SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)
Syllabus with effect from the Academic Year 2021-2022

MCA (Master of Computer Applications)
MCA (Master of Computer Applications) Semester II

Course Code	PS02EMCA60	Title of the Course	EMBEDDED SYSTEMS AND IoT
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	1. To learn the fundamentals of embedded systems. 2. To understand the concepts, techniques, characteristics and applications of Internet of Things. 3. To gain an understanding of developing small/medium sized IoT projects using AVR, Arduino and other components. 4. To gain an understanding of developing IoT projects using the Raspberry Pi.

Course Content		
Unit	Description	Weightage* (%)
1.	**Introduction to Embedded Systems** – An introduction to embedded systems – Types and applications of embedded systems – The embedded system constraints: processing constraints, memory constraints, input/output constraints, response time constraints, predictability/reliability constraints – Processing units: microprocessors, microcontrollers, SoCs, ASICs, DSPs, FPGAs, etc. – Unique characteristics of embedded systems programming	25
2.	**Introduction to Internet of Things** – Definition and characteristics of Internet of Things (IoT) – Applications of IoT in various domains – Hardware elements of IoT and their characteristics – Communication protocols commonly used with IoT – Sensors, actuators and other devices employed in IoT – Security and privacy concerns in IoT	25
3.	**Development of Small/Medium Sized IoT Projects** – Introduction to AVR microcontollers – Introduction to the Arduino – Interfacing with the Arduino – Arduino shields – Arduino programming and the Arduino IDE	25

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	– Wireless control and communications with the Arduino	
4.	**Development of IoT projects using the Raspberry Pi** – Introduction to the Raspberry Pi – Installing operating system and software on the Raspberry Pi – Interfacing with the Raspberry Pi – Raspberry Pi hats – Developing projects using the Raspberry Pi	25

Teaching-Learning Methodology	Blended learning approach incorporating traditional classroom teaching as well as online / ICT-based teaching practices

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	demonstrate an understanding of the fundamentals of embedded systems.
2.	have knowledge of the definition, characteristics and applications of Internet of Things.
3.	gain familiarity with the hardware elements of IoT and the communication protocols commonly used with IoT.
4.	work with sensors, actuators and other devices.
5.	have an appreciation of security and privacy issues with IoT.
6.	possess basic knowledge of developing AVR/Arduino based IoT projects.
7.	possess basic knowledge of developing Raspberry Pi based IoT projects.

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Suggested References:	
Sr. No.	References
1.	Prasad, K. V. K. K.: Embedded / Real-Time Systems – Concepts, Design & Programming Black Book, New Edition, Dreamtech Press, 2009.
2.	Bahga, A., Madisetti, V.: Internet of Things – A Hands-on Approach, Universities Press, 2014.
3.	Hoile C., et al.: Make – Raspberry Pi and AVR Projects, MakerMedia, 2014. Margolis, M.: Arduino Cookbook, O'Reilly, 2nd Edition, 2011.
4.	Margolis, M.: Arduino Cookbook, O'Reilly, 2nd Edition, 2011.
5.	Halfacree, G.: The Official Raspberry Pi Beginner's Guide, Raspberry Pi Press, 2018.
6.	Hughes, J. M.: Arduino – A Technical reference, O'Reilly (SPD), 2017.
7.	Monk, S.: Raspberry Pi Cookbook, O'Reilly (SPD), 2014.
8.	Richardson, M., Wallace, S.: Make – Getting Started with Raspberry Pi, 2nd Edition, MakerMedia, 2015.

On-line resources to be used if available as reference material	
1.	Embedded Systems, Wikibook, https://en.wikibooks.org/wiki/Embedded_Systems.
2.	The Official Raspberry Pi Beginner's Guide (online), https://www.raspberrypi.org/magpi-issues/Beginners_Guide_v1.pdf.
3.	The Official Raspberry Pi Projects Book (online), https://www.raspberrypi.org/magpi-issues/Projects_Book_v1.pdf .

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