Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title	: **Microcontroller Lab**	Course Code	: **15EC46P**
Credits	: **3 Credits**	Semester	: **4**
Teaching Scheme in Hrs (L:T:P)	: **0:2:4**	Course Group	: **Core**
Type of course	: **Tutorial + Practical**	Total Contact Hours	: **78**
CIE	: **25 Marks**	SEE	: **50 Marks**

Prerequisites

Knowledge of instruction set of 8051 and exposure to C programming language

Course Objectives

Imparting on hands on exposure to the students in the usage of development tools and to make them proficient in building 8051 based applications.

Course Outcomes

At the end of the course, the students will be able to obtain the following COs

Course Outcome		CL	Experiments linked	Linked PO	Teaching Hrs
CO1	Select and use a standard IDE for editing, compiling, debugging and simulation of ALP/C programs (program development).	***R/U/A***	Unit -1, Program 1	1,2,4,10	06
CO2	Adjudicate the right usage of assembly language instructions and Embedded C features.	***U/A***	Unit -1, Program 2 to 10	1,2,3,4,10	33
CO3	Write programs for simple I/O, delay generation and standard interfaces.	***U/A***	Unit -1, Program 11 to 16	1,2,3,4,10	24
CO4	Adapt the existing code for development of simple real-world applications-student activity	***U/A***	Unit-2/ Project activity	1,2,3,4,5,8,9, 10	09
Total sessions include two tests					**78**

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Microcontroller Lab	**3**	**3**	**3**	**3**	**1**	**--**	**--**	**1**	**1**	**3**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Contents

Unit-1: Tutorials and Graded Exercises 69 Hours

Sl. No.	Topic/Exercises	Duration (Hr)
	Practicing Exercise	
1	Identification of program development tools and familiarization of program development using such tools.	6
	Basic experiments (Use ALP and embedded C on simulators or kits)	
2	Data movement: (a) Move a block of data within internal RAM (b) Exchange a block of data between internal RAM and external memory	3
3	Arithmetic operations: (a) Evaluate simple arithmetic expression such as *y= (((5*2)-(4+1))/3) %2*. (b) Addition of three 8-bit BCD numbers to result in BCD form.	3
4	Logical operations: (a) Evaluate simple logical expression such as *Y= a&&b||c^!d* where *a, b, c* and *d* are 8-bit data (b) Rotation or shift operations on 16-bit data (c) Convert data to even-parity in a block of internal RAM	6
5	Code conversions (a) Packed BCD to unpacked BCD and vice-versa (b) BCD to binary and vice-versa (b) BCD to ASCII and vice-versa	6
6	Program to search a given 8-bit number in an array of N numbers	3
7	Program to sort N 8-bit numbers.	3
8	Program to count the number of ones and zeros in the data saved in two consecutive memory locations	3
9	Program to clear all the bytes (stored in internal RAM) which have odd-parity	3
10	Program to toggle a particular bit in the internal RAM with the delay of *N* ms given the clock frequency *f* MHz with the use of delay subroutine.	3
	Interfacing experiments (using embedded C and microcontroller boards)	
11	Program to toggle the LED with tone using push-button switch.	3
12	Program to display the value of analog voltage interfacing ADC or any digit pressed in an hex-key pad on LCD display	3
13	Program to control direction and speed of a stepper motor.	3

14	Program to generate DTMF telephone tones; use push-button switch to trigger the tone.	6
15	Program to generate sine, rectangular and triangular wave-forms.	6
16	Program to control traffic lights.	3
Two Internal Assessment Tests		6
	Total	**69**

Unit – 2: Project/Student Activities [CIE- 05 Marks] **9 Hours**

Sl. No.	Activity	Duration (Hrs)
1	Three open-ended experiments of assembly language programs/embedded C other than programs 2 to 10 mentioned above are to be assigned by the teacher (Student is expected to solve and execute/simulate independently).	**09**

References

1. *The 8051 Microcontroller & Embedded systems using assembly and C (2nd Edition)* –M.A.Mazidi , J.C. Mazidi & R.D.McKinlay ISBN: 81-317-1026-2
2. *The 8051 Microcontroller(4th Edition)*- MacKenzie , ISBN:81-317-2018-7
3. *The 8051 Microcontroller(1st Edition*) – Dr.Uma Rao & Andhe Paallavi, ISBN: 81-317-3252-5
4. *Microcontrollers & applications*, Ramani Kalpathi, & Ganesh Raja , ISBN: 81-888-4918-9
5. Embedded C - Michael .J.Pont - Pearson Education -2002 ISBN 0 201 79523 X

Course Delivery

The course will be normally delivered through two-hour tutorials and four-hour hands-on practice per week; hands-on practice shall include basic experiments and interfacing exercises. Normally, one-hour tutorial followed by two-hour hands-on practice is recommended in each class. Tutorial shall be imparted before the conduction of the experiment. However, activities are carried-out off class and demonstration/presentation can be in lab sessions.

Course Assessment and Evaluation Scheme

Master Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Two tests+	10	Blue Books	1 to 4
				Record@	10	Record Book	1 to 4
				Activity*	05	Report/Sheets	1 to 4
	SEE	End exam		End of the course	50	Answer Scripts at BTE	1 to 4
				Total	75		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 2 Delivery of course
	End of course survey			End of the Course	Nil	Questionnaires	1 to 4 Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. test shall be conducted as per SEE scheme of valuation. However, scored marks will be scaled down to 10. Average of two tests, by rounding off any fractional part thereof to next higher integer, shall be considered for IA.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term.

@ Record Writing: Average of marks allotted for all experiments shall be considered; fractional part of average shall be rounded-off to next higher integer.

Composition of CLs

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	20
2	Understanding	30
3	Applying	50
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks)

The student activities in Unit-2 or similar activities can be assigned

Execution Notes:

1. Every batch of two students is assigned three open-ended programs by the teacher; students can also choose any other similar /relevant programs with prior approval from the concerned teacher.
2. Teacher is expected to observe and record the progress of students' activities
3. Assessment is made based on quality of work as prescribed by the following **rubrics** table

(ii) Model of rubrics for assessing student activity (for every student)

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	
1. Research and gathering information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(iii) CIE/IA Tests (10 Marks)

Two tests shall be conducted in accordance with SEE pattern and the marks shall be scaled down to 10. Average of two tests, rounding-off any fractional part thereof to next higher integer, shall be considered for CIE/IA.

(iv) Record Evaluation (10 Marks)

Every experiment shall be given marks, in the scale of 10, after its conduction based on student's performance and quality of write-up. Average of them, by rounding-off any fractional part thereof to next higher integer, shall be considered for CIE/IA.

Semester End-exam Evaluation (SEE) Scheme

Sl. No.	Scheme	Max. Marks
1	Writing program for one basic experiment	05
2	Writing algorithm (20% weightage) and program (80% weightage) for one interfacing experiment	15
3	Execution/Simulation of the basic experiment program assigned in 1	10
4	Execution/Implementation of the interfacing program assigned in 2	10
5	Viva-voce	10
	Total	**50**
Note:		

1. Candidate is expected submit the laboratory record during examination.
2. Student shall be allowed to execute the program even if she/he unable to write the algorithm or procedure or steps

End