ESE Assessment (60 Marks)	10	15	15	20
Total Marks 100	**20**	**25**	**30**	**25**

ITOE0020: Data Structures and Algorithm		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
	ISE II	**15 Marks**
Credits: 03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course description:
The course covers basics of data structures and algorithms. Topics covered in this course include abstraction, stack, queues, lists, trees, and graphs, sorting and complexity of algorithm. The course enables the students to design good efficient solutions to real world problems.

Course Outcomes: After completing the course, students will able to:

CO1 Describe data structures arrays, stacks and queues

CO2 Interpret linked lists, trees and graphs

CO3 Demonstrate best-case, average-case and the worst-case running times of algorithms using asymptotic analysis for various sorting and searching problems

CO4 Choose the standard design techniques of algorithms and their applications

Detailed Syllabus:

Unit 1 Introduction to data structures, Concept of Data type, Data object, Need of Data Structure, Types of Data Structure, Linear data structures, Introduction to Arrays, sorting algorithms with efficiency, Stacks, static and dynamic representation of stack, Stack Operations , Applications of stack, Queues, static & dynamic representation of queues, Operations on queues, Circular queue, priority queues

Unit 2 Linked List, Implementation of List, Types of Linked List, Operations on List, Applications of Linked List, Trees, basic terminology, operation on binary trees, linked storage representation for binary search trees, basic operations on binary search tree, tree traversals, applications of trees

Unit 3 Graphs: basic terminology, matrix representation & implementation of graphs, graph traversals, spanning trees. Algorithm: definition, characteristics, Need for Analysis, Space complexity, time complexity, Asymptotic notations, Space complexities

Unit 4 Divide and conquer basic strategy and its complexity, Sorting algorithms such as selection sort, insertion sort, bubble sort, heap sort, binary search, quick sort, merge sort

Unit 5 Greedy method - Basic strategy and its complexity, application to job sequencing with deadlines problem, Knapsack problem. Dynamic Programming - Basic strategy and its complexity, principle of optimality, multistage graphs, travelling salesman problem, Backtracking basic strategy, 8-Queen’s problem, Hamiltonian cycles

Text and Reference Books

1. Yedidyah Langsam, Moshe J. Augenstein, Aaron M.Tenenbaum, *Data Structures using C and C++* , Pearson Pub.
2. G.S. Baluja, *Principles of Data Structures using C and C++* , Dhanpat Rai & Co.,4th Edition
3. Horowitz, Sahani, Rajsekharan, *Computer Algorithms* , Galgotia Publications Pvt.Ltd
4. Brassard, Bratley, *Fundamentals of Algorithms*, Prentice Hall

Web Resources

1. https://nptel.ac.in/courses/106102064
2. https://nptel.ac.in/courses/106106127
3. https://www.coursera.org/specializations/data-structures-algorithms

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes

Course outcomes	**Program Outcomes**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	2	1	1	1							1
CO2	3	2	1	1	1							1
CO3	3	2	1	1	1							
CO4	3	2	1	1	1							1

3 – High 2 – Medium 1 - Low

Assessment:

ISE I- Maximum Marks-15
ISE II- Class Test of Maximum Marks-15
ISE III-Teacher's Assessment of Maximum Marks-10

ISE I and ISE III -May be based on one of the / or combination of few of following

2) Class Test/ Surprise test/ MCQ Test
2) Assignment
3) Quizzes
4) Any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	05	05	2	10
K2	Understand	05	05	3	25
K3	Apply	05	05	5	25
K4	Analyze	-	00	00	00
K5	Evaluate	-	00	00	00
K6	Create	-	00	00	00
Total Marks 100		**15**	**15**	**30**	**60**

Assessment table:

Assessment Tool	**K2**	**K2**	**K3**	**K3**
	CO1	**CO2**	**CO3**	**CO4**
ISE I(15 Marks)	6	5	2	2
ISEII (15 Marks)	2	3	5	5
ISEIII (10 Marks)	2	2	3	3
ESE Assessment (60 Marks)	10	20	20	10
Total Marks 100	**20**	**30**	**30**	**20**

ITOE1030: Introduction to Artificial Intelligence		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description:
As the use of the internet and the global web increases by the day, the field of AI and its techniques is being used in many areas that directly affect human life. Various search techniques of AI are used for solving the real word problems. This course will acquaint students about various machine learning techniques and models under those techniques andits algorithms and prepare students for research or industry application of machine learning techniques.

Course Outcomes expected: On completion of this course student should be able to

CO1	Comprehend basic concepts of Artificial Intelligence.
CO2	Apply Artificial Intelligence techniques for problem solving.
CO3	Recognize the characteristics of machine learning that make it useful to real-world problems.
CO4	Describe supervised, unsupervised machine learning algorithms.
CO5	Examine the applicability of algorithms to solve problems.

Detailed Syllabus:

Unit 1	**Introduction to Artificial Intelligence**: Artificial Intelligence History, Introduction to Intelligent Agents, AI , Approaches, advantages, and limitations of AI, Application domains of AI
Unit 2	**Problem Solving**: Problem solving by searching, Uninformed and informed search, Constraint satisfaction problems.
Unit 3	**Knowledge Representation & Reasoning:** Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Bayesian Networks.
Unit 4	**Planning:** Forward and backward state space planning, Partial order planning, Planning graphs, Planning with propositional logic.
Unit 5	**Expert System:** Definition and Applications, Characteristics of Expert systems, Architecture of a typical Expert System, Expert System Shells, Building an Expert System, Case studies of Expert Systems.

Text and Reference Books:

1. Stewart Russell and Peter Norvig, "Artificial Intelligence-A Modern Approach ", 2nd Edition, Pearson Education/ Prentice Hall of India, 2004
2. Mitchell, Tom. M., "Machine Learning", McGraw-Hill Education, 1st Edition, May 2013
3. Giuseppe Bonaccorso, "Machine Learning Algorithm",Packt Publishing Limited, ISBN-978-17-8934-799-9, 2018.
4. Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw-Hill.
5. T. Hastie, R. Tibshirani, J. Friedman, "The Elements of Statistical Learning", 2e, 2008.
6. Christopher Bishop, "Pattern Recognition and Machine Learning", 2 edition, Springer.

CO-PO mapping:

PO/ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	2									
CO2	3	3			2							
CO3	1	3	2	3								
CO4	2	1	3		3							
CO5	2	3	2	3								

3- High 2- Medium 1-Low

Assessment:

ISE I-Maximum Marks-15
ISE II- Class Test of Maximum Marks-15
ISE III-Teacher's Assessment of Maximum Marks-10

ISE I and ISE III -May be based on one of the / or combination of few of following

3) Class Test/ Surprise test/ MCQ Test
2) Assignment
3) Quizzes
4) Any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Recommended Assessment pattern

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	05	00	00	10
K2	Understand	10	05	00	20
K3	Apply	00	10	05	20
K4	Analyze	00	00	05	10
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	**K2**	**K2**	**K3**	**K4**
	CO1,CO2	CO1,C02,CO3	CO3, CO4	CO5
ISE I (15 Marks)	10	05	00	00
ISE II (15 Marks)	10	05	00	00
ISE III (10 Marks)	00	00	05	05
ESE Assessment (60 Marks)	15	15	20	10
Total Marks 100	35	25	25	15

ITOE0040 : Introduction to Machine Learning		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Credits:03	**ISE II**	**15 Marks**
	ISE III	**10 Marks**
	End Semester Examination	**60 Marks**

Course description:

As the use of the internet and the global web increases by the day, the field of Machine Learning and its techniques is being used in many areas that directly affect human life. Various techniques of Machine Learning are used for solving the real word problems. This course will acquaint students about various machine learning techniques and models under those techniques and its algorithms and prepare students for research or industry application of machine learning techniques.

Course Outcomes: After completing the course, students will able to:

CO1	Understand basic applications and issues of Machine Learning
CO2	Apply machine learning life cycle for problem solving
CO3	Explain supervised and unsupervised machine learning algorithms
CO4	Identify the applicability of algorithms to solve problems

Detail Syllabus:

Unit 1	**Introduction to Machine Learning**: Introduction, History, Program versus machine learning algorithms, Artificial Intelligence versus Machine Learning versus Deep Learning, Basic definition of Machine Learning, Key terms, Applications, Machine Learning Techniques: Supervised Learning, Unsupervised Learning and Reinforcement Learning, Issues in Machine Learning
Unit 2	**Data Pre-processing for Machine Learning**: Statistical Learning , Steps in developing Machine Learning Application, Data Collection, Data pre-processing, Feature Selection, Dimensionality Reduction Techniques
Unit 3	**Model Design and Evaluation**: Model Selection and validation, Model Evaluation, Training versus Testing, Cross Validation , Under fitting and Over fitting, Gradient decent, regularization
Unit 4	**Supervised Learning:** Linear and Logistic Regression, Naïve Bayes classifier, K-Nearest Neighbours, Decision trees, Evaluation Measures: SSE, MME, R2, confusion matrix, precision, recall, F-Score, ROC-Curve
Unit 5	**Unsupervised Learning:** Introduction to clustering, k-means, Hierarchical Clustering, Density Based Clustering.

Text and Reference Books:

1. Machine Learning, Tom M. Mitchell, McGraw Hill Education, 2017.
2. Machine Learning, By Rajeev Chopra, Khanna Book Publishing Co., 2021.
3. Introduction to Machine Learning (Second Edition): Ethem Alpaydın, The MIT Press (2010).
4. The Hundred-Page Machine Learning Book: Andriy Burkov
5. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs85/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs49/preview
3. https://www.udacity.com/course/intro-to-machine-learning--ud120
4. https://www.coursera.org/learn/machine-learning-duke
5. http://www.cs.cornell.edu/jeh/book.pdf

Mapping of Course outcome with Program Outcomes:

Course outcome	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	1	1									1
CO2	2	1	2	1	1						1	1
CO3	2	2	2	2	1							2
CO4	1	1	2	1	2	1	1	1	1	1	1	1

3 – High 2 – Medium 1 – Low

Assessment:

ISE I-Maximum Marks-15
ISE II- Class Test of Maximum Marks-15
ISE III-Teacher's Assessment of Maximum Marks-10

ISE Iand ISE III -May be based on one of the / or combination of few of following

1) Class Test/ Surprise test/ MCQ Test
2) Assignment
3) Quizzes
4) Any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	00	00	00	00
K2	Understand	09	09	05	36
K3	Apply	06	06	05	24
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment Table:

Assessment Tool	**K2**	**K3**
	CO1, CO3	CO2,CO4
ISE I (15 Marks)	09	06
ISE II (15 Marks)	09	06
ISE III (10 Marks)	05	05
ESE (60 Marks)	36	24