

Manipal School of Information Sciences (MSIS)
Manipal Academy of Higher Education, Manipal
Master of Engineering - ME (Embedded Systems)

Course File

Course Name : Data Structures and Algorithms Lab

Course Code : ESD 5152

Academic Year : 2023 – 24

Semester : I

Name of the Course Coordinator : Dr. Raghavendra Prabhu

Name of the Program Coordinator : Dr. B Dinesh Rao

04/08/2023	04/08/2023
Signature of Program Coordinator with Date	Signature of Course Coordinator with Date

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Program Education Objectives (PEOs)

The overall objectives of the Learning Outcomes-based Curriculum Framework (LOCF) for **ME (Embedded Systems)**, program are as follows.

PEO No.	Education Objective
PEO 1	Enable to draw upon fundamental and advanced knowledge to apply analytical and computational approaches to solve technological problems in embedded systems.
PEO 2	Introduce state of art technologies in the area of embedded systems and inculcate ethical practices to make industry-ready professionals.
PEO 3	Promote scientific and societal advancement through research and entrepreneurship.

Program Outcomes (POs)

By the end of the postgraduate program in cloud computing, graduates will be able to:

PO1	An ability to independently carry out research /investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report/document
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO4	Ability to develop and implement embedded systems requirements based on theoretical principles and practical knowledge.
PO5	Ability to demonstrate knowledge of the underlying principles and evaluation methods for analyzing and decision-making.

1. Course Plan

1.1 Primary Information

Course Name	:	Data Structures and Algorithms Lab [ESD 5152]
L-T-P-C		0-0-3-1
Contact Hours	:	36 Hours
Pre-requisite	:	C programming

1.2 Course Outcomes (COs), Program outcomes (POs) and Bloom's Taxonomy Mapping

CO	At the end of this course, the student should be able to:	No. of Contact Hours	Program Outcomes (PO's)	BL
CO1	Apply programing concepts to implement data structure like linked lists, stack, queues,	24	PO1	3
CO2	Apply programing concepts to implement data structure like binary search tree and hashtable	6	PO3	3
CO3	Analyse sorting and searching algorithms	6	PO4	4

1.3 Assessment Plan

Components	Lab Test	Flexible Assessments (2 – 3 in number)	End semester/ Makeup examination
Duration	90 minutes	To be decided by the faculty.	180 minutes
Weightage	0.3	0.2	0.5
Typology of questions	Applying; Analyzing.	Applying; Analyzing.	Applying; Analyzing;
Pattern	Answer all the questions. Maximum marks 30.	Assignment: Problems in array list, linked list, stack queue and designing the data structure [To be decided by the faculty members. May be Assignments, Problem solving, etc.]	Answer all the questions. Maximum marks 50.
Schedule	As per academic calendar.	Assignment submission: November 2023	As per academic calendar.
Topics covered	array list, linked list, stack queue, sorting algorithms, trees		Comprehensive examination covering the topics covered in the lab

1.4 Lesson Plan

L. No.	TOPICS	Course Outcome Addressed
L0	Course delivery plan, Course assessment plan, Course outcomes, Program outcomes, CO-PO mapping, reference books	---
Lab1	Creating array list: static and dynamic	CO2
Lab2	Array list: insertions, searching, maxmin	CO2
Lab3	Array list: case study	CO1, CO2
Lab4	Linked list: defining data structure, initialization, insertion, deallocation	CO2
Lab5	Linked list: searching, insertion in between nodes, problem solving	CO2
Lab6	LinkedList: deletion	CO2
IT1	Internal lab test	CO2
Lab7	Stack: push pop and peek in array and linked list implementation	CO1, CO2
Lab8	Queue and circular queue	CO2
Lab9	Trees	CO2
Lab10	Sorting algorithm	CO1, CO3
Lab11	Hash table	CO4
Lab12	Hash Table:	CO4

1.5 References

1. Introduction to Algorithms - Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest. MIT Press.
2. Data Structures and Algorithms - Aho, Hopcroft and Ulmann. Pearson Publishers.
3. Data Structures and Algorithms in Python - Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser. John Wiley & Sons.

1.6 Other Resources (Online, Text, Multimedia, etc.)

1. Web Resources: Blog, Online tools and cloud resources.
2. Journal Articles.

1.7 Course Timetable

1 st Semester Data Structures				Lab: Embedded Systems Lab				
	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5
MON								
TUE	DS							
WED			DS Lab					
THU	DS							
FRI								
SAT	DS							

1.8 Assessment Plan

COs		Marks & weightage			
CO No.	CO Name	Lab Test (Max. 30)	Assignment (Max. 20)	End Semester (Max. 50)	CO wise Weightage
CO1	Apply programing concepts to implement data structure like linked lists, stack, queues,	20	5	30	0.25
CO2	Apply programing concepts to implement data structure like binary search tree and hashtable	5		5	0.35
CO3	Analyse sorting and searching algorithms	5	5	5	0.25
	Marks (weightage)	0.3	0.2	0.5	1.0

Note:

- In-semester Assessment is considered as the Internal Assessment (IA) in this course for 50 marks, which includes the performances in lab participation, assignment work, lab work, lab tests, quizzes etc.

- End-semester examination (ESE) for this course is conducted for a maximum of 50.
- End-semester marks for a maximum of 50 and IA marks for a maximum of 50 are added for a maximum of 100 marks to decide upon the grade in this course.

$$\begin{aligned}\text{Weightage for CO1} &= (\text{Lab Test marks for CO1} + \text{Assignment marks for CO1} + \text{ESE marks for CO1}) / 100 \\ &= (5 + 2 + 5) / 100 = 0.12 \quad 2\end{aligned}$$

1.9 Assessment Details

The assessment tools to be used for the Current Academic Year (CAY) are as follows:

Sl. No.	Tools (TLP)	Weightage	Frequency	Details of Measurement (Weightage/Rubrics/Duration, etc.)
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1	Sessional	0.4	2	<ul style="list-style-type: none"> • Performance is measured using sessional attainment level. • Reference: question paper and answer scheme. • Each sessional is assessed for a maximum of 20 marks.
2	Assignments	0.1	1	<ul style="list-style-type: none"> • Performance is measured using assignments/quiz attainment level. • Assignments/quiz are evaluated for a maximum of 10 marks.
3	ESE	0.5	1	<ul style="list-style-type: none"> • Performance is measured using ESE attainment level. • Reference: question paper and answer scheme. • ESE is assessed for a maximum of 100 marks and scaled down to 50 marks.

1.10 Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5
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CO1	Y		Y	Y	Y
CO2	Y		Y	Y	
CO3				Y	
Average Articulation Level	*		*	*	*

2. Assessment Details

2.1 Student Details:

Sl. No.	Registration No.	Name	Learner Email ID
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1	231039001	MEGHANA U KAUSHIK	meghanauk.3@gmail.com
2	231039002	NIRANJAN C	niranjanc2398@gmail.com
3	231039003	PRAJWAL H S	prajwalhs99@gmail.com
4	231039004	AKSHARA J M	aksharagowda144@gmail.com
5	231039005	PRATHEEK SHETTY	shettypratheek2001@gmail.com
6	231039006	ARPITHA N R	arpithanr98@gmail.com
7	231039007	PAVAN ADIGA	pavanadiga636@gmail.com
8	231039008	PRIYANKA H B	ppriyankahb@gmail.com
9	231039009	GOPICHANDAN C	gopichandan2211@gmail.com
10	231039010	SNEHA S	snehasgowda28@gmail.com
11	231039011	DHANUSH B S	dhanushbeyes@gmail.com
12	231039012	DILEEP G R	dileepreddy961@gmail.com
13	231039013	SHASHANK G NAIK	ckms4477@gmail.com
14	231039014	PRAKRATHI R SHRIYAN	prakrathi.rshriyan@gmail.com
15	231039015	KELWIN PRANEETH CRASTA	crastakelwin@gmail.com
16	231039017	SHRIVATSA MOKHASHI	shrivatsamokhashi@gmail.com
17	231039018	DEEPAK BN	deepakbn178@gmail.com
18	231039019	PRAVEEN	praveen2662hk@gmail.com
19	231039020	SAGAR RAO SALANKE P	sagarsalanke2@gmail.com
20	231039021	SUDEEP S D	281100sdsudeep@gmail.com
21	231039022	AMITH N	amithnarasimha108@gmail.com

22	231039023	AKHILA Y S	akhilayalmati@gmail.com
23	231039025	VARUN AV	varunav321@gmail.com
24	231039028	SHIVA SWAROOP GOWDA G P	shivaswaroopg@gmail.com
25	231039029	PUNITH KUMAR GS	punithrajs97@gmail.com
26	231039030	DEEPAK	deepaknaik7473@gmail.com
27	231039032	PAVAN J	pavanjgowda21@gmail.com
28	231039033	PRIYA H M	hmpriya09@gmail.com
29	231039034	ADARSH PRABHAKAR	adarshprabhakar002@gmail.com
30			

2.2 Assessment outcomes

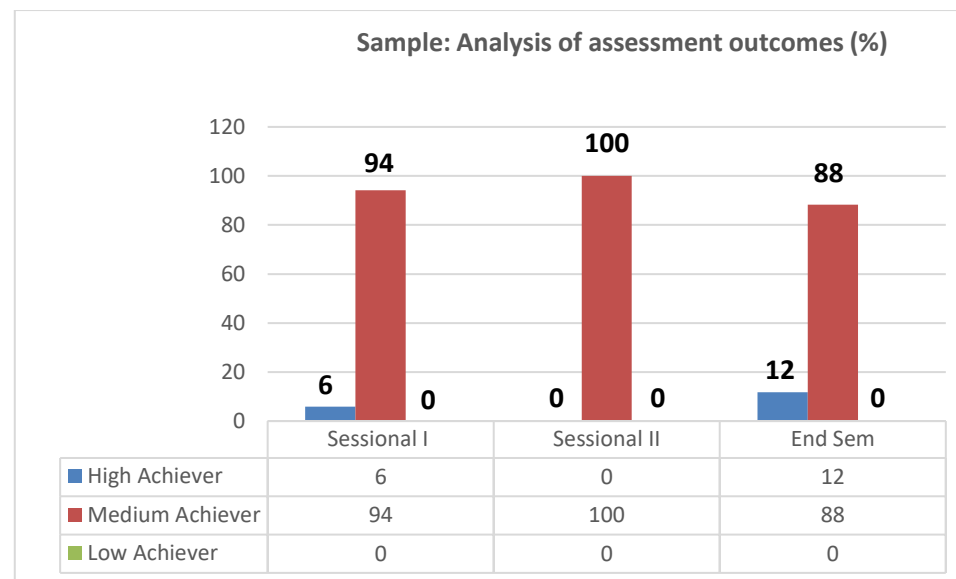
Sl. No.	Registration No.	Name of the Student	Lab Test (30)	Assignment (20)	ESE (50)
1	231039001	MEGHANA U KAUSHIK			
2	231039002	NIRANJAN C			
3	231039003	PRAJWAL H S			
4	231039004	AKSHARA J M			

5	231039005	PRATHEEK SHETTY			
6	231039006	ARPITHA N R			
7	231039007	PAVAN ADIGA			
8	231039008	PRIYANKA H B			
9	231039009	GOPICHANDAN C			
10	231039010	SNEHA S			
11	231039011	DHANUSH B S			
12	231039012	DILEEP G R			
13	231039013	SHASHANK G NAIK			
14	231039014	PRAKRATHI R SHRIYAN			
15	231039015	KELWIN PRANEETH CRASTA			
16	231039017	SHRIVATSA MOKHASHI			
17	231039018	DEEPAK BN			
18	231039019	PRAVEEN			
19	231039020	SAGAR RAO SALANKE P			
20	231039021	SUDEEP S D			
21	231039022	AMITH N			
22	231039023	AKHILA Y S			
23	231039025	VARUN AV			
24	231039028	SHIVA SWAROOP GOWDA G P			
25	231039029	PUNITH KUMAR GS			

26	231039030	DEEPAK			
27	231039032	PAVAN J			
28	231039033	PRIYA H M			
29	231039034	ADARSH PRABHAKAR			
30					

2.3 Analysis of Assessment outcomes

Learning Level	Number of Students		% of Students	
	Lab Test	End Semester	Lab Test	End Semester
High Achievers				
Medium Achievers				
Low Achievers				



2.4 Attainment of Course Outcomes (Direct)

Attainment through Formative Assessment

SI. No.	Course Outcomes	Target	Attainment
1	CO1	2	
2	CO2	2	
3	CO3	2	

2.5 Attainment of Course Outcomes (Indirect): Course End Survey (CES) Questionnaire

Considering your in-class and out-of-class experiences, please rate your ability to do the following:

CO	At the end of this course, the student should be able to:	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
		1	2	3	4	5
CO1	Apply programing concepts to implement data structure like linked lists, stack, queues,					
CO2	Apply programing concepts to implement data structure like binary search tree and hashtable					
CO3	Analyse sorting and searching algorithms					

2.6 Attainment of Course Outcomes (Indirect): Analysis

SI. No.	Course Outcomes	Course End Survey (CES) Attainment
1	CO1	
2	CO2	
3	CO3	

Course End Survey Example: For a question related to CO1 from 30 responses (5-point Likert's scale):

Attainment Level 1: 50% students rated more than or equal to 60% of maximum marks

Attainment Level 2: 60% students rated more than or equal to 60% of maximum marks

Attainment Level 3: 70% students rated more than or equal to 60% of maximum marks

3. CO-PO Assessment

	PO Assessment (Direct)					PO Assessment (Indirect)				
	PO1	PO2	PO3	PO4	PO5	PO1	PO2	PO3	PO4	PO5
CO1	Y		Y	Y	Y	Y		Y	Y	Y
CO2	Y		Y	Y		Y		Y	Y	
CO3				Y					Y	
Average										

Note:

*** please enter actual attainment values**

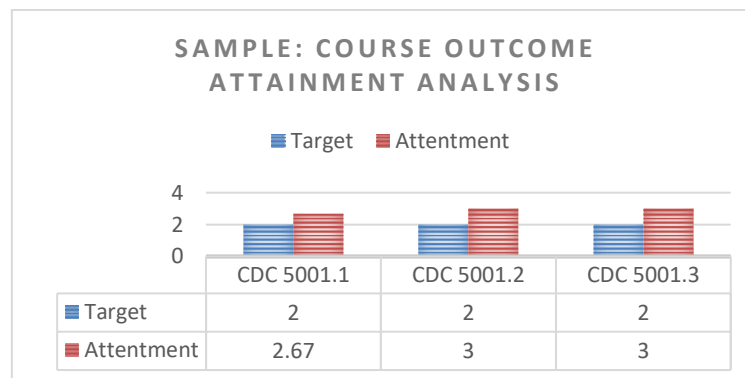
Direct Attainment = Average (PO_i). Example: PO4 = Average (2.02, 1.73, 2.05) = 1.93

Indirect Attainment = Average (PO_i). Example: PO4 = Average (2.02, 1.73, 2.05) = 1.93

4. Observations and Comments

4.1 Observations from Course Coordinator based on the direct and indirect assessments

SI. No.	Course Outcomes	Target (X)	A: Direct Attainment Weightage (80%)	B: Indirect Attainment Weightage (20%)	Combined Attainment $Y = (A+B)$	Gap (Y-X)	Action Proposed to bridge the Gap	Revision of target wherever achieved
1	CO1	2						
2	CO2	2						
3	CO3	2						



4.2 Comments/Suggestions by the Course Coordinator

SI. No.	Comment/Observations	Suggested Actions
1.		