BIX - 01

2020-21

Dr G R DAMODARAN COLLEGE OF SCIENCE (AUTONOMOUS)
COIMBATORE - 641014
PG Diploma in Robotics (Part-Time)
(Under Choice Based Credit System)
EFFECTIVE FOR THE STUDENTS ADMITTED DURING THE ACADEMIC YEAR 2020-2021

Programme Outcome	
PO1	To acquire knowledge on robotics, necessary to do the analysis study and to identify the anatomy of robotics.
PO2	Devise, discover, and analyze various components and its concepts which lead to further study.
PO3	Identify and Choose the solution for the problems and learning on different applications that meets the specific standard.
PO4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Create, select, and apply appropriate techniques, and use resources to work with different robotics applications by understanding its limitations.
PO6	Apply the skills to develop a prototype for societal, health, safety measures and environmental solutions.
PO7	To understand the impact of robotics solutions in a global, economic, and environmental and demonstrate the knowledge need for sustainable development.
PO8	An ability to communicate and present effectively on activities, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO9	Demonstrate knowledge and understanding of the robotics principles for managing projects in multidisciplinary environments.
PO 10	Identifying the need and have the preparation and ability to engage in acquiring life-long learning, based on the technological demands.

Programme Specific Outcome	
PSO1	Analyze, design and implement robotic applications by applying the knowledge on robotics, components, and problem solving skills.
PSO2	Identify, formulate and develop methodology for various issues in the society.
PSO3	Ability to adapt for rapid changes in tools and technologies with the understanding of societal and ecological issues.
PSO4	Provide cost effective design solutions for various robotics applications.
PSO5	Gain knowledge in diverse areas of robotics and experience an environment conducive in cultivating skills for successful career, higher studies and entrepreneurship.

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SCHEME OF EXAMINATIONS

Sem.	Course Code	Course Name	Credits	MARKS			Hrs. / Week	Exam. Duration (Hrs.)	Category
				CA	TEE	TOTAL			
I	20187A	Core: Fundamentals of Robotics	5	25	75	100	4	3	THEORY
II	20287A	Core: Microcontrollers and Embedded Systems	5	25	75	100	4	3	THEORY
	20287P	Core: Embedded and Robotics Lab	4	40	60	100	2	3	PRACTICAL
III	20387S	Core: Case Study - Robotics*	6	100	NA	100	2	-	PRACTICAL
	20387A	Core: Applications and Prototype Development in Robotics	5	25	75	100	5	3	THEORY
IV	20487S	Core: Project and Viva-Voce	20	25	75	100	-	-	PRACTICAL
			45			600			

Case Study - Robotics* Split up	
Total (100 Marks)	
Document	50 Marks
Presentation	50 Marks

Project and Viva Voce Split up	
CA (25 marks)	
Review I	10 Marks
Review II	15 Marks
TEE (75 Marks)	
Viva	50 Marks
Documentation	25 Marks

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MAPPING OF COURSES WITH PROGRAMME OUTCOME LEVELS

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
20187A	Core: Fundamentals of Robotics	3	3								
20287A	Core: Microcontrollers and Embedded Systems	3	3	1							
20287P	Core: Embedded and Robotics Lab	3	3	3	2	3					
20387S	Core: Case Study - Robotics*	3	3	3	3	3	3	2	3		
20387A	Core: Applications and Prototype Development in Robotics	1	2	3				1		3	3
20487S	Core: Project and Viva-Voce	3	3	3	3	3			3		

Indicators: 1. Reasonable 2. Significant 3. Strong

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Semester	Course Code	Course Title	Credits	Theory/ Practical	Problems %	Theory %
FIRST	20187A	CORE: FUNDAMENTALS OF ROBOTICS	5	Theory	-	100

Objective of the course: The objective of the course is to introduce the basic components of embedded systems and robotics. This course also introduce some of the interfacing IDEs with Robot.

Unit I: Introduction and Law **(Teaching hours: 8)**

Fundamentals of robot Technology: Robotics and programmable automation – Laws of robotics – Robotics Systems and Robot anatomy: Robot Manipulator and Wrist – Robot Reference frame and Coordinate system – Work envelopes – Robot Wrists – Robot End effectors – Accuracy and repeatability – Types of controls.

Unit II: Sensors & Motors **(Teaching hours: 8)**

Sensors & Motors: Analog I/O and Digital I/Os – Sensors: Types of sensors – LM35 Temperature sensor – IR Sensors – Range Finders – LDR. Motors: DC Motors – AC Motors – Servo Motors – Working with Servo Motors – Working with DC Motors – Assignment: DC Motor Control.

Unit III: Interfacing Motors, LCD & LED **(Teaching hours: 8)**

Interfacing with Stepper motor – Assignment: Interfacing IR Proximity Sensors. Port Manipulation – 7-segment LED – Working with the LCD Displays – Working with Storage – Internal EEPROM – Working with Interrupts – Assignment: Interfacing with 7 segment display.

Unit IV : A Classical Example - Humanoid **(Teaching hours: 8)**

Bioloid, Humanoid robot introduction – components – Mobile robots: Introduction – working principle – working with RoboPlus – Motion Controller.

Unit V Robot Languages and Programming **(Teaching hours: 8)**

Robot Languages and Programming: Introduction to robot languages – Classification of robot languages - ROBOTC programming – AVR studio – Microcontroller programming using C – IDE — Introduction to Simulators – VSE.
Introduction to Building a Line Follower using Various Logics – Assignment: Design of Line Follower Robot.

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Course Outcome mapping with Knowledge level

Course Outcome	CO Statement	Knowledge level
CO1	Aware and Understand the basic concepts of robot, robotics systems and its anatomy.	K1, K2
CO2	Explore and Use the sensors, motors and its types.	K1,K2,K3
CO3	Strengthen their knowledge on Interfacing Motors, LCD, LED, interrupts	K1,K2
CO4	Enable the students to know about different classification of robots.	K1,K2,K4
CO5	Acquire necessary knowledge in robot languages and programming	K1,K2,K3

Note:
K1- Remembering; K2 – Understanding; K3 – Applying; K4 – Analysing; K5 – Creating & Evaluating.

Course Outcome mapping with Programme outcome

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3							2	
CO2	3	2	1	2	1	2				
CO3	2	2	2		2	2				
CO4	2	3	3	3	1				2	2
CO5	2	2		2	2	3	2	1	2	2

Indicators: 1. Reasonable 2. Significant 3.Strong

Reference Books				
S.No.	Title	Author	Publishers	Year of Publications, Edition
1	Introduction to Robotics analysis, Systems & Applications	Saeed B. Niku	Pearson Education Singapore Pvt. Ltd.,	2011
2	Robotic Technology and Flexible Automation	S. R. Deb	Tata McGraw Hill Publishing Co. Ltd.	2010
3	Robotics	Bajd.T, Mihelj M, Lenarcic J, Stanovnik A, Munih M	Springer	2010

Pedagogy: Lecture, PPT presentation, e-content seminar, Assignment, Quiz, Group Discussion

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Semester	Course Code	Course Title	Credits	Theory/ Practical	Problems %	Theory %
SECOND	20287A	CORE: MICROCONTROLLERS AND EMBEDDED SYSTEMS	5	Theory	-	100

Objective of the Course: The objective of this course is to introduce embedded system design environment. The course covers microcontrollers, third programming and interfacing techniques.

Unit I: Atmega 2560 Microcontroller **(Teaching hours: 8)**

Microprocessors, Microcontrollers – Basic differences between Microprocessors and Microcontroller – Atmega 2560 Micro controller – Introduction to Atmega 2560 Microcontroller – Architecture – Registers – Internal and External Memory – Instruction Set – On Chip Counters / Timers – Serial I/O – Interrupts and their use.

Unit II: Pic Microcontrollers **(Teaching hours: 8)**

PIC Microcontrollers: Introduction to PIC C6X microcontrollers – types – architecture – registers – Internal and External Memory – Instruction Set – On Chip Counters / Timers – Serial I/O – Interrupts and their use.

Unit III: ARM7TDMI **(Teaching hours: 8)**

ARM7TDMI(Advanced RISC Machines): Introduction to ARM7TDMI Microcontroller – types – architecture – registers – Internal and External Memory – Instruction Set – On Chip Counters/Timers– Serial I/O – Interrupts and their use.

Unit IV: Overview of Embedded Systems **(Teaching hours: 8)**

Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits – Embedded Programming – an Overview.

Unit V: Serial I/O Devices **(Teaching hours: 8)**

Serial I/O Devices: RS232 Specifications – RS422/RS423/RS435 – other communication protocols – Introduction to Universal Robot Body Interface (URBI) and VPL. CASE STUDIES: Industrial Applications.

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Course Outcome mapping with Knowledge level

Course Outcome	CO Statement	Knowledge level
CO1	Identify and Exhibit on Microprocessors, Microcontrollers, and Atmega 2560 Microcontroller concepts.	K1,K2
CO2	Understanding about PIC Microcontrollers with its architecture, storage, interrupts.	K2,K3
CO3	Explain ARM7TDMI microcontrollers architectures, instruction set, and registers.	K2,K3
CO4	Expose on embedded systems, Exemplary Embedded Systems, Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.	K1,K2
CO5	Bring to the Serial I/O Devices with the case study on industrial applications is discussed.	K1,K2,K3

Note: K1- Remembering; K2 – Understanding; K3 – Applying; K4 – Analysing; K5 – Creating & Evaluating.

Course Outcome mapping with Programme outcome

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2			2					1
CO2	2	2			3					
CO3	3	2			3					
CO4	2	2			2				2	
CO5	1	3	3	1	1	1	2		2	3

Indicators: 1. Reasonable 2. Significant 3.Strong

Reference Books

S.No.	Title	Author	Publishers	Year of Publications
1	The 8051 Micro Controller & Embedded Systems	M.A. Mazadi & J.G. Mazidi	Pearson Education	Asia -2013
2	8051 Microcontroller Architecture, Programming and Application	M. Mahalakshmi	University Science press	2012
3	Microcontrollers: Architecture, Programming, Interfacing and System Design	Raj Kamal	Pearson edition	2011
4	An Embedded Software Primer	David E. Simon	Pearson Education	First Edition, 2002
5	http://www.eecs.umich.edu/~panalyzer/pdfs/ARM_doc.pdf			
6	http://www.sunrom.com/files/P89V51RD2.pdf			

Pedagogy: Lecture, PPT presentation, e-content seminar, Assignment, Quiz, Group Discussion

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Semester	Course Code	Course Title	Credits	Theory/ Practical	Problems %	Theory %
SECOND	20287P	CORE: EMBEDDED AND ROBOTICS LAB	4	Practical	-	-

Objective: To introduce and work on microcontrollers and sensors. To experiment embedded applications with various interfacing methods.

1. **Basics/Digital I/O's**
   - Microcontroller IDE & Driver Installation
   - Board Overview
   - Toggling of LED
2. **Analog I/O's, Sensors & Motors**
   - Working with Analog Outputs
   - Working with Analog Inputs-Sensors
   - Working with Servo Motors
   - Working with DC Motors
   - Stepper motor interfacing
3. **Sensor Construction & IO Expansion**
   - Sensor Construction-IR Proximity Sensor
4. **Advanced IO, Displays, Storage & Interrupts**
   - Advanced IO Operations-Port Manipulation -7- segment LED
   - Working with the LCD Displays
5. **Robotics:**
   - Robotics Building a Line Follower using Various Logics

Course Outcome mapping with Knowledge level

Course Outcome	CO Statement	Knowledge level
CO	Design, implement, test and debug various application programs using Firebird V Robot.	K1,K2,K3,K4,K5

Note: K1- Remembering; K2 – Understanding; K3 – Applying; K4 – Analysing; K5 – Creating & Evaluating.

Course Outcome mapping with Programme outcome

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO	3	3	2	3	2	2			1	3

Indicators: 1. Reasonable 2. Significant 3.Strong

Pedagogy: PPT presentation, Demo, Exercises

B Ix -09

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Semester	Course Code	Course Title	Credits	Theory/ Practical	Problems %	Theory %
THIRD	20387S	CORE: CASE STUDY – ROBOTICS	6	Practical	-	-

Course Outcome mapping with Knowledge level

Course Outcome	CO Statement	Knowledge level
CO	To understand the basic concepts of Robotics and various sensors used in Robots. To apply the knowledge of Robotics and design the Robots to work with real time applications like smart Home, Hospitals, Industry etc.,	K2, K3, K4, K5

Note: K1- Remembering; K2 – Understanding; K3 – Applying; K4 – Analysing; K5 – Creating & Evaluating.

Course Outcome mapping with Programme outcome

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO	3	2	2	3	3	3	3	1	3	2

Indicators: 1. Reasonable 2. Significant 3.Strong

Pedagogy: PPT presentation

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Semester	Course Code	Course Title	Credits	Theory/ Practical	Problems %	Theory %
THIRD	20387A	CORE: APPLICATIONS AND PROTOTYPE DEVELOPMENT IN ROBOTICS	5	Theory	-	100

Objective of the Course:
To impart knowledge on various fields that facilitates the robotics applications. Every unit is intended to discuss with case studies of the different application domains using Robotics.

UNIT I: Smart home **(Teaching hours: 08)**

Smart home environment – enabling robot based security and tracking system – smart electrical system of a house

UNIT II: Robots in Industries **(Teaching hours: 08)**

Industrial Robots – Pick and Place Robots – Transport and Logistics – design of an autonomous vehicle – control of a vehicle from remote location – GPS tracking of vehicles.

UNIT III: Robots in science **(Teaching hours: 08)**

Features of robots in Bioscience experiments – Ant Robotics – Swarm Robots – Nano robotics in Medical Fields – Surgical Robots.

UNIT IV: Robots in computing **(Teaching hours: 08)**

Robots in Natural Language Processing – Computer Vision Robots – Robots in Pattern Recognition.

UNIT V: Robots in security **(Teaching hours: 08)**

Robots in National Security System – Robots for Army – Land based systems – Robots in Air based Systems – Robots for Waterways.

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Course Outcome mapping with Knowledge level

Course Outcome	CO Statement	Knowledge level
CO1	To introduce smart home environment and its advantages	K1, K2, K4,K5
CO2	To gain knowledge on application of robotics in various industries	K1, K2, K4,K5
CO3	To know the applications of robotics in science and research	K1, K2, K4,K5
CO4	To acquaint the application of robotics in computing	K1, K2, K4,K5
CO5	To impart the need and application of robotics in national security	K1, K2, K4,K5

Note: K1- Remembering; K2 – Understanding; K3 – Applying; K4 – Analysing; K5 – Creating & Evaluating.

Course Outcome mapping with Programme outcome

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	1	2	2	1	3	3	3	3	3
CO2	2	1	2	3	1	3	2	3	3	3
CO3	2	1	2	2	1	3	3	3	3	3
CO4	2	1	2	3	1	3	3	1	3	3
CO5	2	1	2	2	1	2	3	1	3	3

Indicators: 1. Reasonable 2. Significant 3.Strong

Reference Books				
S.No.	Title	Author	Publishers	Year of Publications and Edition
1	Surgical Robotics: Systems applications and vision	Jacob Rosen et al	Springer LLC	2011
2	Nanorobotics – Current Approaches and Techniques	Mavroidis, Constantinos, Ferreira, Antoine	Springer	2012
3	PIC Robotics	John Iovine	McGraw Hill	2004

Pedagogy: Lecture, PPT presentation, e-content seminar, Assignment, Quiz, Group Discussion