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 MG7DSEUAI423 MG7DSEUAI424	1. Reinforcement Learning 2. Fuzzy Logic and Nature inspired Computing 3. Digital Image Processing	4	3	1	“	Minor A(E)
MG7DSEUAI441 MG7DSEUAI442 MG7DSEUAI443	1. Robotics and Intelligent Systems 2. Cyber Physical Systems 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 **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. 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. Interactive Instruction: Active co-operative learning, Seminar, Group Assignments. Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative. **Field activities:** Challenges AI, Hackathon.
Mode of Assessment	**Continuous Internal Assessment:** • Internal Examinations • Seminar Presentation • Assignments • Case Study • 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.

	MAHATMA GANDHI UNIVERSITY **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:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning Interactive Instruction: Active co-operative learning, Seminar, Group Assignments 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)** • Two Internal Tests • Assignments–Written, Practical • Seminar • Case Study **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.

`

	MAHATMA GANDHI UNIVERSITY **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 *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 Interactive Instruction: Active co-operative learning, Seminar,

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

	MAHATMA GANDHI UNIVERSITY **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. 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. 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. 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 Interactive Instruction: Active co-operative learning, Seminar, Group Assignments Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative
Mode of Assessment	**Continuous Internal Assessment (CIA)** • Two Internal Tests • Assignments • Seminar • Case Study **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.

	MAHATMA GANDHI UNIVERSITY **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. 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 Interactive Instruction: Active co-operative learning, Seminar, Group Assignments Authentic learning: Library work and Group discussion, Presentation by individual student/Group representative
Mode of Assessment	**Continuous Internal Assessment (CIA)** • Two Internal Tests • Seminar • Assignments **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.

	MAHATMA GANDHI UNIVERSITY **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	**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 *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. 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. 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. Types of actuators used in robotics: DC motors, servos, stepper motors, Introduction to actuator control and interfacing., Introduction to robot control systems. Basics of robot programming, Introduction to robot programming languages.	**15**	**2,4**

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