# Syllabus of 4 + 1 Year Integrated UG and PG Programme

**w. e. f 2024-25 Academic Year**


**GRADUATE SCHOOL**

**Mahatma Gandhi University**

**P. D. Hills P O**

**Kottayam, Kerala**

**www.gs.mgu.ac.in**

**www.mgu.ac.in**

# Schools offering Majors

| SL.No | School/Centre |
|---|---|
| 1 | School of Bio Sciences |
| 2 | School of Chemical Sciences |
| 3 | School of Computer Sciences |
| 4 | School of Environmental Sciences |
| 5 | School of Gandhian Thought and Development Studies |
| 6 | School of International Relations and Politics |
| 7 | School of Pure and Applied Physics |
| 8 | School of Social Sciences |

| Sl. No. | Major | Intake |
|---|---|---|
| **SCIENCE** | | |
| 1 | Bio Sciences | 6** |
| 2 | Chemistry | 6 |
| 3 | Computer Science | 6 |
| 4 | Environmental Science | 6 |
| 5 | Physics | 6 |
| **SOCIAL SCIENCES** | | |
| 1 | Development Studies | 5 |
| 2 | Gandhian Studies | 5 |
| 3 | History | 10 |
| 4 | International Relations and Politics | 10 |

**Majors offered and Intake** *1 seat shall be sanctioned over and above the intake in each major in the 3rd semester for students who opt for a change of major after two semesters.

**Progression to PG Shall be based on the specialization selected by students as Biochemistry (2 seats) Biotechnology (2 seats) and Microbiology (2 seats) based on merit.

# Schools offering Minors/MDCs/AECs/VACs/SECs

| SL.No | School/Centre |
|---|---|
| 1 | School of Artificial Intelligence And Robotics |
| 2 | School of Behavioural Sciences |
| 3 | School of Biosciences |
| 4 | School of Chemical Sciences |
| 5 | School of Computer Sciences |
| 6 | School of Data Analytics |
| 7 | School of Energy Materials |
| 8 | School of Environmental Sciences |
| 9 | School of Food Science And Technology |
| 10 | School of Gandhian Thought And Development Studies |
| 11 | School of Gender Studies |
| 12 | School of Indian Legal Thought |
| 13 | School of International Relations And Politics |
| 14 | School of Letters |
| 15 | School of Mathematics And Statistics |
| 16 | School of Nanoscience And Nano Technology |
| 17 | School of Pedagogical Sciences |
| 18 | School of Polymer Science And Technology |
| 19 | School of Pure And Applied Physics |
| 20 | School of Social Sciences |
| 21 | School of Tourism Studies |
| 22 | International and Inter University Centre for Nanoscience and Nanotechnology |
| 23 | K N Raj School of Economics |

**Scheme for 4 + 1 Integrated UG and PG Programme**
**Graduate School**
**Mahatma Gandhi University**
**School of Artificial Intelligence And Robotics**

| Course Code | Title | Credits | Hours per Week | | Level | Type |
|---|---|---|---|---|---|---|
| | | | Theory | Practicals | | |
| **SEMESTER I** | | | | | | |
| | Major | 4 | | | Foundation (100-199) | Major |
| MG1DSCUAI121 | Foundations of Artificial Intelligence | 4 | 4 | 0 | " | Minor A |
| MG1DSCUAI141 | Problem Solving and Programming in Python | 4 | 3 | 1 | " | Minor B |
| MG1MDCUAI101 | Fundamentals of Artificial Intelligence | 3 | 3 | 0 | " | MDC |
| | AEC (Eng) | 3 | | | " | |
| | AEC (Mal) | 3 | | | " | |
| **SEMESTER II** | | | | | | |
| | Major | 4 | | | " | |
| MG2DSCUAI121 | Basic Electronics and Devices | 4 | 4 | 0 | " | Minor A |
| MG2DSCUAI141 | Computational Foundations for Machine Learning | 4 | 4 | 0 | " | Minor B |
| MG2MDCUAI101 | Introduction to Robotics | 3 | 3 | 0 | " | MDC |
| | AEC (Eng) | 3 | | | " | |
| | AEC (Mal) | 3 | | | " | |
| **SEMESTER III** | | | | | | |
| | Major | 4 | | | Intermediate (200-299) | |
| | Major | 4 | | | " | |
| | Major | 4 | | | " | |
| MG3DSCUAI221 | Introduction to Machine Learning | 4 | 3 | 1 | " | Minor A |
| MG3MDCUAI201 | Principles of Machine Learning | 3 | 3 | 0 | " | MDC |
| MG3VACUAI201 | Ethics in Artificial Intelligence | 3 | 3 | 0 | " | VAC |
| **SEMESTER IV** | | | | | | |
| | Major | 4 | | | " | |
| | Major | 4 | | | " | |
| | Major | 4 | | | " | |
| MG4DSCUAI241 | IoT and BlockChain Technologies | 4 | 4 | 0 | " | Minor B |
| MG4SECUAI201 | Documentation and Presentation Tools | 3 | 2 | 1 | " | SEC |
| MG4VACUAI201 | AI for Sustainable | 3 | 3 | 0 | " | VAC |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Development | | | | | |
| | Internship/Fieldwork | 2 | | | | |
| **SEMESTER V** | | | | | | |
| | Major | 4 | | | Higher (300-399) | |
| | Major | 4 | | | “ | |
| | Major | 4 | | | “ | |
| | Major | 4 | | | “ | |
| MG5SECUAI301 | UI/UX Design Fundamentals | 3 | 2 | 1 | “ | SEC |
| MG5VACUAI301 | Research Methodology | 3 | 3 | 0 | “ | VAC |
| **SEMESTER VI** | | | | | | |
| | Major | 4 | | | “ | |
| | Major | 4 | | | “ | |
| | Major | 4 | | | “ | |
| | Major (E) | 4 | | | “ | |
| | Major (E) | 4 | | | “ | |
| MG6SECUAI301 | Data Visualization using Python/R | 3 | 2 | 1 | “ | SEC |
| **Total Credits** | | **133** | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **SEMESTER VII** | | | | | | |
| | Major | 4 | | | Advanced (400-499) | |
| | Major (E) | 4 | | | “ | |
| | Major (E) | 4 | | | “ | |
| MG7DSCUAI421 | GPU Computing and Parallel Programming | 4 | 3 | 1 | “ | Minor A |
| MG7DSEUAI422<br><br>MG7DSEUAI423<br><br><br>MG7DSEUAI424 | 1. Reinforcement Learning<br>2. Fuzzy Logic and Nature inspired Computing<br>3. Digital Image Processing | 4 | 3 | 1 | “ | Minor A(E) |
| MG7DSEUAI441<br><br><br><br>MG7DSEUAI442<br><br>MG7DSEUAI443 | 1. Robotics and Intelligent Systems<br>2. Cyber Physical Systems<br>3. Deep Learning | 4 | 3 | 1 | “ | Minor A/B (E) |
| **SEMESTER VIII** | | | | | | |
| | Major | 4 | | | “ | |
| | Major (E) | 4 | | | “ | |
| | Research Project | 12 | | | “ | |
| | Major* | 4 | | | “ | |
| | Major* | 4 | | | “ | |
| | Major* | 4 | | | “ | |
| **Total Credits** | | **44** | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **SEMESTER IX** | | | | | | |
| | Major | 4 | | | PG Level (500-599) | |
| | Major | 4 | | | “ | |
| | Major | 4 | | | “ | |
| | Major | 4 | | | “ | |
| | Major | 4 | | | “ | |
| **SEMESTER X** | | | | | | |
| | Research Project | 20 | | | “ | |
| | Major** | 4 | | | “ | |
| | Major** | 4 | | | “ | |
| | Major** | 4 | | | “ | |
| | Major** | 4 | | | “ | |
| | Major** | 4 | | | “ | |
| **Total Credits** | | **40** | | | | |

*Only for 4-Years Honours Students

**Only for students who opt for theory courses instead of Research Project

*Note: General foundations courses shall be offered by different schools. Students can flexibly choose the courses across disciplines.*

| **Level** | Foundation (100-199 | Intermediate (200-299) | Higher (300-399) | Advanced (400-499) | PG Level (500-599) |
|---|---|---|---|---|---|

| **Type** | Major | Minor | MDC | SEC | VAC | AEC |
|---|---|---|---|---|---|---|

| | |
|---|---|
| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

| | | | |
|---|---|---|---|
| **School** | School of Artificial Intelligence and Robotics | | |
| **Programme** | 4 + 1 Integrated UG and PG Programme | | |
| **Course Title** | **Foundations of Artificial Intelligence** | | |
| **Course Type** | Minor | | |
| **Course Level** | 100-199 | | |
| **Course Code** | MG1DSCUAI121 | | |
| **Course Overview** | The Foundations of Artificial Intelligence course provides an introduction to the key concepts, techniques, and applications of Artificial Intelligence (AI). The course emphasizes both the theoretical underpinnings of AI and practical implementation, including programming and the use of AI tools. Students will gain a solid understanding of how AI systems are designed, built, and evaluated, preparing them for advanced study or careers in the field. | | |
| **Semester** | 1 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 60 | - | |
| **Pre-requisite** | Higher secondary level knowledge of Mathematics and Computer Science. | | |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome | Learning Domains | PSO No. |
|---|---|---|---|
| | *Upon completion of this course, students will be able to;* | | |
| 1 | Explain fundamentals of Artificial Intelligence. | U | 1,2,3 |
| 2 | Analyse various types of standard search algorithms, illustrate advanced search techniques and algorithms. | An | 2,4 |
| 3 | Illustrate knowledge representation and predicate logic. | A | 3,5,6 |
| 4 | Apply artificial intelligence concepts in real life problems. | A | 1,6,7 |

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| Introduction of Artificial Intelligence (AI): concept and definition, history of AI, related concepts of AI, comparison of human and computer skills, practical system based on AI, components of AI. | 15 | 1 |
| **Module 2** | **Hours** | |
| Problem-solving through AI: Introduction, representation of AI problems, algorithm of problem solving, examples of AI problems, nature of AI problems, search techniques.<br>Heuristic search: basic concepts, design heuristic function, types of heuristic techniques, popular game playing theories. | 20 | 2 |
| **Module 3** | **Hours** | |
| Introduction to knowledge and logic: types of knowledge, knowledge representation, propositional calculus, predicate logic. | 10 | 3 |
| **Module 4** | **Hours** | |
| Advanced techniques: neural networks, pattern recognition, computer vision. | 15 | 4 |

| | | |
|---|---|---|
| Expert system: experts and expert system, characteristics, architecture, types of experts system- Dendral, Mycin. | | |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning.<br><br>Interactive Instruction: Active co-operative learning, Seminar, Group Assignments.<br><br>Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative.<br><br>**Field activities:** Challenges AI, Hackathon. |
| **Mode of Assessment** | **Continuous Internal Assessment:**<br>• Internal Examinations<br>• Seminar Presentation<br>• Assignments<br>• Case Study<br>• Semester End Examination |

## Learning Resources


1. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, Second Edition, Pearson Education.
2. Ela Kumar, "Artificial Intelligence", Wiley Publications, 2022, First Edition.
3. Elaine Rich and Kelvin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2017.


| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| Learning the course "Foundations of Artificial Intelligence" is highly relevant due to the increasing integration of AI in various industries, driving innovation and efficiency. It equips students with essential skills in problem-solving, and logical thinking, which are crucial in today's tech-driven job market. |

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| | **MAHATMA GANDHI UNIVERSITY**<br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

| | | | |
|---|---|---|---|
| **School** | School of Artificial Intelligence and Robotics | | |
| **Programme** | 4 + 1 Integrated UG and PG Programme | | |
| **Course Title** | **Problem Solving and Programming in Python** | | |
| **Course Type** | Minor | | |
| **Course Level** | 100-199 | | |
| **Course Code** | MG1DSCUAI141 | | |
| **Course Overview** | The course aims to impart core principles of programming using Python, focusing on building a strong foundation in Python syntax, data structures, control structures, functions, file input/output, and Python libraries. Through a combination of lectures, hands-on lab activities, and practical assignments, students will develop the skills necessary to write, debug, and optimize Python code. | | |
| **Semester** | 1 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/fieldwork** | |
| | 45 | 30 | |
| **Pre-requisite** | General familiarity with computers and the internet is enough. No prior programming experience is required. | | |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome | Learning Domains | PSO No. |
|---|---|---|---|
| | *Upon completion of this course, students will be able to**;*** | | |
| 1 | Illustrate the basic programming constructs and their syntax and semantics to develop efficient, effective, and error-free code. | A | 1,4 |

| | | | |
|---|---|---|---|
| 2 | Develop, test, debug, and execute programs using Python Integrated Development Environment (IDE) | An | 1,2,4 |
| 3 | Utilize conditional and iterative statements, functions, and string manipulation techniques in Python to solve problems. | A | 1,2,4 |
| 4 | Develop programs using lists, tuples, sets, and dictionaries, and demonstrate the usage of file input/output operations. | An | 1,2,4 |
| 5 | Build modular, scalable, and maintainable applications using Python libraries. | C | 1,2,4, 7 |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| Introduction to problem-solving – steps, algorithms, flow charts, programming methodologies. Fundamentals of coding - Python IDEs, syntax and semantics, data types, tokens, input and output. | 20 | 1,2 |
| **Module 2** | **Hours** | |
| Conditional and iteration statements, functions, recursion, lambda functions. strings and number systems. | 20 | 3 |
| **Module 3** | **Hours** | |
| Lists, tuples, sets and dictionaries – operations and functions. Reading and writing text files, binary files and CSV files. | 18 | 4 |
| **Module 4** | **Hours** | |
| Python libraries- modules and packages, Numpy, Pandas and Matplotlib. | 17 | 5 |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:**<br>Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning<br>Interactive Instruction: Active co-operative learning, Seminar, Group Assignments<br>Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative |

| | |
|---|---|
| | **Lab-based activities:** Hands-on exercises, Guided tutorials, Project-based learning, Code reviews |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br>• Two Internal Tests<br>• Assignments–Written, Practical<br>• Seminar<br>• Case Study<br>**Semester End Examination** |

**Learning Resources**

1. Kenneth A Lambert., Fundamentals of Python: First Programs, Second Edition, Cengage Publishing, 2016

2. Wes McKinney, Python for Data Analysis, Second Edition, O'Reilly Publishers, 2017

3. Matthes, E., Python Crash Course, Second Edition, No Starch Press,2019

| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| The course lays the foundation for problem-solving skills, logical thinking and technical proficiency, preparing students for advanced studies and various real-world applications in machine learning, data science, artificial intelligence and web development. By the end of the course, students will be capable of writing, debugging, and optimizing Python code, preparing them for more advanced studies and diverse applications in the technology field. |

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

| | | | |
|---|---|---|---|
| **School** | School of Artificial Intelligence and Robotics | | |
| **Programme** | 4 + 1 Integrated UG and PG Programme | | |
| **Course Title** | **Fundamentals of Artificial Intelligence** | | |
| **Course Type** | MDC | | |
| **Course Level** | 100-199 | | |
| **Course Code** | MG1MDCUAI101 | | |
| **Course Overview** | The course is designed to provide a comprehensive foundation in Artificial Intelligence (AI). This course aims to equip students with fundamental concepts and skills that are increasingly valuable in today's technology-driven world. | | |
| **Semester** | 1 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 45 | - | |
| **Pre-requisite** | General familiarity with computer science | | |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome<br><br>*Upon completion of this course, students will be able to;* | Learning Domains | PSO No. |
|---|---|---|---|
| 1 | Explain fundamentals of Artificial Intelligence | U | 1,2,4 |
| 2 | Analyse various types of standard search algorithms | An | 2,4 |
| 3 | Illustrate search techniques and algorithms for game playing. | E | 1,4 |
| 4 | Apply artificial intelligence concepts in real life problems | A | 1,2,6,7 |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| Introduction to Artificial Intelligence (AI): concept and definition, history of AI, comparison of human and computer skills, practical system based on AI, components of AI. | 15 | 1 |
| **Module 2** | **Hours** | |
| Problem-solving through AI: introduction, representation of AI problems, algorithm of problem solving, examples of AI problems, nature of AI problems, search techniques. | 15 | 2 |
| **Module 3** | **Hours** | |
| AI tools for Research: QuillBot, Trinka, Bit AI, Scite, PDFgear Copilot, Consensus, Connected Papers, Litmaps, Jenni, Paperpal, Research Rabbit. | 15 | 3,4 |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning<br><br>Interactive Instruction: Active co-operative learning, Seminar, |

| | |
|---|---|
| | Group Assignments<br><br>Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative<br><br>**Lab based activities:** Interactive Notebooks, AI Challenges. |
| **Mode of Assessment** | **Continuous Internal Assessment:**<br>• Internal Examinations<br>• Seminar<br>• Assignments<br>• Semester End Examination |

## Learning Resources


1. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, Second Edition, Pearson Education.
2. Ela Kumar, "Artificial Intelligence", Wiley Publications,2022, First Edition.
3. Elaine Rich and Kelvin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2017.


| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| An "Introduction to Artificial Intelligence" course equips students with essential skills and knowledge that are highly relevant in today's technology-driven world. The course not only enhances employability but also provides a solid foundation for a successful and dynamic career in AI and related fields. |

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|---|---|
| | **MAHATMA GANDHI UNIVERSITY**<br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

| | | | |
|---|---|---|---|
| **School** | School of Artificial Intelligence and Robotics | | |
| **Programme** | 4 + 1 Integrated UG and PG Programme | | |
| **Course Title** | **Basic Electronics and Devices** | | |
| **Course Type** | Minor | | |
| **Course Level** | 100-199 | | |
| **Course Code** | MG2DSCUAI121 | | |
| **Course Overview** | This course explores the evolution and impact of electronics, detailing fundamental components. The course focuses on bipolar junction transistors, configurations, and their use as amplifiers and switches. The course covers junction field-effect transistors and an introduction to communication systems, while the course delves into diode circuits, power supplies, and voltage regulation. | | |
| **Semester** | 2 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 60 | - | |
| **Pre-requisite** | A foundational understanding of Physics and Mathematics | | |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome | Learning Domains | PSO No. |
|---|---|---|---|
| | *Upon completion of this course, students will be able to;* | | |
| 1 | Discuss the evolution and impact of electronics, | U | 1,2,4 |

| | | | |
|---|---|---|---|
| | and learn about basic electronics components, including their specifications, functions and applications. | | |
| 2 | Describe the structure, operation, and configurations of bipolar junction transistors, their current gain, amplifiers and the necessity of biasing and stabilization. | A | 1,2 |
| 3 | Summarise the principles of operation of junction field-effect transistors (JFETs), including the operation of special semiconductor devices and illustrate the evolution of communication system. | An | 1,2,7 |
| 4 | Analyze various diode circuits including clippers, clampers, and voltage multipliers, and demonstrate the principles of half-wave and full-wave rectifiers, as well as Zener voltage regulators and DC power supply. | An | 1,2 |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| Evolution of Electronics, Impact of electronics in industry and in society, Resistors, Capacitors: Types, Specifications, Colour coding.<br>Inductors and Transformers: Types, principle of working. PN junction diode- Working, V-I characteristics, Working principle of LED, Zener diode. | **15** | **1** |
| **Module 2** | **Hours** | |
| Bipolar Junction transistors: structure, principle of operation- configurations, current gain. Need for biasing and stabilization, Transistor as an amplifier, Switch.<br>RC coupled amplifier and frequency response- simulations. | **15** | **2** |
| **Module 3** | **Hours** | |
| Junction field effect transistors: Principle of operation, comparison with BJT. Principle of operation of Photo transistor, UJT, SCR.<br>Introduction to Communication Systems: Evolution of communication systems – Telegraphy to 5G. Radio communication: principle of AM and FM. | **15** | **3** |

| **Module 4** | **Hours** | |
|---|---|---|
| Diode circuits and power supplies: Clippers, Clampers, Voltage multipliers, Half-wave and full wave rectifiers, Zener voltage regulator, Block diagram description of a DC Power supply. | **15** | **4** |

| | |
|---|---|
| **Mode of Transaction** | Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning<br><br>Interactive Instruction: Active co-operative learning, Seminar, Group Assignments<br><br>Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br>• Two Internal Tests<br>• Assignments<br>• Seminar<br>• Case Study<br>**Semester End Examination** |

**Learning Resources**


1. Boylestad, R. L., & Nashelsky, L. (2013). Electronic Devices and Circuit Theory (11th ed.). Pearson Education.
2. Bell, D. A. (2007). Electronic Devices and Circuits (5th ed.). Oxford University Press.
3. Chattopadhyay, D., and P. C. Rakshit. 2022. Electronics: Fundamentals and Applications. New Age International Private Limited.


| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| The course provides a foundation for advanced courses, technological literacy and industrial applications. |

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|---|---|
| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

| | | | |
|---|---|---|---|
| **School** | School of Artificial Intelligence and Robotics | | |
| **Programme** | 4 + 1 Integrated UG and PG Programme | | |
| **Course Title** | **Computational Foundations for Machine Learning** | | |
| **Course Type** | Minor | | |
| **Course Level** | 100-199 | | |
| **Course Code** | MG2DSCUAI141 | | |
| **Course Overview** | This course covers key areas of mathematics such as linear algebra, calculus, probability, and optimization, ensuring students acquire the foundational knowledge necessary for understanding and developing machine learning algorithms. This enables them to apply mathematical techniques effectively in real-world scenarios, enhancing their problem-solving capabilities and innovation potential. | | |
| **Semester** | 2 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 60 | - | |
| **Pre-requisite** | Higher secondary level Mathematics | | |

## COURSE OUTCOMES (CO)

| CO | Expected Course Outcome | Learning | PSO |
|---|---|---|---|

| No. | | Domains | No. |
|---|---|---|---|
| | *Upon completion of this course, students will be able to;* | | |
| 1 | Demonstrate the concepts, rules and results of linear equations, matrix algebra and vector spaces to solve computational problems. | U | 1,2 |
| 2 | Apply vector and matrix calculus in mathematical modelling and problem-solving. | A | 1,2 |
| 3 | Utilize probability rules, concepts of random variables, specific distributions and Bayes' theorem to solve scenarios involving information and probabilities. | An | 1,2,4 |
| 4 | Analyze various basic optimization and constrained optimization techniques to solve practical problems. | E | 1,2,7 |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| Linear Algebra-Matrices and solving methods for systems of linear equations. Vector spaces- sub spaces and spanning sets, linear independence and basis, dimension of a vector space.<br><br>Matrices- Hadamard product, linear transformation, inverse and rank. | 15 | 1 |
| **Module 2** | **Hours** | |
| Calculus-functions, differentiation, partial derivatives, gradient and directional derivatives. Vector and matrix calculus-eigenvalues and eigenvectors Jacobian matrix and applications. | 14 | 2 |
| **Module 3** | **Hours** | |
| Random variables- Continuous, discrete, expectation, variance. Probability- Rules, axioms, events, sample space, frequentist approach, dependent and independent events, conditional probability, Bayes' theorem. Distributions-binomial, Bernoulli and Gaussian. | 16 | 3 |

| **Module 4** | **Hours** | |
|---|---|---|
| Optimization- optimization using gradient descent, gradient descent with momentum, stochastic gradient descent. Constrained optimization - Lagrange multipliers, convex optimization, linear programming, quadratic programming. | 15 | 4 |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brainstorming lecture, Explicit Teaching, E- learning<br>Interactive Instruction: Active co-operative learning, Seminar, Group Assignments<br>Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br>• Two Internal Tests<br>• Seminar<br>• Assignments<br>**Semester End Examination** |

## Learning Resources


1. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong “Mathematics for Machine Learning” ,Cambridge University Press,2020.

2.Gilbert Strang, “Linear Algebra and Its Applications”, 4th Edition

3.Axler, Sheldon, “Linear Algebra Done Right”, Springer, 2014.

4. Härdle, Wolfgang Karl, and Léopold Simar, “ Applied Multivariate Statistical Analysis”, Springer, 2015.

5. Morin, David, “Probability” Create space Independent Publishing Platform, 2016.


| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| This course focuses on essential mathematical concepts for manipulating data and developing analytical skills necessary to address complex challenges. These capabilities are pivotal in industries such as technology, finance, and healthcare, where data-driven decision-making is fundamental, especially in the context of machine learning applications. |

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | School of Artificial Intelligence and Robotics | | |
| **Programme** | 4 + 1 Integrated UG and PG Programme | | |
| **Course Title** | **Introduction to Robotics** | | |
| **Course Type** | MDC | | |
| **Course Level** | 100-199 | | |
| **Course Code** | MG2MDCUAI101 | | |
| **Course Overview** | This course covers the fundamental concepts, components, and systems involved in modern robotics, providing a historical context and exploring emerging trends and technologies. Students learn about robot locomotion, navigation, and the ethical considerations surrounding robotic development and deployment. Sensor and actuator interfacing, control systems, and programming are developed, preparing students for further study and careers in the dynamic field of robotics. | | |
| **Semester** | 2 | **Credit** | 3 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 45 | - | |
| **Pre-requisite** | General familiarity with Mathematics, Electronics, and | | |

| | |
|---|---|
| | Computer Science. |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome<br><br>*Upon completion of this course, students will be able to;* | Learning Domains | PSO No. |
|---|---|---|---|
| 1 | Explain historical perspective on the development of robotics, identifying key milestones and figures in its evolution. | U | 1,2,7 |
| 2 | Demonstrate and describe the basic components of a robot, sensors, types of robots, different architectures, movement mechanism and navigation strategies. | A | 1,2 |
| 3 | Discuss ethical considerations in robotics, including safety, privacy, job displacement, and the societal impact, along with responsible development and deployment practices. | U | 4,5,6 |
| 4 | Develop emerging trends, programming and research opportunities in the field of robotics. | A | 4,3,7 |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| Module 1 | Hours | CO No |
|---|---|---|
| Definition of robotics and its importance, historical overview of robotics, basic components of a robot, Understanding the structure of robots, types of robots.<br><br>Emerging trends and technologies in robotics. Opportunities for further study and research in robotics. | **15** | **1,2** |

| **Module 2** | **Hours** | |
|---|---|---|
| Components of a Robot, robot locomotion: basic locomotion principles. Introduction to basic robot mobility and navigation.<br><br>Discussion of ethical considerations in robotics, including safety, privacy, and job displacement, exploration of the societal impact of robotics, reflection on responsible robotics development and deployment practices. | **10** | **2,3** |
| **Module 3** | **Hours** | |
| Types of sensors used in robotics: Basic principles of sensor operation, Introduction to sensor interfacing and data acquisition.<br><br>Types of actuators used in robotics: DC motors, servos, stepper motors, Introduction to actuator control and interfacing., Introduction to robot control systems.<br><br>Basics of robot programming, Introduction to robot programming languages. | **15** | **2,4** |
| | | |
| | | |

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|---|---|
| **Mode of Transaction** | **Classroom activities:**<br><br>Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning<br><br>Interactive Instruction: Active co-operative learning, Seminar, Group Assignments<br><br>Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br><br>• Two Internal Tests<br>• Assignments<br>• Seminar<br>• Case Study<br>**Semester End Examination** |

**Learning Resources**


1. Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, “Industrial Robotics Technology, Programming and Applications”, Tata – McGraw Hill Pub. Co 2008.

2. R K Mittal and I J Nagrath, “Robotics and Control”, Tata McGraw Hill, New Delhi,2003.

3. Fu.K.S, Gonzalez.R.C&Lee.C.S.G, “Robotics control, sensing, vision and intelligence”, Tata- McGraw Hill Pub. Co., 2008


| **Relevance of Learning the Course/ Employability of the Course** |
| --- |
| Explain the principles of robot locomotion, navigation, and control can be directly applied to real-world problems, improving efficiency and innovation in various domains. The course equips students with essential knowledge and skills, fosters interdisciplinary learning, prepares them for diverse career opportunities, and promotes responsible and ethical development in the rapidly growing field of robotics. |

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| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | School of Artificial Intelligence and Robotics | | |
| **Programme** | 4 + 1 Integrated UG and PG Programme | | |
| **Course Title** | **Introduction to Machine Learning** | | |
| **Course Type** | Minor | | |
| **Course Level** | 200-299 | | |
| **Course Code** | MG3DSCUAI221 | | |
| **Course Overview** | This course provides an introduction to the fundamental concepts and techniques of machine learning, including supervised and unsupervised learning, model evaluation, and practical applications. Students will explore algorithms such as decision trees, support vector machines, and clustering algorithms, gaining hands-on experience with Python-based machine learning libraries. | | |
| **Semester** | 3 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/fieldwork** | |
| | 45 | 30 | |
| **Pre-requisite** | Basic understanding of probability theory and linear algebra. | | |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome | Learning Domains | PSO No. |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | *Upon completion of this course, students will be able to**;*** | | |
| 1 | Understand the core concepts of machine learning and its paradigms to differentiate between supervised, unsupervised, and reinforcement learning approaches. | U | 1,4,7 |
| 2 | Identify appropriate input representations for supervised learning tasks and analyze their impact on model performance. | U | 1,2,4 |
| 3 | Apply supervised learning techniques to solve multi-class classification problems effectively. | A | 2,4,6 |
| 4 | Evaluate machine learning models using model selection techniques and generalization methods to ensure robust performance. | An | 1,2,4 |
| 5 | Develop insights into the generalization capabilities of models to enhance predictive accuracy and adaptability to unseen data. | E | 1,2,4 |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| Introduction to Machine Learning, Machine learning paradigms-supervised, semi-supervised,<br>unsupervised, reinforcement learning.<br>Supervised learning- Input representation, Hypothesis class, Learning Multiple classes, Model Selection and Generalization. | 20 | 1 |
| **Module 2** | **Hours** | |
| Regression - Linear regression with one variable, Linear regression with multiple variables, Solution using gradient descent algorithm and matrix method, Basic idea of overfitting in regression. Linear Methods for Classification- Logistic regression. | 20 | 2 |
| **Module 3** | **Hours** | |
| Classification Performance measures - Precision, Recall, Accuracy, F-Measure, Bootstrapping, Cross Validation. Naive Bayes- Case study. | 18 | 3 |

| **Module 4** | **Hours** | |
|---|---|---|
| Support Vector Machines - Introduction, Maximum Margin hyperplanes, Soft margin SVM classifier, Kernel Trick. Unsupervised Learning - Clustering Methods -Similarity measures, Case Study: Develop an image classifier. | 17 | 4 |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:**<br>Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning<br>Interactive Instruction: Active co-operative learning, Seminar, Group Assignments<br>Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative<br>**Lab-based activities:** Hands-on exercises, Guided tutorials, Project-based learning, Code reviews |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br>• Two Internal Tests<br>• Assignments–Written, Practical<br>• Seminar<br>• Case Study<br>**Semester End Examination** |

**Learning Resources**

1. Ethem Alpaydin, Introduction to Machine Learning, Fourth edition, MIT Press 2020.

2. Tom Mitchell, Machine Learning, McGraw-Hill, 2017.

3. Christopher Bishop. Neural Networks for Pattern Recognition, Oxford University Press, 1995.

4. Z. Ghahramani, Probabilistic Machine Learning: An Introduction, Cambridge, MA, USA: MIT Press, 2021.

| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| The Machine Learning course equips students with essential skills for data-driven decision-making, a critical competency in today's tech-driven |

industries. Proficiency in machine learning algorithms and tools enhances employability in diverse fields such as AI development, data analysis, and automation. Graduates are well-prepared for roles in sectors like finance, healthcare, and technology, where machine learning is driving innovation and efficiency.

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|  | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | School of Artificial Intelligence and Robotics | | |
| **Programme** | 4 + 1 Integrated UG and PG Programme | | |
| **Course Title** | **Principles of Machine Learning** | | |
| **Course Type** | MDC | | |
| **Course Level** | 200-299 | | |
| **Course Code** | MG3MDCUAI201 | | |
| **Course Overview** | This course introduces the foundational concepts of supervised, unsupervised, and reinforcement learning, focusing on algorithms like linear regression, classification, and clustering. It emphasizes the mathematical basics, model evaluation techniques, and practical applications of machine learning in real-world scenarios. | | |
| **Semester** | 3 | **Credit** | 3 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 60 | - | |

| | |
|---|---|
| **Pre-requisite** | General familiarity with Mathematics and Computer Science. |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome<br>*Upon completion of this course, students will be able to;* | Learning Domains | PSO No. |
|---|---|---|---|
| 1 | Understand the fundamentals of machine learning, including its paradigms, supervised learning techniques, input representation, multi-class learning, model selection, and generalization principles. | U | 1,7,4 |
| 2 | Implement and evaluate linear regression models, addressing overfitting issues. | A | 1,2,4 |
| 3 | Apply various classification techniques and evaluate their performance using appropriate metrics. | U | 2,3,4 |
| 4 | Apply unsupervised learning techniques, particularly clustering methods, and develop an image classifier. | A | 4,7,6 |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| Introduction to Machine Learning, Machine learning paradigms, Supervised learning: Input representation, Learning Multiple classes, Model Selection and Generalization. | **20** | **1** |
| **Module 2** | **Hours** | |
| Regression - Linear regression with one variable, Solution using gradient descent algorithm and matrix method, Basic | **15** | **2** |

| | | |
|---|---|---|
| idea of overfitting in regression. Linear Methods for Classification- Logistic regression. | | |
| **Module 3** | **Hours** | |
| Classification Performance measures - Accuracy, Precision, Recall - Bootstrapping, Cross Validation. Naive Bayes Classifier - Case study. Support Vector Machines. Unsupervised Learning - Clustering Methods - Case Study: Develop an image classifier. | **25** | **3,4** |
| | | |
| | | |

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|---|---|
| **Mode of Transaction** | **Classroom activities:**<br><br>Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning<br><br>Interactive Instruction: Active co-operative learning, Seminar, Group Assignments<br><br>Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br><br>• Two Internal Tests<br>• Assignments<br>• Seminar<br>• Case Study<br>**Semester End Examination** |

## Learning Resources

1. Ethem Alpaydin, Introduction to Machine Learning, Fourth edition, MIT Press 2020.

2. Tom Mitchell, Machine Learning, McGraw-Hill, 2017.

3. Christopher Bishop. Neural Networks for Pattern Recognition, Oxford University Press, 1995.

4. Z. Ghahramani, Probabilistic Machine Learning: An Introduction, Cambridge, MA, USA: MIT Press, 2021.

5. A. Géron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, 2nd ed., Sebastopol, CA, USA: O'Reilly Media, 2019.

| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| Machine learning principles are highly relevant in today's data-driven world, powering advancements in various fields such as artificial intelligence, data science, and software engineering. A strong understanding of machine learning principles is highly sought after by employers across diverse industries, offering excellent career opportunities in fields like data analysis, research, and development. |

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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| **School** | School of Artificial Intelligence and Robotics |
| **Programme** | 4 + 1 Integrated UG and PG Programme |

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|---|---|---|---|
| **Course Title** | **Ethics in Artificial Intelligence** | | |
| **Course Type** | VAC | | |
| **Course Level** | 200-299 | | |
| **Course Code** | MG3VACUAI201 | | |
| **Course Overview** | The Ethics in AI course explores the moral, social, and legal implications of Artificial Intelligence technologies. It delves into the ethical considerations surrounding AI development, deployment, and use, examining issues such as bias, fairness, transparency, accountability, privacy, and the impact on society. This course provides a foundational understanding of the ethical dimensions of AI, preparing students to navigate the ethical challenges of developing and deploying AI technologies in a responsible and beneficial manner. | | |
| **Semester** | 3 | **Credit** | 3 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 60 | - | |
| **Pre-requisite** | Nil | | |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome | Learning Domains | PSO No. |
|---|---|---|---|
| | *Upon completion of this course, students will be able to;* | | |
| 1 | Analyze and evaluate the ethical implications of AI systems | U | 6,7 |

| | | | |
|---|---|---|---|
| 2 | Understanding of AI regulations and best practices for ethical AI development | An | 2,4 |
| 3 | Create informed discussions and debates about the ethical, social, and societal impacts of AI | A | 5,6 |
| 4 | Evaluate and propose solutions to ethical challenges in emerging AI technologies | A | 4,7 |

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| Introduction to AI Ethics-Importance of Ethics in AI-Key Ethical Principles: Fairness, Accountability, Transparency, and Privacy-Overview of AI Regulations-Case Studies: Ethical Failures in AI. | 15 | 1 |
| **Module 2** | **Hours** | |
| Bias and Discrimination in AI-Privacy and Data Protection Challenges-Explainability and Transparency in AI Systems-Accountability in Autonomous Decision-Making-Ethical Concerns in Emerging AI. | 20 | 2 |
| **Module 3** | **Hours** | |
| Designing Ethical AI Systems: Guidelines and Frameworks-Inclusive AI: Ensuring Diversity and Fairness-Sustainability and Environmental Impact of AI-Dual-Use Technologies: Misuse and Harm Prevention-The Future of Ethical AI: Opportunities and Challenges. | 10 | 3 |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning.<br><br>Interactive Instruction: Active co-operative learning, Seminar, Group Assignments.<br><br>Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative. |

| | |
|---|---|
| | **Field activities:** Debates and discussion. |
| **Mode of Assessment** | **Continuous Internal Assessment:**<br>• Internal Examinations<br>• Seminar Presentation<br>• Assignments<br>• Case Study<br>• Semester End Examination |

## Learning Resources


1. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, Second Edition, Pearson Education.
2. Stuart J. Russell, “Human Compatible: Artificial Intelligence and the Problem of Control”, Penguin Books Limited,2019 Edition.
3. Michael Kearns, Aaron Roth, "The Ethical Algorithm: The Science of Socially Aware Algorithm Design", November 1, 2019 by Oxford University Press.


| **Relevance of Learning the Course/ Employability of the Course** |
|---|
| Learning AI ethics is crucial for responsible development and deployment of AI systems. It helps mitigate harm by identifying and addressing biases, fosters public trust, and shapes the future of AI for the benefit of humanity. |

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | School of Artificial Intelligence and Robotics | | |
| **Programme** | 4 + 1 Integrated UG and PG Programme | | |
| **Course Title** | **IoT and Blockchain Technologies** | | |
| **Course Type** | Minor | | |
| **Course Level** | 200-299 | | |
| **Course Code** | MG4DSCUAI241 | | |
| **Course Overview** | The course introduces the essential concepts and applications of Internet of Things (IoT) and Blockchain technologies. Students will explore IoT architecture, smart objects and communication protocols well as the fundamentals of blockchain, smart contracts, and how IoT integrates with blockchain. | | |
| **Semester** | 4 | **Credit** | 4 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 60 | | |

| | |
|---|---|
| **Pre-requisite** | Computer networks, security and basic programming skills |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome<br>*Upon completion of this course, students will be able to;* | Learning Domains | PSO No. |
|---|---|---|---|
| 1 | Outline the genesis, design, architecture, and challenges of IoT, and evaluate its role in digital transformation. | U | 1,2,4 |
| 2 | Apply knowledge of sensors, actuators, and IoT communication networks to design and develop IoT systems. | A | 1,2,3,4 ,7 |
| 3 | Understand cryptographic methods and explain the fundamentals of blockchain technology. | U | 1,2, 4 |
| 4 | Assess the importance of consensus and decentralisation in blockchain and develop applications using smart contracts and Ethereum. | C | 1,2,3,4 ,7 |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| IoT -Genesis, IoT and Digitization, Challenges, IoT Network Architecture and Design, The core IoT Functional Stack, IoT Data Management and Compute Stack | 14 | 1 |
| **Module 2** | **Hours** | |
| Sensors, Actuators and Smart Objects, Sensor Networks, IoT Communication Protocols, IoT Network Layer, Developing IoT Systems. | 15 | 2 |
| **Module 3** | **Hours** | |
| Fundamentals of Cryptography- Symmetric and Asymmetric cryptography, Fundamentals of | 15 | 3 |

| | | |
|---|---|---|
| Blockchain Technology- Architecture, Types, Elements of Blockchain, Blockchain Use Cases | | |
| **Module 4** | **Hours** | |
| Consensus in Blockchain, Decentralization using Blockchain, Bitcoin, Mining, Wallets, Smart Contracts, Ethereum and Solidity, Integration of IoT and blockchain | 16 | 4 |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brainstorming lecture, Explicit Teaching, E- learning, Interactive Instruction: Active co-operative learning, Seminar, Group Assignments<br>Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative |
| **Mode of Assessment** | **Mode of Assessment**<br>A. Continuous Internal Assessment (CIA)<br>Internal Tests – Minimum two (Extended answers)<br>Seminar –<br>Research Literature review<br>Report writing<br>Presentation<br>Assignments – Written, Oral presentation and viva.<br>Case study<br>B. Semester End Examination |

## Learning Resources

1. Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms," Morgan Kaufmann, 2016.

2. Imran Bashir, "Mastering Blockchain," Packt Publishing, 2023.

3. David Hanes et al., "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases," Cisco Press, 2017.

4.Bahga and Madisetti, "Blockchain for IoT," VPT, 2018.

| Relevance of Learning the Course/ Employability of the Course |
| --- |
| This course equips students with skills relevant to the growing fields of IoT and blockchain, enhancing employability in industries such as smart manufacturing, logistics, healthcare etc. |

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | School of Artificial Intelligence and Robotics | | |
| **Programme** | 4 + 1 Integrated UG and PG Programme | | |
| **Course Title** | **Documentation and Presentation Tools** | | |
| **Course Type** | SEC | | |
| **Course Level** | 200-299 | | |
| **Course Code** | MG4SECUAI201 | | |
| **Course Overview** | This course provides comprehensive knowledge of popular documentation and presentation tools. It equips students with skills to create, format documents and presentations effectively. The course emphasizes real-world applications, fostering collaboration skills essential for academic and professional success. | | |
| **Semester** | 4 | **Credit** | 3 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 15 | 45<br><br>- | |

| | |
|---|---|
| **Pre-requisite** | Basic computer literacy and familiarity with word processing software. |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome<br><br>Upon completion of this course, students will be able to; | Learning Domains | PSO No. |
|---|---|---|---|
| 1 | Create documents using MS Word, LaTeX, and LibreOffice, utilizing features. Create and compile LaTeX documents. | U | 2,3,4, 6 |
| 2 | Create and format tables, customize charts, automate tasks using macros, and integrate multimedia and interactive elements in MS Word or LibreOffice for professional document creation. | C | 2,3,4, 6,7 |
| 3 | Create presentations, banners, and posters using PowerPoint, Google Slides, Canva, and Adobe Express. | C | 3,4,6, 7 |
| 4 | Design and develop professional documents, presentations, and creative materials using advanced features of MS Word, LaTeX, LibreOffice, PowerPoint, Google Slides, Canva, and Adobe Express | C | 2,3,4, 6,7 |

*(Learning Domains: Remember (R ), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| Overview of popular documentation tools: MS Word, LaTeX, and LibreOffice<br>MS word: Spell-check and grammar review, saving in multiple formats (DOCX, PDF).<br>LaTeX: Inserting equations, tables, and figures, bibliography management using BibTeX, compilation through LaTeX editor. | 20 | 1,4 |
| **Module 2** | **Hours** | |
| Creating and formatting tables with advanced features like merging cells, adding borders, and sorting data, | 22 | 2 |

| | | |
|---|---|---|
| along with inserting and customizing charts such as bar, line, and pie charts for data visualization in MS Word or LibreOffice. Recording and creating macros using VBA in MS Word to automate tasks. Embedding and formatting multimedia elements such as images, videos, and audio clips while integrating interactive features like hyperlinks and bookmarks. | | |
| **Module 3** | **Hours** | |
| Overview of presentation softwares: PowerPoint, Google Slides, Canva and Adobe Express. Create presentations, banners and posters using these softwares. | 18 | 3,4 |

| | |
|---|---|
| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brainstorming lecture, Explicit Teaching, E- learning<br>Interactive Instruction: Active co-operative learning, Seminar, Group Assignments<br>Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative |
| **Mode of Assessment** | **Continuous Internal Assessment (CIA)**<br>• Two Internal Tests<br>• Seminar<br>• Assignments<br>**Semester End Examination** |

**Learning Resources**

1. Microsoft, Microsoft Word Documentation, Microsoft Corporation, 2020.

2. Lamport, Leslie, “LaTeX: A Document Preparation System”, Addison-Wesley, 1994.

3. Google, Google Slides Help Documentation, Google LLC, 2023.

4.Canva, Canva Design School, Canva, 2023.

5. Adobe, Adobe Express: Create & Design, Adobe Inc., 2023.

6. Bruce Byfield, “Designing with LibreOffice”, Friends of Opendocument, Inc.2016.

| **Relevance of Learning the Course/ Employability of the Course** |
| --- |
| This course focuses on acquiring essential skills in documentation and presentation tools such as MS Word, LaTeX, Google Slides, Canva, and Adobe Express. Mastery of these tools enhances the ability to create professional documents, reports, presentations, and visual content, which is crucial in various fields including business, academia, marketing, and design. |

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| | **MAHATMA GANDHI UNIVERSITY**<br><br>**Graduate School** |
| | **4 + 1 Integrated UG and PG Programme** |

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|---|---|---|---|
| **School** | School of Artificial Intelligence and Robotics | | |
| **Programme** | 4 + 1 Integrated UG and PG Programme | | |
| **Course Title** | **AI for Sustainable Development** | | |
| **Course Type** | VAC | | |
| **Course Level** | 200-299 | | |
| **Course Code** | MG4VACUAI201 | | |
| **Course Overview** | This course explores the transformative potential of Artificial Intelligence to address global sustainability challenges. The course will cover a range of AI applications, including machine learning, deep learning, and natural language processing, and examine ethical considerations and potential risks associated with AI for sustainability. | | |
| **Semester** | 3 | **Credit** | 3 |
| **Total Student Learning Time** | **Instructional hours for theory** | **Instructional hours for practical/lab work/field work** | |
| | 60 | - | |
| **Pre-requisite** | Nil | | |

**COURSE OUTCOMES (CO)**

| CO No. | Expected Course Outcome<br><br>*Upon completion of this course, students will be able to;* | Learning Domains | PSO No. |
|---|---|---|---|
| 1 | Understanding of the Sustainable Development Goals and the potential of AI to contribute to their achievement. | U | 4,7 |
| 2 | Analyze the environmental and social impacts of AI technologies. | An | 3,5,7 |
| 3 | Create best practices for developing and deploying AI for sustainable development. | A | 2,4 |
| 4 | Evaluate emerging AI applications for sustainability, such as environmental monitoring, conservation, and the circular economy. | A | 4,7 |

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S))

**COURSE CONTENT**

| **Module 1** | **Hours** | **CO No** |
|---|---|---|
| Introduction to Sustainable Development Goals-Role of AI in Achieving Global Sustainability-Key Areas: Climate Action, Healthcare, Agriculture, and Education-Challenges of AI: Energy Usage and Ethical Concerns. | 15 | 1 |
| **Module 2** | **Hours** | |
| Environmental Impact of AI: Energy and Resource Consumption-Green AI: Strategies for Energy-Efficient Algorithms-Social Impact: Inclusivity and Equity in AI Applications-Ethical Challenges in AI for Sustainable Development. | 20 | 2 |
| **Module 3** | **Hours** | |
| Frameworks for Sustainable AI Development-AI Applications for Environmental Monitoring and Conservation-Policies and Practices for Responsible AI | 10 | 3 |

| | | |
|---|---|---|
| Deployment-Future Trends: AI for Circular Economy and Green Technologies. | | |

| | |
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| **Mode of Transaction** | **Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning.<br><br>Interactive Instruction: Active co-operative learning, Seminar, Group Assignments.<br><br>Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative.<br><br>**Field activities:** Debates and Discussion. |
| **Mode of Assessment** | **Continuous Internal Assessment:**<br><br>• Internal Examinations<br>• Seminar Presentation<br>• Assignments<br>• Case Study<br>• Semester End Examination |

## Learning Resources


4. Henrik Skaug Sætra, "AI for the Sustainable Development Goals", CRC Pr I Llc, 1st edition (24 February 2022).
5. Shashank Awasthi, Carlos M. Travieso-González, Goutam Sanyal, Dinesh Kumar Singh, "Artificial Intelligence for a Sustainable Industry 4.0", Springer (21 October 2021).
6. Dr. Prashant Kumar, Dr. Harish Kumar Yadav, Mamta Rawat, Dr. Rohit Kumar, "Ai for Sustainability: Innovative Solutions for Global Challenges", Red Unicorn Publishing.


| **Relevance of Learning the Course/ Employability of the Course** |
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| The relevance of learning AI for sustainable development lies in its potential to revolutionize how we address global challenges. By understanding how AI can be harnessed for climate action, resource management, and social equity, we can contribute to a more sustainable future. |