AIL332	ROBOTICS LAB	Category	L	T	P	Credit	Year of Introduction
		PCC	0	0	3	2	2022

Preamble: Robotics lab provides students with exposure to the common sensor and actuator interfacing, setting up mobile robots and familiarising intelligent systems.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Interface different peripherals to arduino board
CO 2	Assemble a mobile robot with different sensors and actuators..
CO 3	Familiarise about localisation of mobile robots
CO 4	Impart intelligence to robot using standard algorithms.
CO 5	Familiarise the robot navigation

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										✓
CO2	✓	✓										✓
CO3	✓	✓			✓							✓
CO4	✓	✓	✓	✓	✓							✓
CO5	✓	✓	✓	✓	✓							✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Lifelong learning

Assessment Pattern

Bloom's Category	Continuous Assessment Test (Internal Exam) Marks in percentage	End Semester Examination Marks in percentage
Remember	**20**	**20**
Understand	**20**	**20**
Apply	**60**	**60**
Analyze		
Evaluate		
Create		

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	**75**	**75**	**2.5**

Continuous Internal Evaluation Pattern:

Attendance : **15 marks**

Continuous Evaluation in Lab : **30 marks**

Continuous Assessment Test : **15 marks**

Viva voce : **15 marks**

Internal Examination Pattern: The Internal examination shall be conducted for 75 marks, which will be converted to out of 15 while calculating Internal Evaluation marks. The marks will be distributed as,

Preliminary work : 15 Marks,

Implementing the work/Conducting the experiment : 10 Marks

Performance, result and inference (usage of equipment and troubleshooting) : 25 Marks,

Viva voce : 25 Marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work : 15 Marks

(b) Implementing the work/Conducting the experiment : 10 Marks

(c) Performance, result and inference (usage of equipment and troubleshooting) : 25 Marks

(d) Viva voce : 25 Marks

General instructions:

Practical examination to be conducted immediately after the second series test covering the entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

ROS Essentials

• Installing and Configuring Your ROS Environment—ROS Kinetic/Melodic/Compatible versions
• Familiarisation with ROS (Master, nodes, topics, messages, services, parameters and actions)
• Familiarisation with ROS Tools – Gazebo , Moveit , Rviz
• Creating Workspace and Package in ROS

LIST OF EXPERIMENTS
Any 4 experiments from each group are mandatory

Part A: Interfacing sensors and actuators

1. Familiarisation of Arduino IDE,Arduino microcontroller I/O interfacing(LED, LCD,Serial Monitor)
2. Interfacing IR and Ultrasonic sensor with Arduino
3. Interfacing DC motors with arduino - speed and direction control
4. Interfacing Servo Motors with Arduino - angle of rotation
5. Calibration of sensors-sonar, IR sensors and obtain the calibration curve
6. Mobile Robot assembly
7. Networking with Arduino: GSM and Bluetooth

Part B: Intelligent systems

8. Writing a Simple Publisher and Subscriber, Simple Service and Client,Recording and playing back data, Reading messages from a bag file(Python/C++)
9. Localization of a mobile robot using LIDAR (ROS)
10. Touch Sensors interfacing and feedback system
11. Line following Robot using IR sensor
12. Obstacle avoidance of a mobile robot while moving to a point.
13. Object detection using any one standard algorithm
14. Navigation simulation using turtlebot using ROS

Reference Books

1. Siegwart, Roland, Introduction to Autonomous Mobile Robots, Cambridge, Mass. : MIT Press, 2nd ed.
2. Peter Corke, Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Springer 2021
3. John. J. Craig, Introduction to Robotics (Mechanics and control), Pearson Education Asia 2002.
4. S K Saha, Introduction to Robotics by Mc Graw Hill Education, 2014.
5. R K Mittal and I J Nagrath, “Robotics and Control”, Tata McGraw Hill, New Delhi,2003.
6. Dahiya, Ravinder S., Valle, Maurizio, Robotic Tactile Sensing, Springer, 2013.
7. https://emanual.robotis.com/docs/en/platform/turtlebot3/simulation/