

Laboratory Manual

(Version 03.0)

for

Object Oriented Software Engineering Lab

(MCA- 164)

MCA - II Semester

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List of Abbreviations

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Appendix- A

List of Abbreviations

BTL	Bloom's Taxonomy Level
CE	Communication Efficacy
CICP	Conduct Investigations of Complex Computing Problems
CK	Computational Knowledge
CO	Course Outcome
DAC	Departmental Advisory Committee
DDS	Design and Development of Solutions
I&E	Innovation and Entrepreneurship
I&T	Individual & Team Work
IQAC	Internal Quality Assurance Cell
LLL	Life-Long Learning
MTU	Modern Tool Usage
PA	Problem Analysis
PE	Professional Ethics
PEO	Programme Educational Objective
PMF	Project Management and Finance
PO	Programme Outcome
SEC	Societal and Environmental Concern

Declaration

Department	:	Department of Computer Science and Applications
Course, Year and the Semester to which Lab is offered	:	MCA I Year, II Semester
Name of the Lab Course	:	Object-Oriented Software Engineering Lab
Course Code	:	MCA-164
Version No.	:	03.0
Name of Course/Lab Teacher	:	Dr. Ritika Wason
Laboratory Manual Committee	:	<ol style="list-style-type: none"> 1. Mrs. Vaishali Joshi, Chairperson 2. Dr. Anupam Baliyan, Member 3. Dr. Ritika Wason, Member 4. Mrs. Tanya Pathak Garg, Member 5. Mr. Uttam Singh Bist, Member 6. Prof. P. S. Grover, Margdarshak 7. Mr. Amit Sharma, Alumni & Industry Expert 8. Mrs. Tanya Pathak Garg, Concerned Subject Teacher, Convener
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Signature
(Course Teacher)

Signature
(Head of Department)

Signature
(IQAC Coordinator)

1. Vision of the Department

To become a Centre of excellence in the field of Computer Science and Applications, to contribute effectively in the rapidly changing global economy directed towards national development ensuring prosperity for the mankind.

2. Mission of the Department

- M1** To become a center of excellence in the field of Computer Science and Applications and produce professionals as per global industry standards.
- M2** To foster innovation, entrepreneurial skills, research capabilities and bring all-round development amongst budding professionals.
- M3** To promote analytical and collaborative life-long learning skills, among students and faculty members involving all stakeholders.
- M4** To inculcate strong ethical values and professional behaviour while giving equal emphasis to social commitment and nation building.

3. Programme Educational Objectives (PEOs)

The PEO's for the MCA programme are as follows:

- PEO1** Exhibit professional competencies and knowledge for being a successful technocrat.
- PEO2** Adopt creative and innovative practices to solve real-life complex problems.
- PEO3** Be a lifelong learner and contribute effectively to the betterment of the society.
- PEO4** Be effective and inspiring leader for fellow professionals and face the challenges of the rapidly changing multi-dimensional, contemporary world.

4. Programme Outcomes (POs)

PO1: Computational Knowledge (CK)

Demonstrate competencies in fundamentals of computing, computing specialization, mathematics, and domain knowledge suitable for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

PO2: Problem Analysis (PA)

Identify, formulate, and analyze complex real-life problems in order to arrive at computationally viable conclusions using fundamentals of mathematics, computer sciences, management and relevant domain disciplines.

PO3: Design and Development of Solutions (DDS)

Design efficient solutions for complex, real-world problems to design systems, components or processes that meet the specifications with suitable consideration to public health, and safety, cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Computing Problems (CICP)

Ability to research, analyze and investigate complex computing problems through design of experiments, analysis and interpretation of data, and synthesis of the information to arrive at valid conclusions.

PO5: Modern Tool Usage (MTU)

Create, select, adapt and apply appropriate technologies and tools to a wide range of computational activities while understanding their limitations.

PO6: Professional Ethics (PE)

Ability to perform professional practices in an ethical way, keeping in mind cyber regulations & laws, responsibilities, and norms of professional computing practices.

PO7: Life-Long Learning (LLL)

Ability to engage in independent learning for continuous self-development as a computing professional.

PO8: Project Management and Finance (PMF)

Ability to apply knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments.

PO9: Communication Efficacy (CE)

Ability to effectively communicate with the technical community, and with society at large, about complex computing activities by being able to understand and write effective reports, design documentation, make effective presentations, with the capability of giving and taking clear instructions.

PO10: Societal and Environmental Concern (SEC)

Ability to recognize and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities applicable to professional computing practices.

PO11: Individual & Team Work (I&T)

Ability to work in multi-disciplinary team collaboration both as a member and leader as per need.

PO12: Innovation and Entrepreneurship (I&E)

Ability to apply innovation to track a suitable opportunity to create value and wealth for the betterment of the individual and society at large.

5. Institutional Policy for Students' Conduct

The following guidelines shall be followed: -

- 5.1 All the students in their introductory Lab. shall be assigned a system, which shall be their workplace for the complete semester. Students can store records of all their Lab. assignments on their individual workstations.
- 5.2 Introductory Lab. shall include an introduction to the appropriate software/tool, followed by a basic Introductory Assignment having Practice Questions. All the students are expected to complete this assignment within a week time, as the same shall be assessed through a lab. test.
- 5.3 Each week the instructor, in parallel to respective topics covered in the theory lecture, shall assign a set of practical problems to the students in form of Assignments (A, B, C,). The problems in these assignments shall be divided into two parts. The first set of Problems shall be compulsory for all the students and its record need to be maintained in the Practical File, having prescribed format, as given in Appendix-A. All the students should get the weekly assignment checked and signed in the Practical File by the respective teacher in the immediate succeeding week. The second sets of problems are Advanced Problems and shall be optional. Student may solve these advanced problems for their further practice.
- 5.4 Cellular phones, pagers, CD players, radios and similar devices are prohibited in the classrooms, laboratories and examination halls.
- 5.5 Laptop-size computers / Tablets may be used in lectures for the purpose of taking notes or working on team-projects.
- 5.6 The internal practical exam shall be conducted towards the end of the semester and shall include the complete set of Lab exercises conducted as syllabus. However, students shall be assessed on continuous basis through overall performances in regular lab tests, both announced and surprise and viva-voce.

- 5.7 The respective faculty shall prepare and submit sufficient number of practical sets of computing problems to the Dean (Examinations), at least two weeks prior to the actual exam. It is the responsibility of the faculty to ensure that a set should not be repeated for more than 5 students in a given batch.
- 5.8 The exam shall be of 3 hours duration where the student shall be expected to implement solutions to his/her assigned set of problems on appropriate software tools in the lab.
- 5.9 Once implemented, student shall also appropriately document code implemented in the assigned answer sheets, which shall be submitted at the end of the examination. All the students shall also appear for viva-voce examination during the exam.
- 5.10 Co-operate, Collaborate and Explore for the best individual learning outcomes but copying or entering into the act of plagiarism is strictly prohibited.

6. Learning Outcomes of Laboratory Work

The student shall demonstrate the ability to:

- Verify and implement the concepts and theory learnt in class.
- Code and use Software Tools to solve problems and present their optimal solutions.
- Apply numerical/statistical formulas for solving problems/questions.
- Develop and apply critical thinking skills.
- Design and present Lab as well as project reports.
- Apply appropriate methods for the analysis of raw data.
- Perform logical troubleshooting as and when required.

- Work effectively as a member of a team in varying roles as need be.
- Communicate effectively, both oral and written.
- Cultivate ethics, social empathy, creativity and entrepreneurial mindset.

7. Course/Lab Outcomes (COs)

CO1 Apply object-oriented software engineering concepts to a project. (BTL3)

CO2 Analyzing and constructing models and diagrams in analysis phase. (BTL6)

CO3 Creating design model diagrams for design phase. (BTL3)

CO4 Use advanced CASE tool. (BTL6)

CO5 Work in teams to design practical solutions for real-life case studies using UML. (BTL6)

8. Mapping of COs with POs

Table 1: Mapping of COs with POs

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	3	3	-	-	-	3	-	-
CO2	3	2	2	-	-	3	-	-	-	3	-	-
CO3	3	3	3	-	2	3	2	-	-	3	-	-
CO4	3	3	3	3	-	3	2	-	-	3	-	-
CO5	3	3	3	2	3	3	2	3	3	3	3	2

9. Course/Lab Description

Course (Lab) Title	: Object-Oriented Software Engineering Lab
Course (Lab) Code	: MCA-164
Credits	: 01
Pre-requisites	: A computer with StarUML, basics of object-oriented concepts, basic knowledge of UML notations.
Academic Session	: January to July
Contact Hours/Week	: 02 (01 Labs of 02 hours each/Week)
Internal Assessment	: 40 Marks
External Assessment	: 60 Marks

10. Grading Policy

Item	Points	Marks	Remarks
Weekly Lab Assignments including Practical Files	10	10	Closed Book/Open Book
Internal End-Term Practical Examination	20	10	Closed Book
Viva-Voce	10	10	Closed Book
Project	10	10	Innovative Applications of Programming
External End-Term Examinations	60	60	Closed Book (conducted and evaluated by the University)
Total		100	

11. Lesson Plan

Week No.	Lab No.	Topics / Concepts to be Covered	Reference of Lab Manual
1.	1.	Implementing the basics of model creation in StarUML.	Assignment 1 (Problem Q1 To Q4, AQ1 & 2)
	2.	Implementing the concept of Use Case Diagrams.	
2.	3.	Develop class diagrams for appropriate cases.	Assignment 2 (Problem Q5 To Q6, AQ3-4)
	4.	Forward engineer class model to automatically generate equivalent Java stub code.	
3.	5.	Test class diagrams through suitable object diagrams.	Assignment 3 (Problem Q7-Q9, AQ5-6)
	6.	Buffer Reserved for Revision	Assignment 1-3
4.	7.	Create suitable activity diagrams for the given scenario.	Assignment 4 (Problem Q10-Q11, AQ7)
5.	8.	Create suitable sequence diagrams for the given scenario.	Assignment 5 (Problem Q12-13, AQ8)
	9.	Buffered Reserved for Revision	Assignment 4-5
6.	10.	Create suitable state diagram for the given scenario.	Assignment 6 (Problem Q14-Q15, AQ9)

Week No.	Lab No.	Topics / Concepts to be Covered	Reference of Lab Manual
7.	11.	Create suitable communication diagram for the given scenario.	Assignment 7 (Problem Q16-17, AQ10)
8.	12.	Create Component Diagrams for the given scenario.	Assignment 8 (Problem Q18-19, AQ11)
9.	13.	Buffer Reserved for Revision	Assignment 6-8
10.	14.	Create suitable Deployment Diagrams for the given scenario.	Assignment 9 (Problem Q20-21, AQ12)
11.	15.	Create PERT/GANTT chart.	Assignment10 (Problem Q22, 23)
12.	16.	Buffer Reserved for Revision	Assignment 1-10

12. Assignments

Assignment Set: 1

Objectives of the Assignment:

- Implementing the basic concepts of Object-Oriented software engineering using StarUML.
- Developing diagrams to evaluate the concepts of use case diagrams.

CO/BTLCovered: CO1/BTL3 & BTL6

Problems:

- Q1** Create a Use Case Diagram for a Digital Sound Recorder with the following main features:
1. The recorder stores up to 10 messages
 2. Each message is max. 2 minutes long
 3. The user can record message
 4. Recording of a message end after 2 minutes or when the user stops recording
 5. Recording destroys the original message at chosen slot
 6. Sufficient level of battery is checked before recording message
 7. Message of a given slot can be replayed
 8. Sufficient level of battery is checked before replaying message
 9. Messages can be locked/unlocked
 10. Locked messages cannot be deleted or over-written by recording to the same slot
- User uses LCD display and buttons to interact with recorder
- Q2** Formulate use case descriptions for 5 major use cases identified in the digital sound recorder
- Q3** As the head of Information Technology at Acme Airlines, you are tasked with building a new booking system to replace the existing system. Acme needs a new system to allow employees to book ticket electronically and check the status of the booked tickets.

The new system will be state of the art and will have a Windows-based desktop interface to allow employees to enter booking details and view employee details. The system will run on individual employee desktops throughout the entire company. For reasons of security and auditing, employees can access only their data. The employees would only be able to view their information, and for any changes they would have to send an

E-Mail to the administrator. Administrator would only have the right to make any changes in the records.

For the cost being a factor Acme wants to use their old server with the existing database. The system will retain information on all employees in the company.

The administrator maintains employee information. He is responsible for adding new employees, deleting employees and changing all employee information such as name, address, and paycheck generation, as well as running administrative reports.

Q4 Consider the following use-case of a travel agency.

Use-Case Name: Ticket Purchasing

Description:

1. The use-case begins when the customer calls the travel agency to ask it to issue a ticket that (s)he has booked.
2. The travel agency operator asks the customer to give his/her booking number.
3. The customer gives the booking number.
4. The operator types in the booking number and the flight reservation system displays the details of the reservation made.
5. The operator asks the customer to confirm the details of the reservation made.
5. The customer confirms the reservation made.
6. The operator asks the customer for a credit card number.
7. The customer gives his/her credit card number.
8. The operator types in the customer's credit card number and when the system confirms that the credit card transaction has been authorized (s)he asks the system to print the tickets, the details of the flights, and an invoice.
9. When the system confirms that the requested items have been printed, the operator informs the customer that the tickets have been issued.

Think of at least two alternative courses of events for this use-case. Describe the alternative courses as separate use-cases. Modify the description of the original use-case to make evident where exactly these alternative use-cases may be called and under which conditions. Create a use-case diagram to illustrate the relationships between the alternative use-cases and the use-case given.

Advanced Problems:

AQ1 Create a use case diagram for a restaurant ordering and billing system?

AQ2 Create a use case diagram for any project carried out by you?

Assignment Set: 2

Objectives of the Assignment:

- Learn the concept of class-diagrams

CO/BTLCovered: CO1 & CO2/BTL2, BTL3 & BTL6

Problems:

Q5 Create a Class Diagram for a Digital Sound Recorder with the following main features:

1. The recorder stores up to 10 messages
 2. Each message is max. 2 minutes long
 3. The user can record message
 4. Recording of a message end after 2 minutes or when the user stops recording
 5. Recording destroys the original message at chosen slot
 6. Sufficient level of battery is checked before recording message
 7. Message of a given slot can be replayed
 8. Sufficient level of battery is checked before replaying message
 9. Messages can be locked/unlocked
 10. Locked messages cannot be deleted or over-written by recording to the same slot
- User uses LCD display and buttons to interact with recorder

Q6 Forward engineer the model obtained in Q5 to automatically generate equivalent Java stub Code?

Advanced Problems:

- AQ3** Create a class diagram for your project for which you created use case model in AQ2?
- AQ4** A reactive real-time object (e.g.: any embedded real time system) wants to communicate an event to an interactive non-real time object (e.g.: user-interface or system monitoring or data logging)?

Assignment Set: 3

Objectives of the Assignment:

- To draw use case diagram, class diagram, package and object diagram for the problems from real situation.

CO/BTLCovered: CO1 & CO2/BTL2, BTL3 & BTL6

Q7 Purpose: Describe major services (functionality) provided by a hospital's reception.
Summary: Hospital Management System is a large system including several subsystems or modules providing variety of functions. **Hospital Reception** subsystem or module supports some of the many job duties of hospital receptionist. Receptionist schedules patient's appointments and admission to the hospital, collects information from patient upon patient's arrival and/or by phone. For the patient that will stay in the hospital ("inpatient") she or he should have a bed allotted in a ward. Receptionist may also receive and process patient's payments, record them and provide receipts. She also is responsible to file insurance claims and generate medical reports.

- a. Make the use case diagram
- b. Provide description for at least 04 use cases
- c. Make the class diagram
- d. Generate Java stub code
- e. Create Object Diagram

Q8 Create an object diagram for a Digital Sound Recorder with the following main features:

1. The recorder stores up to 10 messages
 2. Each message is max. 2 minutes long
 3. The user can record message
 4. Recording of a message end after 2 minutes or when the user stops recording
 5. Recording destroys the original message at chosen slot
 6. Sufficient level of battery is checked before recording message
 7. Message of a given slot can be replayed
 8. Sufficient level of battery is checked before replaying message
 9. Messages can be locked/unlocked
 10. Locked messages cannot be deleted or over-written by recording to the same slot
- User uses LCD display and buttons to interact with recorder

Q9 Create a package diagram for the Digital Sound Recorder in AP1

Advanced Problems:

- AQ5** Create an object diagram for your project?
- AQ6** Create a corresponding package diagram for your project?

Assignment Set: 4

Objectives of the Assignment:

- To draw Activity diagram for the problems from real situation.

CO/BTLCovered: CO1 & CO2/BTL2, BTL3 & BTL6

Problems:

Q10 Create an activity diagram for record message use case of AP1?

Q11 Create an activity diagram for any two use cases of Hospital Reception Subsystem in CP1

Advanced Problems:

AQ7 Create an activity diagram for each basic use case of the project made by you in AQ2?

Assignment Set: 5

Objectives of the Assignment:

- To draw Sequence diagram for the problems from real situation.

CO/BTLCovered: CO1 & CO2/BTL2, BTL3 & BTL6

Problems:

Q12 Create a sequence diagram for the playback message use case of AP1?

Q13 Create a sequence diagram for any two use cases of Hospital Reception Subsystem in CP1

Advanced Problems:

AQ8 Create a sequence diagram for each basic use case of the project made by you in AQ2?

Assignment Set: 6

Objectives of the Assignment:

- To draw State diagram for the problems from real situation.

CO/BTL Covered: CO4/BTL2, BTL3 & BTL5

Q14 Create a state diagram for any two use cases of Hospital Reception Subsystem in CP1

Q15 Create a state diagram for a BANK ATM machine?

Advanced Problems:

AQ9 Create a state diagram for each basic use case of the project made by you in AQ2?

Assignment Set: 7

Objectives of the Assignment:

- To draw Communication diagram for the problems from real situation.

CO/BTLCovered: CO1 & CO2/BTL2, BTL3 & BTL6

Problems:

Q16 Create a communication diagram for the playback message use case of AP1?

Q17 Create a communication diagram for any two use cases of Hospital Reception Subsystem in CP1?

Advanced Problems:

AQ10 Create a communication diagram for each basic use case of the project made by you in AQ2?

Assignment Set: 8

Objectives of the Assignment:

- To draw Component diagram for the problems from real situation.

CO/BTLCovered: CO1 & CO2/BTL2, BTL3 & BTL6

Problems:

Q18 Create a component diagram for the Hospital Reception Subsystem?

Q19 Create a component diagram for ATM Machine

Advanced Problems:

AQ11 Create a component diagram for your project?

Assignment Set: 9

Objectives of the Assignment:

- To draw Deployment diagram for the problems from real situation.

CO/BTLCovered: CO1 & CO2/BTL2, BTL3 & BTL6

Q20 Create a deployment diagram for the Hospital Reception Subsystem?

Q21 Create a deployment diagram for ATM machine?

Advanced Problems:

AQ12 Create a deployment diagram for your project?

Assignment Set: 10

Objectives of the Assignment:

- To draw PERT/GANTT diagram for the problems from real situation.

CO/BTLCovered: CO1 & CO2/BTL2, BTL3 & BTL6

Problems:

Q22 Create a PERT Chart on PowerPoint for the following

Activity	Description	Predecessor	Estimated Time (hours)
A	Drive Home	None	0.5
B	Wash Clothes	A	4.0
C	Pack	B	0.5
D	Go to Bank	A	1.0
E	Pay Bill	D	0.5

F	Pack Car	C,E	0.5
G	Drive to Bus	F	0.5

Q23 Create a GANTT Chart on PowerPoint for the following

Task	Prec Task	Description	Time (in hrs)
A	None	Decide on Date for the Party	1
B	A	Book a bouncy Castle	1
C	A	Send Invitations	5
D	C	Receive Replies	7
E	D	Buy Toys and Balloons	1
F	D	Buy Food	3
G	E	Blow up Balloons	2
H	F	Make Food	1
I	H, G	Decorate	1
J	B	Get Bouncy Castle	1
K	J, I	Have Party	2
L	K	Cleanup	4
M	K	Send Back Bouncy Castle	1
N	M	Donate Unwanted Gifts	3

- label hours 0 to 30 across the horizontal axis
- Mark a review stage at hour 14 to monitor the progress
- Assume and illustrate that tasks A, B, C and D have been completed at hour 14
State which tasks are ahead and which tasks are behind schedule

APPENDIX-A

Template for the Index of Lab File

WEEK NO.	PROBLEMS WITH DESCRIPTION		PAGE NO.	SIGNATURE OF THE TEACHER WITH DATE
1	Q1			
	Q2			
	AQ			
2	Q3			
	Q4			
	Q5			
3	AQ2			
	Q6			
	Q7			
	Q8			

Note: The students should use Header and Footer mentioning their roll no. & name in header and page no. in footer