Paper code: ARI 306	L	T/P	Credits
Subject: Embedded Systems	4	0	4

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: As per University Norms
➤ There should be 9 questions in the end term examination question paper
➤ Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
➤ Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
➤ The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
➤ The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes Bloom's Knowledge Level (KL):	
CO1	Students will Understand the importance, use and architecture of Microcontrollers [**K1,K2,K3**]
CO2	Ability of students to understand the AVR Microcontroller and apply the knowledge for its detailed configuration. [**K1,K2,K3**]
CO3	Analyze the various modes and timers of AVR microcontroller along and evaluate output with the C program of AVR. [**K4,K5**]
CO4	Understand the interfacing of AVR microcontroller and apply it to various electronic and electrical devices. [**K2,K3**]]

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	3	3	3	2	2	-	-	-	-	1	1	2
CO2	3	3	2	3	3	-	-	-	1	1	2	2
CO3	3	3	2	3	3	-	-	-	1	1	2	3
CO4	3	3	2	3	3	-	-	-	1	1	2	3

Course Content	No of lectures
Unit I **Introduction of Embedded System:** Overview of Embedded Systems, Features, Requirements and Applications, Recent Trends in the Embedded System Design, Common architectures for the Embedded System Design, Embedded Software design issues. Introduction to microcontrollers, Overview of Harvard architecture and Von Neumann architecture, RISC and CISC microcontrollers, Architecture of 8051, Pin Function of 8051 microcontroller.	[8]

Unit II **AVR Microcontroller:** Introduction to AVR Microcontroller, Architecture and Pin Configuration, Register and memory mapping, Status Register, Instruction set, Data Transfer Instructions, Arithmetic and Logic Instructions, Branch Instructions, Bit and Bit-test Instructions, MCU Control Instructions, Delay time loop.	[10]
Unit III **Interrupts and Timer:** Introduction to System Clock, Reset sources, Introduction to interrupts, External interrupts, UART- Basic Operation, I/O Register configuring, IO Ports, 8-bit and 16-bit Timer block diagram, Modes- Output Compare Mode, Fast PWM Mode, CTC Mode, Simple programs in C Language, AVR I/O Port Programming.	[12]
Unit IV **Peripherals Interfacing:** Analog Comparator, ADC, DAC and sensor interfacing, Serial Peripheral Interface (SPI), The Universal Synchronous and Asynchronous serial Receiver and Transmitter (USART), Two Wire Interface (TWI), I2C Protocol and RTC interfacing, 7-Segment LED Display, LCD and Keyboard Interfacing, Opto-isolator and Stepper Motor Interfacing, Relay.	[10]

Text Books:

[T1] Muhammad Ali Mazidi,Shujen Chen, Sepehr Naimi,Sarmad Naimi, Embedded Programming using C Language, 1st Edition, Freescale ARM Cortex-M.

[T2] Dhananjay Gadre, (2001) Programming and Customizing the AVR Microcontroller, McGraw Hill, Education.

Reference Books:

[R1] Steve Ferbur, ARM System on Chip.

[R2] Rajkamal, Embedded System: Architecture, Programming and Design, TMH3.