

MICROCONTROLLER TECHNIQUES AND ITS APPLICATIONS

Syllabus

Unit 1: Microcontroller Basics: Difference between microprocessor and microcontroller, architectural considerations, CPU, memory sub system, I/O sub system, control logic. Architecture of MCS-51 microcontroller. Memory structure, different registers (SFR's), addressing modes. Timing Diagram, timing diagram for execution cycle.

Unit 2: Programming: Concept of assembler directives, editor, linker, loader, debugger, simulator, emulator. Instruction set, basic programming using 8051 instructions. Introduction to embedded-C, Integrated Development Environment (IDE), cross compiler, ISP, software delay generation.

Unit 3 : I/O Programming: I/O programming, interfacing with simple switch, LED. Seven segment interfacing techniques. Programming with alphanumeric LCD and matrix keypad.

Unit 4 : On-Chip Peripheral Interfaces: Programming with on-chip Timers, Counters, UART, RS485 transceiver. I2C and SPI protocols. Interrupts, interrupt execution sequence, programming with software and hardware interrupts.

Unit 5 : External Interfaces: Analog to digital convertor, interfacing with external serial and parallel ADC's, Digital to analog convertor (DAC), interfacing with DAC, Interfacing with stepper motor and DC motor.

Unit 6: RISC Microcontrollers, introduction to AVR series microcontrollers. Introduction to ARM7 microcontroller (LPC2148).

Course Outcomes:

i

CO 1: Understanding the basic principles of Microcontroller based design and development

CO 2: Ability to design and build functional prototype for real world applications

CO 3: To encourage the students to have a better understanding of the state-of-the-art interfacing technologies, their potential applications and their market views

CO 4: Ability to undertake problem identification, formulation and selection of an appropriate Microcontroller

Table I : Relationship between program outcome and course outcome

CO. PO	PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k	PO l	PO m
CO 1	2	1											2
CO 2	1	1	2									1	
CO 3										1		2	2
CO 4	2	1	1		2		1			2		1	1

Table 2: Marks Distribution Sheet

Year:2016-17			SEM -V													
Final Grade Sheet								T1			T2		ESE			Total
								10	5	5	10	10	30	20	10	100
No	MIS No.	Name	T1 Marks (20)	T2 Mark s (20)	ESE Marks (60)	Total (100)	Final Grades	Q. 1	Q.2 A	Q. 2 B	Q.1	Q.2	Q.1	Q. 2	Q. 3	
1	11140900 1	MAKARAND YASHWANT BADGUJAR	13	19	43	75	AB	8	3	2	9	10	22	16	5	75
2	11140900 2	AMOGH RAMKRISHNA BARVE	14	16	33	63	BC	9	3	2	9	7	24	9	0	63
3	11140900 3	PIYUSHA PRAMOD BHOKRE	6	18	16	40	DD	3	3	0	9	9	10	4	2	40

4	11140900 4	NAMRATA RAVINDRA BIRNALE	12	14	25	51	CC	8	3	1	9	5	14	7	4	51
5	11140900 5	NIKHIL ATMARAM BORSE	11	14	0	25	FF	8	3	0	10	4	0	0	0	25
6	11140900 6	SAMRUDDHI SANTOSH CHAVAN	12	12	25	49	CC	8	3	1	8	4	14	7	4	49
7	11140900 7	SHALINI SUBHASHRAO DHANWE	6	8	27	41	DD	5	1	0	6	2	19	5	3	41
8	11140900 8	GOVIND RAJHANS JADHAV	13	19	44	76	AB	8	4	1	9	10	24	13	7	76
9	11140900 9	DHANANJAY TUKARAM JAGTAP	18	19	47	84	AA	9	5	4	9	10	27	15	5	84
10	11140901 1	NINAD RAJESH KULKARNI	9	15	33	57	BC	6	2	1	10	5	23	6	4	57
11	11140901 2	SAMRUDDHI SHREERAM KULKARNI	8	13	31	52	CC	5	2	1	8	5	23	7	1	52
12	11140901 3	MALAVIKA MURALEEDHARAN CHAKKALAK	9	18	42	69	BB	6	3	0	8	10	26	11	5	69
13	11140901 4	NEHA DILIP MALVE	11	15	21	47	CD	6	3	2	8	7	14	5	2	47
14	11140901 5	SURAJ MADHUKAR MANE	6	15	24	45	CD	3	3	0	9	6	14	8	2	45
15	11140901 7	VAISHNAVI SANTOSH MUTHA	14	20	48	82	AA	10	3	1	10	10	28	16	4	82
16	11140901 8	APEKSHA SOPAN NALAWADE	15	20	40	75	AB	10	3	2	10	10	29	8	3	75
17	11140901 9	VAIBHAV BALAJI PANCHAL	11	11	31	53	CC	8	3	0	7	4	23	8	0	53
18	11140902 0	VAIBHAVI SURESH PANDIT	9	13	38	60	BC	6	3	0	6	7	21	12	5	60
19	11140902 1	SAMRAT VIJAY PATIL	2	6	9	17	FF	2	0	0	6	0	6	3	0	17
20	11140902 2	HRISHIKESH POPAT PAWAR	16	19	42	77	AB	9	3	4	9	10	25	13	4	77
21	11140902 3	KIRAN PANDURANG PHALKE	10	15	47	72	AB	6	2	2	8	7	25	14	8	72
22	11140902 4	MUKESH RAMESH RADKAR	11	9	30	50	CC	8	1	2	8	1	22	5	3	50
23	11140902 5	SHYAM GANPAT RATHOD	4	15	25	44	DD	3	1	0	9	6	17	7	1	44
24	11140902 6	NAMAN DEEPAK SATIYA	16	19	49	84	AA	8	4	4	10	9	27	17	5	84
25	11140902 7	SAYALI SANJAY KULKARNI	13	19	36	68	BB	9	2	2	9	10	23	7	6	68

26	11140902 8	SUJATA VASANTRAO SELUKAR	4	16	27	47	CD	3	1	0	7	9	18	7	2	47
27	11140902 9	DARSHAN GIRISH SHAHA	17	20	55	92	AA	10	3	4	10	10	29	18	8	92
28	11140903 1	SUSHANTI RITRAJ	11	16	39	66	BB	10	1	0	9	7	20	12	7	66
29	11140903 2	SUVARNA AJITLAL UPALKAR	8	13	25	46	CD	6	2	0	8	5	16	7	2	46
30	11140903 3	VAIBHAV SUNIL GONDANE	7	12	37	56	CC	5	2	0	9	3	21	11	5	56
31	11140903 4	SHREYESH KIRAN WAGHMARE	7	15	31	53	CC	6	1	0	10	5	20	11	0	53
32	11140903 5	GADAGKAR AAKANKSHA VIVEK	10	17	41	68	BB	7	2	1	9	8	21	15	5	68
33	11140903 6	T AASHISH	8	14	28	50	CC	6	2	0	10	4	21	3	4	50
34	11140903 7	VINIT DHARANT VARU	6	15	26	47	CD	6	0	0	10	5	18	7	1	47
35	14150900 1	DEVRE JUGAL SHANTARAM	3	12	32	47	CD	3	0	0	9	3	21	9	2	47
36	14150900 2	GADGE RAJ VINOD	9	13	37	59	BC	6	3	0	10	3	25	10	2	59
37	14150900 3	GAIKWAD SHIVKANYA DILIP	6	9	28	43	DD	5	1	0	8	1	20	8	0	43
38	14150900 4	GOLEY MEDHA NANDKISHOR	11	15	31	57	BC	7	2	2	8	7	23	7	1	57
39	14150900 5	MESHRAM DIVYA ASHOK	5	10	27	42	DD	5	0	0	6	4	15	9	3	42
40	14150900 6	SAGAVEKAR SHUBHAM RAVINDRA	10	16	38	64	BC	4	3	3	9	7	26	8	4	64
41	11131030 5	Ludger Fringe	13	18	36	67	BB	7	4	2	8	10	13	14	9	67
42	11110900 9	Bipeen Gaikwad	4	5	20	29	FF	4	0	0	5	0	17	3	0	29
43	11120902 3	Namala Varun	3	2	14	19	FF	3	0	0	2	0	13	1	0	19
44	11140930 2	Kshitija Jadhav	7	15	33	55	CC	7	0	0	8	7	19	9	5	55
45	11140930 1	Kulkarni Kshitija	7	16	22	45	CD	7	0	0	9	7	15	7	0	45

Table 3: CO Mapping with Exam questions for direct assessment

Course Outcomes	Test 1	Test 2	ESE
CO 1	Q.1	Q.1	Q.1
CO 2		Q.2	Q.3
CO 3	Q.2	Q.2	Q.1, Q.2
CO 4	Q.1	Q.1	Q.2

Table 4: Course Outcome 1 Attainment

Eq. = Test 1 (Q.1) + Test 2 (Q. 1) + ESE (Q.1) >= 40% of Total marks 36 i.e. 14.50

No	MIS No.	Name	Test 1	Test 2	ESE	Total	CO Attained
			Q.1 (04)	Q.1 (08)	Q.1 (24)	36	
1	111409001	MAKARAND YASHWANT BADGUJAR	4	7	16	27	Y
2	111409002	AMOGH RAMKRISHNA BARVE	4	7	18	29	Y
3	111409003	PIYUSHA PRAMOD BHOKRE	2	7	6	15	Y
4	111409004	NAMRATA RAVINDRA BIRNALE	4	7	10	21	Y
5	111409005	NIKHIL ATMARAM BORSE	4	8	0	12	N
6	111409006	SAMRUDDHI SANTOSH CHAVAN	4	6	8	18	Y
7	111409007	SHALINI SUBHASHRAO DHANWE	4	6	13	23	Y
8	111409008	GOVIND RAJHANS JADHAV	4	7	18	29	Y
9	111409009	DHANANJAY TUKARAM JAGTAP	4	7	21	32	Y
10	111409011	NINAD RAJESH KULKARNI	2	8	17	27	Y
11	111409012	SAMRUDDHI SHREERAM KULKARNI	2	6	17	25	Y

12	111409013	MALAVIKA MURALEEDHARAN CHAKKALAK	2	6	20	28	Y
13	111409014	NEHA DILIP MALVE	4	6	10	20	Y
14	111409015	SURAJ MADHUKAR MANE	2	7	10	19	Y
15	111409017	VAISHNAVI SANTOSH MUTHA	4	10	22	36	Y
16	111409018	APEKSHA SOPAN NALAWADE	4	8	23	35	Y
17	111409019	VAIBHAV BALAJI PANCHAL	4	6	17	27	Y
18	111409020	VAIBHAVI SURESH PANDIT	2	4	15	21	Y
19	111409021	SAMRAT VIJAY PATIL	2	4	4	10	N
20	111409022	HRISHIKESH POPAT PAWAR	4	7	19	30	Y
21	111409023	KIRAN PANDURANG PHALKE	4	6	19	29	Y
22	111409024	MUKESH RAMESH RADKAR	4	6	18	28	Y
23	111409025	SHYAM GANPAT RATHOD	2	7	12	21	Y
24	111409026	NAMAN DEEPAK SATIYA	4	8	21	33	Y
25	111409027	SAYALI SANJAY KULKARNI	4	7	17	28	Y
26	111409028	SUJATA VASANTRAO SELUKAR	2	5	12	19	Y
27	111409029	DARSHAN GIRISH SHAHA	4	8	24	36	Y
28	111409031	SUSHANTI RITRAJ	4	7	14	25	Y
29	111409032	SUVARNA AJITLAL UPALKAR	4	6	12	22	Y
30	111409033	VAIBHAV SUNIL GONDANE	2	6	18	26	Y
31	111409034	SHREYESH KIRAN WAGHMARE	4	8	14	26	Y
32	111409035	GADAGKAR AAKANKSHA VIVEK	3	7	18	28	Y
33	111409036	T AASHISH	4	8	18	30	Y
34	111409037	VINIT DHARANT VARU	4	8	12	24	Y
35	141509001	DEVRE JUGAL SHANTARAM	2	7	15	24	Y
36	141509002	GADGE RAJ VINOD	4	8	20	32	Y
37	141509003	GAIKWAD SHIVKANYA DILIP	3	6	14	23	Y
38	141509004	GOLEY MEDHA NANDKISHOR	3	6	18	27	Y
39	141509005	MESHARAM DIVYA ASHOK	2	4	9	15	Y
40	141509006	SAGAVEKAR SHUBHAM RAVINDRA	4	7	20	31	Y
41	111310305	Ludger Fringe	4	6	10	20	Y

42	111109009	Bipeen Gaikwad	2	4	11	17	Y
43	111209023	Namala Varun	2	2	10	14	N
44	111409302	Kshitija Jadhav	4	6	15	25	Y
45	111409301	Kulkarni Kshitija	4	7	12	23	Y

Out of 45 students 42 students attain CO 1

i.e. CO 1 Attainment is 93.33%

Table 5: Course Outcome 2 Attainments

Eq. = Test 2 (Q.2) + ESE (Q.3) >= 40% of Total marks 15 = 6.00

No	MIS No.	Name	Test 2	ESE	Total	CO Attained
			Q.2 (5)	Q.3(10)	20	
1	111409001	MAKARAND YASHWANT BADGUJAR	5	5	10	Y
2	111409002	AMOGH RAMKRISHNA BARVE	4	0	4	N
3	111409003	PIYUSHA PRAMOD BHOKRE	4	2	6	Y
4	111409004	NAMRATA RAVINDRA BIRNALE	2	4	6	Y
5	111409005	NIKHIL ATMARAM BORSE	2	0	2	N
6	111409006	SAMRUDDHI SANTOSH CHAVAN	2	4	6	Y
7	111409007	SHALINI SUBHASHRAO DHANWE	2	3	5	N
8	111409008	GOVIND RAJHANS JADHAV	5	7	12	Y
9	111409009	DHANANJAY TUKARAM JAGTAP	5	5	10	Y
10	111409011	NINAD RAJESH KULKARNI	3	4	7	Y

11	111409012	SAMRUDDHI SHREERAM KULKARNI	3	1	4	N
12	111409013	MALAVIKA MURALEEDHARAN CHAKKALAK	5	5	10	Y
13	111409014	NEHA DILIP MALVE	5	2	7	Y
14	111409015	SURAJ MADHUKAR MANE	3	2	5	N
15	111409017	VAISHNAVI SANTOSH MUTHA	5	4	9	Y
16	111409018	APEKSHA SOPAN NALAWADE	5	3	8	Y
17	111409019	VAIBHAV BALAJI PANCHAL	2	0	2	N
18	111409020	VAIBHAVI SURESH PANDIT	4	5	9	Y
19	111409021	SAMRAT VIJAY PATIL	0	0	0	N
20	111409022	HRISHIKESH POPAT PAWAR	5	4	9	Y
21	111409023	KIRAN PANDURANG PHALKE	3	8	11	Y
22	111409024	MUKESH RAMESH RADKAR	1	3	4	N
23	111409025	SHYAM GANPAT RATHOD	3	1	4	N
24	111409026	NAMAN DEEPAK SATIYA	5	5	10	Y
25	111409027	SAYALI SANJAY KULKARNI	5	6	11	Y
26	111409028	SUJATA VASANTRAO SELUKAR	4	2	6	Y
27	111409029	DARSHAN GIRISH SHAHA	5	8	13	Y
28	111409031	SUSHANTI RITRAJ	4	7	11	Y
29	111409032	SUVARNA AJITLAL UPALKAR	2	2	4	N
30	111409033	VAIBHAV SUNIL GONDANE	2	5	7	Y
31	111409034	SHREYESH KIRAN WAGHMARE	4	0	4	N
32	111409035	GADAGKAR AAKANKSHA VIVEK	8	5	13	Y
33	111409036	T AASHISH	2	4	6	Y
34	111409037	VINIT DHARANT VARU	3	1	4	N
35	141509001	DEVRE JUGAL SHANTARAM	3	2	5	N
36	141509002	GADGE RAJ VINOD	3	2	5	N
37	141509003	GAIKWAD SHIVKANYA DILIP	1	0	1	N
38	141509004	GOLEY MEDHA NANDKISHOR	2	1	3	N
39	141509005	MESHARAM DIVYA ASHOK	2	3	5	N

40	141509006	SAGAVEKAR SHUBHAM RAVINDRA	5	4	9	Y
41	111310305	Ludger Fringe	5	9	14	Y
42	111109009	Bipeen Gaikwad	0	0	0	N
43	111209023	Namala Varun	0	0	0	N
44	111409302	Kshitija Jadhav	5	5	10	Y
45	111409301	Kulkarni Kshitija	5	0	5	N

Out of 45 students 25 students attain CO 2

i.e. CO 2 Attainment is 55.55%

Table 6: Course Outcome 3 Attainments

Eq. = Test1 (Q.2)+Test 2 (Q.2) + ESE (Q.1+Q.2) >= 40% of Total marks 31 is 12.4

No	MIS No.	Name	Test 1	Test2	ESE		Total	CO Attained
			Q.2(10)	Q.2 (5)	Q.1 (06)	Q.2 (10)		
							31	
1	111409001	MAKARAND YASHWANT BADGUJAR	5	5	6	8	24	Y
2	111409002	AMOGH RAMKRISHNA BARVE	5	3	6	5	19	Y
3	111409003	PIYUSHA PRAMOD BHOKRE	3	5	4	2	14	Y
4	111409004	NAMRATA RAVINDRA BIRNALE	4	3	4	4	15	Y
5	111409005	NIKHIL ATMARAM BORSE	3	2	0	0	5	N
6	111409006	SAMRUDDHI SANTOSH CHAVAN	4	2	6	5	17	Y
7	111409007	SHALINI SUBHASHRAO DHANWE	1	0	6	4	11	N
8	111409008	GOVIND RAJHANS JADHAV	5	5	6	7	23	Y

9	111409009	DHANANJAY TUKARAM JAGTAP	9	5	6	8	28	Y
10	111409011	NINAD RAJESH KULKARNI	3	2	6	3	14	Y
11	111409012	SAMRUDDHI SHREERAM KULKARNI	3	2	6	4	15	Y
12	111409013	MALAVIKA MURALEEDHARAN CHAKKALAK	3	5	6	7	21	Y
13	111409014	NEHA DILIP MALVE	5	2	4	4	15	Y
14	111409015	SURAJ MADHUKAR MANE	3	3	4	4	14	Y
15	111409017	VAISHNAVI SANTOSH MUTHA	4	5	6	8	23	Y
16	111409018	APEKSHA SOPAN NALAWADE	5	5	6	4	20	Y
17	111409019	VAIBHAV BALAJI PANCHAL	3	2	6	4	15	Y
18	111409020	VAIBHAVI SURESH PANDIT	3	3	6	8	20	Y
19	111409021	SAMRAT VIJAY PATIL	0	0	2	3	5	N
20	111409022	HRISHIKESH POPAT PAWAR	7	5	6	7	25	Y
21	111409023	KIRAN PANDURANG PHALKE	4	4	6	7	21	Y
22	111409024	MUKESH RAMESH RADKAR	3	0	4	4	11	N
23	111409025	SHYAM GANPAT RATHOD	1	3	5	3	12	Y
24	111409026	NAMAN DEEPAK SATIYA	8	4	6	9	27	Y
25	111409027	SAYALI SANJAY KULKARNI	4	5	6	4	19	Y
26	111409028	SUJATA VASANTRAO SELUKAR	1	5	6	4	16	Y
27	111409029	DARSHAN GIRISH SHAHA	7	5	5	10	27	Y
28	111409031	SUSHANTI RITRAJ	1	3	6	7	17	Y
29	111409032	SUVARNA AJITLAL UPALKAR	2	3	4	4	13	Y
30	111409033	VAIBHAV SUNIL GONDANE	2	1	3	5	11	N
31	111409034	SHREYESH KIRAN WAGHMARE	1	1	6	6	14	Y
32	111409035	GADAGKAR AAKANKSHA VIVEK	3	3	3	8	17	Y
33	111409036	T AASHISH	2	2	3	2	9	N
34	111409037	VINIT DHARANT VARU	0	0	6	4	10	N
35	141509001	DEVRE JUGAL SHANTARAM	0	0	6	5	11	N
36	141509002	GADGE RAJ VINOD	3	0	5	5	13	Y
37	141509003	GAIKWAD SHIVKANYA DILIP	1	4	6	4	15	Y
38	141509004	GOLEY MEDHA NANDKISHOR	4	1	5	4	14	Y

39	141509005	MESHARAM DIVYA ASHOK	0	2	6	5	13	Y
40	141509006	SAGAVEKAR SHUBHAM RAVINDRA	6	2	6	4	18	Y
41	111310305	Ludger Fringe	6	5	3	9	23	Y
42	111109009	Bipeen Gaikwad	0	0	6	3	9	N
43	111209023	Namala Varun	0	0	3	1	4	N
44	111409302	Kshitija Jadhav	0	2	4	4	10	N
45	111409301	Kulkarni Kshitija	0	2	3	3	8	N

Out of 45 students **33** students attain CO 3

i.e. CO 3 Attainment is 73.33%

Table 7: Course Outcome 4 attainment

Eq. = Test1 (Q.1)+Test 2 (Q.2) + ESE (Q.2) >= 40% of Total marks 18 is 7.2

No	MIS No.	Name	Test 1	Test 2	ESE	Total	CO Attained
			Q. 1 (06)	Q.1 (02)	Q.2 (10)	18	
1	111409001	MAKARAND YASHWANT BADGUJAR	4	2	8	14	Y
2	111409002	AMOGH RAMKRISHNA BARVE	5	2	4	11	Y
3	111409003	PIYUSHA PRAMOD BHOKRE	1	2	2	5	N
4	111409004	NAMRATA RAVINDRA BIRNALE	4	2	3	9	Y
5	111409005	NIKHIL ATMARAM BORSE	4	2	0	6	N
6	111409006	SAMRUDDHI SANTOSH CHAVAN	4	2	2	8	Y
7	111409007	SHALINI SUBHASHRAO DHANWE	1	0	1	2	N
8	111409008	GOVIND RAJHANS JADHAV	4	2	6	12	Y
9	111409009	DHANANJAY TUKARAM JAGTAP	5	2	7	14	Y
10	111409011	NINAD RAJESH KULKARNI	4	2	3	9	Y

11	111409012	SAMRUDDHI SHREERAM KULKARNI	3	2	3	8	Y
12	111409013	MALAVIKA MURALEEDHARAN CHAKKALAK	4	2	4	10	Y
13	111409014	NEHA DILIP MALVE	2	2	1	5	N
14	111409015	SURAJ MADHUKAR MANE	1	2	4	7	Y
15	111409017	VAISHNAVI SANTOSH MUTHA	6	2	8	16	Y
16	111409018	APEKSHA SOPAN NALAWADE	6	2	4	12	Y
17	111409019	VAIBHAV BALAJI PANCHAL	4	1	4	9	Y
18	111409020	VAIBHAVI SURESH PANDIT	4	2	4	10	Y
19	111409021	SAMRAT VIJAY PATIL	0	2	0	2	N
20	111409022	HRISHIKESH POPAT PAWAR	5	2	6	13	Y
21	111409023	KIRAN PANDURANG PHALKE	2	2	7	11	Y
22	111409024	MUKESH RAMESH RADKAR	4	2	1	7	Y
23	111409025	SHYAM GANPAT RATHOD	1	2	4	7	Y
24	111409026	NAMAN DEEPAK SATIYA	4	2	8	14	Y
25	111409027	SAYALI SANJAY KULKARNI	5	2	3	10	Y
26	111409028	SUJATA VASANTRAO SELUKAR	1	2	3	6	N
27	111409029	DARSHAN GIRISH SHAHA	6	2	8	16	Y
28	111409031	SUSHANTI RITRAJ	6	2	5	13	Y
29	111409032	SUVARNA AJITLAL UPALKAR	2	2	3	7	Y
30	111409033	VAIBHAV SUNIL GONDANE	3	2	6	11	Y
31	111409034	SHREYESH KIRAN WAGHMARE	2	2	5	9	Y
32	111409035	GADAGKAR AAKANKSHA VIVEK	4	2	7	13	Y
33	111409036	T AASHISH	2	2	1	5	N
34	111409037	VINIT DHARANT VARU	2	2	3	7	Y
35	141509001	DEVRE JUGAL SHANTARAM	1	2	4	7	Y
36	141509002	GADGE RAJ VINOD	2	2	5	9	Y
37	141509003	GAIKWAD SHIVKANYA DILIP	2	2	4	8	Y
38	141509004	GOLEY MEDHA NANDKISHOR	4	2	3	9	Y
39	141509005	MESHARAM DIVYA ASHOK	3	2	4	9	Y
40	141509006	SAGAVEKAR SHUBHAM RAVINDRA	0	2	4	6	N

41	111310305	Ludger Fringe	3	2	5	10	Y
42	111109009	Bipeen Gaikwad	2	1	0	3	N
43	111209023	Namala Varun	1	0	0	1	N
44	111409302	Kshitija Jadhav	3	2	5	10	Y
45	111409301	Kulkarni Kshitija	3	2	4	9	Y

Out of 45 students **35** students attain CO 4

i.e. CO 4 Attainment is 77.77%

Table 8: CO attainment

Course Outcomes	Assessment Methods	% Total	Result
CO 1	Test 1, Test 2, ESE	93%	Y
CO 2	Test 2, ESE,	56%	Y
CO 3	Test1,Test2, ESE	73%	Y
CO 4	Test1,Test2, ESE	78%	Y