TKM COLLEGE OF ENGINEERING

(Government Aided and Autonomous)

celebrating 60 years of excellence

MCA

Curriculum 2023

&

First & Second Semester Syllabus

THANGAL KUNJU MUSALIAR COLLEGE OF ENGINEERING
(Government Aided and Autonomous)
KOLLAM-691005, KERALA

Abstract

TKMCE-Academics- MCA   Curriculum & Syllabus (S1& S2) 2023 -orders issued

No: ACU3/657/2023   Date: 12/06/2023

Order

Read:
1. UGC order Ref: F. 22-1/2022(AC) dated 26th May 2022
2. U.O. No. KTU/ASST11(ADMIN)/3212/2022 dated 2nd September 2022
3. ACU3/1010/2022 dated 16th September 2022

The TKM College of Engineering was conferred with autonomous status by the UGC on 26th May 2022 vide Ref: 1 and the same was notified by the APJ Abdul Kalam Technological University, on 2nd September 2022, vide ref.2

The first meeting of the Governing Body after the notification of autonomous status was held on 15th September 2022, authorized the Principal to constitute the Academic council as per the UGC (Conferment of Autonomous Status upon Colleges and Measures for Maintenance of Standards in Autonomous Colleges) Regulations, 2018. As per the resolution of the Governing Body, the Principal has constituted the Academic council on 16th September 2022 vide ref.3.

The Second Academic council meeting held on 27th May 2023, approved the MCA Curriculum & First year Syllabus (S1&S2) for the academic year 2023-24 onwards.

PRINCIPAL
THANGAL KUNJU MUSALIAR
COLLEGE OF ENGINEERING
KOLLAM-5

Copy to All HODs, Deans, IQAC, COE, AA, AO, SS, JS(A

Preface to the Curriculum

The TKM College of Engineering is pleased to announce the launch of its new postgraduate MCA curriculum, aiming at a comprehensive and rigorous education in computer application and technology, a holistic approach. The curriculum has been carefully designed to provide our students with the skills and knowledge needed to become competent professionals capable of tackling real-world problems in a variety of fields.

The curriculum has a total of 87 credits, spread over a period of two years, with each year comprising two semesters. The curriculum is designed to expose students to both theoretical and practical aspects and provide them with hands-on experience in the latest technologies and tools used in the industry.

The project-based courses that emphasize hands-on learning and real-world applications supported by the fundamentals of computer application is the core of this curriculum. These courses are offered with lab components, which allow students to gain practical experience in applying the concepts they have learned. In addition, there are courses which include core courses and mathematical courses with lab components, core courses without practical components, 2-hour theory courses, as well as 1-hour theory courses and 2-hour lab courses. This variety of courses ensures that students receive well-rounded education and have the flexibility to customize their own learning experience according to their interests and career goals. In addition to these core subjects, students will have the opportunity to choose from a wide range of elective courses in specialised areas.

The students can opt for MOOC courses corresponding to Elective Courses, which will give them flexibility in doing internships during their 3rd semester as part of a mini project.

An industry internship/research project is also included in the curriculum in 4th semester, giving students the opportunity to apply their theoretical knowledge to socially relevant real-world problems and gain valuable practical experience. The

internship will also assist students in developing professional skills and expanding their industry network.

In addition to the academic curriculum, students should also participate in various extracurricular activities such as sports, cultural events, community service, and entrepreneurship. These activities will help students develop their leadership, teamwork, and communication skills, and provide them with a well-rounded education.

Major highlights of the Curriculum

- ✓ Flexible and Fragmented credit system
- ✓ Self-learning Assessment system
- ✓ IT industry readiness activities
- ✓ Internship
- ✓ Project based core courses
- ✓ Lab based core courses
- ✓ Mandatory MOOC course

GENERAL COURSE STRUCTURE

1. Credit and Courses:

Classification	Credit assigned
1 Hour Lecture (L) per week	1 Credit
1 Hour Tutorial (T) per week	1 Credit
1 Hour Project (J) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

Credit pattern

Credit is a unit by which the course work is measured. It determines the number of hours of instructions required per week. All courses are considered to be offered for the entire duration of a semester. 1 Hour class room lecture (L) of 60 minutes duration per week, carried out during all weeks of the semester, shall be considered as one Instructional Unit or one Credit. A tutorial (T) of 60 minutes duration per week, carried out during all weeks of the semester, will be considered as one Instructional Unit or one credit. A project (J) of 60 minutes duration per

week, carried out during all weeks of the semester, shall be considered as one Instructional Unit or one Credit. A minimum of 120 minutes per week of laboratory session/ practical or field work/ training (P) or a combination of these, carried out during all weeks of the semester, shall also be considered as one Instructional Unit or one Credit.

Courses are organized as 1/2/3/4/5 credit courses based on the content delivery mechanism adopted   and the indented depth of the course (Theory only, Theory embedded with tutorial, Theory embedded with practice, Theory embedded with project, etc.). The L-T-P for each course indicates the number of credits delivered as Lecture (L), Tutorial (T), Practical (P) per week. Apart from lecture, tutorial, and practical/practice hours the curriculum offers Project Hour (J) and Self learning hours (S). For each course Self learning hour (number of hours a student must spent for learning) per week is calculated as:

$$S= (L*1+T*0+P*1+[J/2])$$

where J belongs to the project component of a project-based course.

Thus, the L-T-P-J-S-C for each course indicates the number of credits delivered as Lecture (L), Tutorial (T), Practical (P), Project (J), Self-study hours (S) and the total instructional delivery indicated as Credits (C).

$$C = L+ T + [P/2] + J$$

Sl No.	Lecture-Tutorial-Practical/Project [L-T-P-J]	Self-learning hours[S]	Credit [C]	Description
1	2-0-0-0	2	2	Theory course without ESE
2	3-1-0-0	3	4	Theory course embedded with tutorial
3	2-1-2-0	4	4	Theory course embedded with tutorial & practical
4	1-0-2-0	3	2	Theory course embedded with practical without ESE
5	2-0-2-2	5	5	Project based course
6	0-0-2-0	2	1	Seminar
7	0-0-6-0	6	3	Mini Project
8	0-0-12-0	12	6	Final year Project

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2. Course category and coding/definition:

Course category	Description
PCC	Program Core Course
PBC	Project Based Course
PEC	Professional Elective Course
MP	Mini project
SR	Seminar
PR	Main Project (Research project/Internship)
MC	Mandatory Course

Structure of PG Program

The curriculum of the MCA Program shall have a total of 87 academic credits. It should provide sufficient opportunities to students to enhance their communication, soft skills, managerial and technical skills. The structure of MCA program shall have essentially the following categories of courses with the breakup of credits as given:

Sl No:	Category	Credit Breakup
1	Program core courses	53
2	Professional Elective courses relevant to chosen specialization/ branch	12
3	Project work, seminar and internship in industry or elsewhere	18
4	Soft skill courses	2
5	Mandatory Courses	2
	Total	87

In general, the curriculum of programme consists of courses that are grouped into different heads such as Program Core (PCC), Professional Elective (PEC), Project based courses (PBC) and mandatory courses.

Program Core Course (PCC): Courses listed under Program Core of a curriculum are program specific. Students have to complete all the courses listed under PCC to become eligible for the degree.

Project Based Course (PBC): By taking courses under PBC, students get a deeper knowledge through active exploration of real-world challenges and problems. The ultimate aim of a student is to resolve a problem by applying theoretical knowledge. Doing multiple projects improves problem solving skills.

Professional Elective Course (PEC): By taking courses under Professional Elective, students get an opportunity to study courses which are more advanced or applied or specialized than the basic courses he/she studies as part of program core courses.
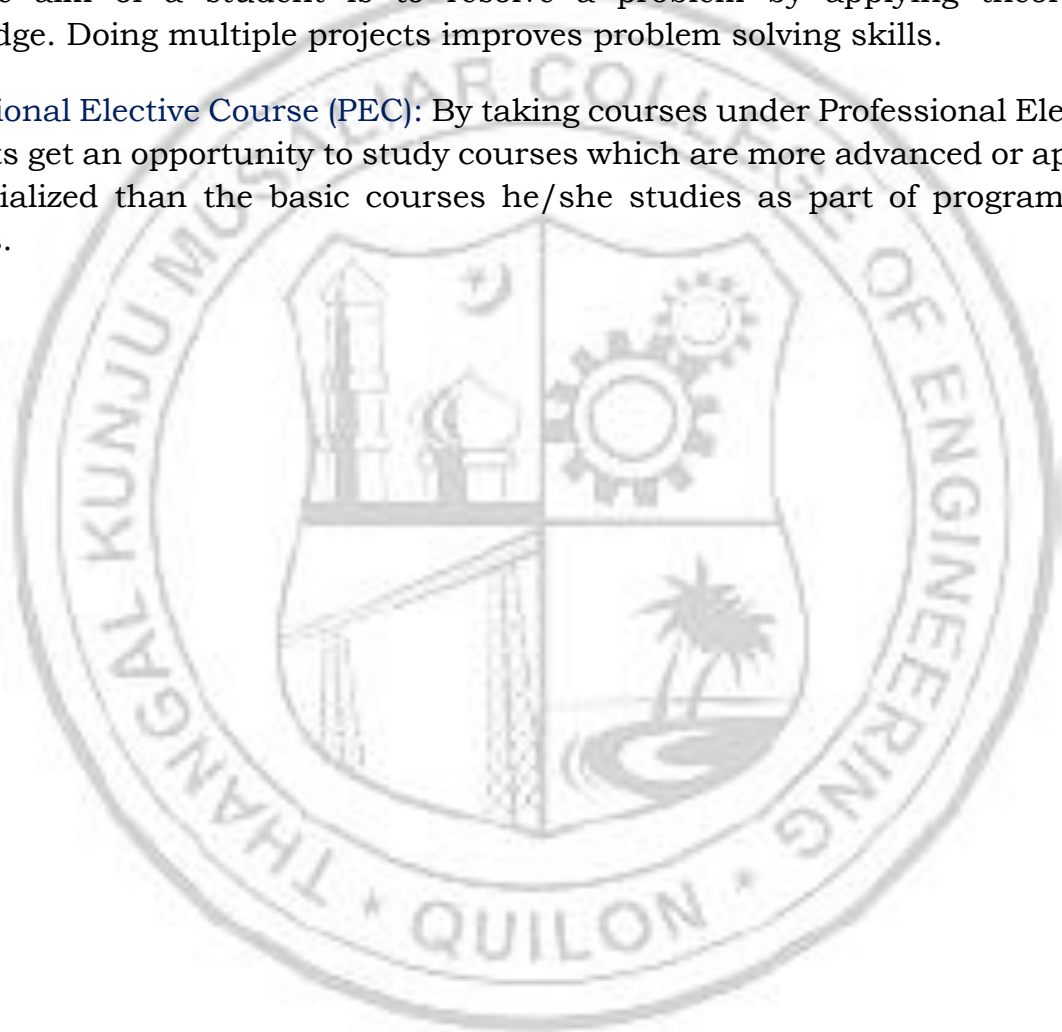
Semester wise credit distribution

Semester wise credit distribution is given below:

Semester	No. & Details of Courses	Total Hours/week	Total Credits
I	Project based course -1 Theory Course – 1 Lab based Courses – 5	29	23
II	Project based course -1 Lab based Courses – 5 Professional Elective - 1	29	23
III	Project based course -1 Theory Course – 2 Lab based Courses – 1 Professional Elective - 2 Mini Project -1	29	24
IV	Seminar Main Project (Research project/Internship)-1 MOOC Course*	29	17+2*
		TOTAL	**87**

* Additional Credits for MOOC Course.

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Course codes:

Each course will be identified by a unique Course Code consisting of eight alphanumeric characters (Two digits, Three alphabets which together followed by three digits) and is represented as YY **XXX C S NN**, which can be interpreted as given below.

YY – Year of Regulation,   **XXX** – Course/Department, **C** - Category Code, **S** – Semester Number (it can have a number from 1 to 4), **NN**- Course Sequence Number.

The alphabets XXX reflect the Program MCA. The alphabet C- in the course code indicates the Course Delivery Mode, the method by which the course will be delivered. Course delivery mode can be placed into one of the eight categories given below.

SL NO	CATEGORY CODE	COURSE CATEGORY
1	T	THEORY ALONE
2	P	THEORY EMBEDDED WITH PRACTICAL COURSE
3	J	THEORY EMBEDDED WITH PROJECT (PROJECT BASED COURSE)
4	E	PROFESSIONAL ELECTIVE COURSE
5	S	SEMINAR
6	M	MINI PROJECT
7	N	MAIN PROJECT (RESEARCH PROJECT / INTERNSHIP)
8	C	MANDATORY MOOC COURSE

For eg: 23MCAT107- is a theory course offered by the department in the first semester of the 2023 scheme.
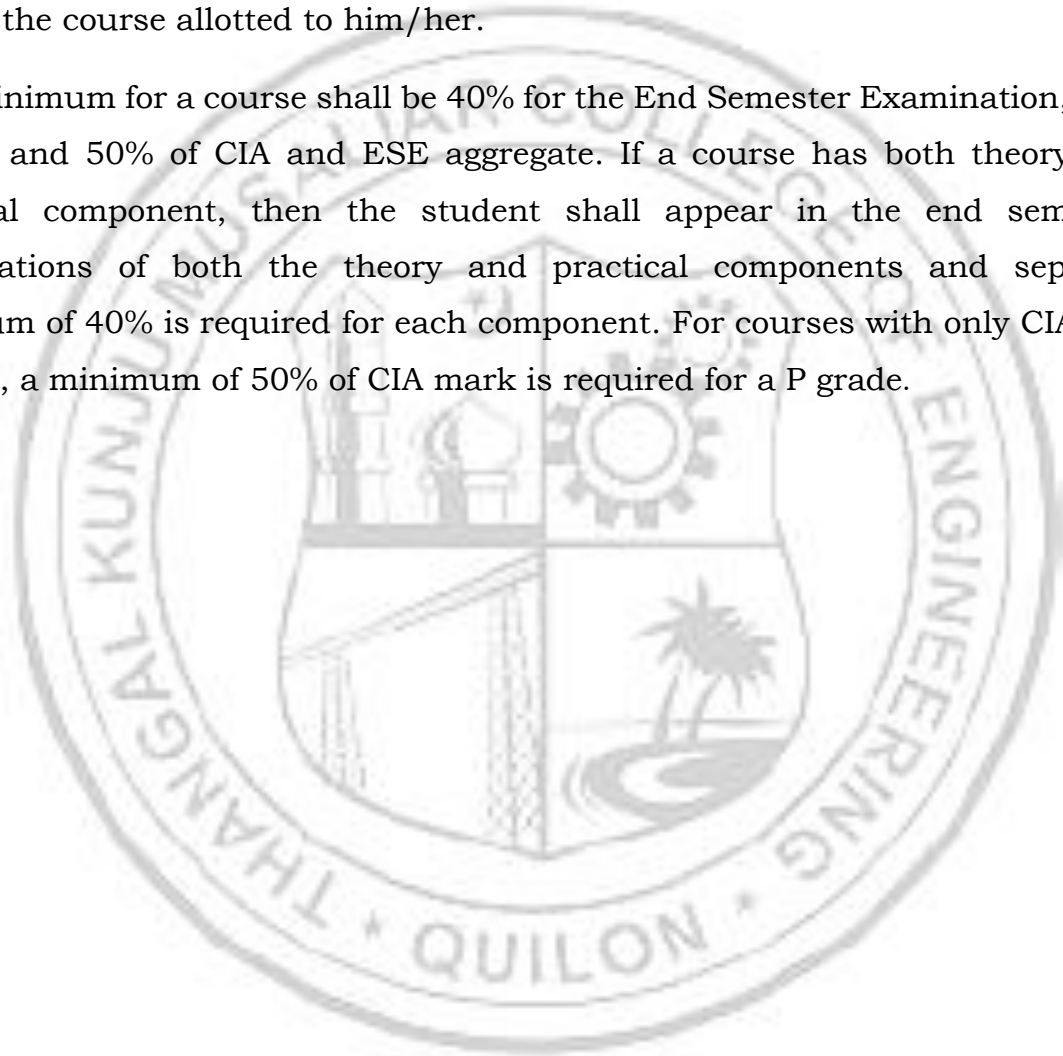
23MCAP204 - is a theory embedded practical course offered by the department in the second semester of 2023 scheme.

23MCAJ301 - is a theory embedded project based course offered by the department in the third semester of 2023 scheme.

Assessment

In each semester, candidates shall be evaluated both by Continuous Internal Assessment (CIA) and End Semester Examinations (ESE) or by Continuous Internal Assessment alone based on the credit assigned to the course. The Continuous Internal assessment shall be on the basis of the day-to-day work, periodic tests, assignments, quizzes, presentations and other suitable tools devised by the course tutor. The faculty member (s) concerned shall carry out the CIA for the course allotted to him/her.

Pass minimum for a course shall be 40% for the End Semester Examination, 40% of CIA, and 50% of CIA and ESE aggregate. If a course has both theory and practical component, then the student shall appear in the end semester examinations of both the theory and practical components and separate minimum of 40% is required for each component. For courses with only CIA and no ESE, a minimum of 50% of CIA mark is required for a P grade.

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Grade and Grade point

Grades	Grade Point [GP]	% of Total Marks obtained
S	10	90% and above
A+	9.0	85% and above but less than 90%
A	8.5	80% and above but less than 85%
B+	8	75% and above but less than 80%
B	7.5	70% and above but less than 75%
C+	7.0	65% and above but less than 70%
C	6.5	60% and above but less than 65%
D	6	55% and above but less than 60%
P [Pass]	5.5	50% and above but less than 55%
F [Fail]	0	Below 50% (CIA + ESE) or Below 40 % for ESE or Below 40% for CIA Below 50% for courses with only CIA and no ESE
FE	0	Failed due to lack of eligibility criteria
ab	0	Could not appear for the end semester examination but fulfils the eligibility criteria.
First Class with Distinction		CGPA 8.0 and above
First Class		CGPA 6.5 and above
Equivalent percentage mark shall be = 10 * CGPA – 2.5		

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Evaluation pattern for End Semester Examination

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	
PATTERN 2		2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x 8 = 40 marks) Time: 2.5 hours [150 minutes]	40
	Total Marks: 0	Total Marks: [5x8 = 40 marks]	

Assessment pattern and marks distribution for CIA and ESE

Mark Distribution

CIA

Course Structure (L-T-P-J)	Attendance	Theory (L- T)			Practical (P)		Project (J)			Total Marks
		Assignment*	Test-1	Test-2	Class work #	Lab Exam	Evaluation 1	Evalaution-2	Report	
2-0-0-0	5	35	30	30	-	-	-	-	-	**100**
1-0-2-0	5	10	20	-	25	40	-	-	-	**100**
3-1-0-0	5	15	10	10	-	-	-	-	-	**40**
2-1-2-0	5	10	10	10	15	10	-	-	-	**60**
2-0-2-2	5	-	10		20		10	10	5	**60**

* Recommended assessment tools for assignment are detailed below

Continuous Assessment of Lab

Assessment of Assignment component of CIA

Course Category	L-T-P-J	Credit	Assessment of Assignment component of CIA
Theory Course	2-0-0-0	2	One Assessment per Two and Half module
Theory Embedded with Practical	1-0-2-0		
Theory Course	3-1-0-0	4	One Assessment per Module, Best of FOUR shall be considered for Marks calculation.
Theory Embedded with Practical	2-1-2-0		

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Evaluation Type, CIA & ESE Mark Distribution: for courses with various course structure is given in the following table:

Evaluation Type	Course Category	L-T-P-J	Credit	CIA & ESE Marks	
				CIA Mark	ESE Mark
CIA only	Theory Course	2-0-0-0	2	100	--
	Theory Embedded with Practical	1-0-2-0	2		
	Seminar	0-0-2-0	1	50	
	Mini Project	0-0-6-0	3	100	
CIA + ESE	Theory Course	3-1-0-0	4	40	60
	Theory Embedded with Practical	2-1-2-0	4	60	40
	Project Based Course	2-0-2-2	5	60	40

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Assessment for Mini Project, Seminar and Main Project is given in the table given below

Course	Mark Distribution
Mini Project work	a. Continuous evaluation by Supervisor, Scrum Master and Project Guide – 50% b. Interim evaluation by the Project Assessment Board)-25% c. Final evaluation by the Project Assessment Board -25%
Seminar	The report and the presentation shall be evaluated by a team of internal members comprising two senior faculty members based on the style of presentation, technical content, adequacy of reference, depth of knowledge and overall quality of the report. a) Evaluation by Faculty Guide – 20 Marks b) Evaluation by the Faculty Committee-30 Marks **Assessment Criteria** • Scope and relevance of topic – 20% • Quality of presentation slides – 10% • Presentation Skill- 30% • Knowledge in the topic- 20% • Report-20%
Main Project (Research Project / Internship)	a) Continuous evaluation by Supervisor, Guide(s) and Scrum Master – 30 Marks(Internal) b) Evaluation by the Project Assessment Board- 40 Marks(Internal) c) Evaluation by the External expert- 30 Marks (External)

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					SEMESTER I									
Sl. No	Slot	Course Code	Category	Course Title	L	T	P	J	S	No. of Hours	No. of Credits	CIE Marks	ESE Marks
1	A	23MCAJ101	PBC	Programming in Python	2	-	2	2	5	6	5	60	40
2	B	23MCAP103	PCC	Mathematical Foundations for Computing	2	1	2		4	5	4	60	40
3	C	23MCAP105	PCC	Advanced Data Structures	2	1	2		4	5	4	60	40
4	D	23MCAT107	PCC	Computer Networks	3	1			3	4	4	40	60
5	I	23MCAP09	PCC	Data Analytics and Visualization	1	-	2		3	3	2	100	-
6	J	23MCAP11	PCC	Linux Commands and Shell Scripting	1	-	2		3	3	2	100	-
7	K	23MCAP13	PCC	Professional Communication & business etiquettes	1	-	2		3	3	2	100	-
				Mandatory course (Bridge Course : C, DBMS fundamentals and Operating System)									
					12	3	12	2	25	29	23		

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Sl. No	Slot	Course Code	Category	Course Title	L	T	P	J	S	No. of Hours	No. of Credits	CIE Marks	ESE Marks
				SEMESTER II									
1	A	23MCAJ202	PBC	Web Application Development	2	-	2	2	5	6	5	60	40
2	B	23MCAP204	PCC	Object Oriented Programming (JAVA)	2	1	2		4	5	4	60	40
3	C	23MCAP206	PCC	Advanced Database Management Systems	2	1	2		4	5	4	60	40
4	D	23MCAE2--	PEC	Elective 1 / MOOC Course	3	1			3	4	4	40	60
5	I	23MCAP208	PCC	Cloud Computing	1	-	2		3	3	2	100	-
6	J	23MCAP210	PCC	Applied Statistics with R	1	-	2		3	3	2	100	-
7	K	23MCAP212	PCC	Virtualisation and Containers	1	-	2		3	3	2	100	-
					12	**3**	**12**	**2**	**25**	**29**	**23**		

Sl. No	Slot	Course Code	Category	Course Title	L	T	P	J	S	No. of Hours	No. of Credits	CIE Marks	ESE Marks
SEMESTER III													
1	A	23MCAJ301	PBC	Machine Learning	2	-	2	2	5	6	5	60	40
2	B	23MCAT302	PCC	Advanced Software Engineering	3	1			3	4	4	40	60
3	C	23MCAE3--	PEC	Elective 2 / MOOC Course	3	1			3	4	4	40	60
4	D	23MCAE3--	PEC	Elective 3 / MOOC Course	3	1			3	4	4	40	60
5	I	23MCAP305	PCC	Mobile Application Development (Flutter)	1	-	2		3	3	2	100	-
6	L	23MCAT306	PCC	Cyber Security	2	-			2	2	2	100	-
7	U	23MCAM307	MP	Mini Project		-	6		6	6	3	100	-
					14	**3**	**10**	**2**	**25**	**29**	**24**		
SEMESTER IV													
1	U	23MCAN302	PR	Main Project (Research Project / Internship)	-	-	27		14	27	14	70	30
2	S	23MCAS304	SR	Seminar and Technical writing	-	-	2		2	2	1	50	-
3		23MCAC304	MC	Mandatory course : One MOOC Course					2	-	2		
							29		18	29	17	70	30
				TOTAL					**93**	**116**	**87**		

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Professional Elective Courses

Elective - 1	
23MCAE232	Design and Analysis of Algorithms
23MCAE234	Functional Programming
23MCAE236	Advanced Operating Systems
23MCAE238	Compiler Design
23MCAE240	Object Oriented Modelling and Design
23MCAE242	Organisational Behaviour
23MCAE244	Data Mining
23MCAE246	IPR and Cyber laws
23MCAE248	Cyber Forensics
23MCAE250	Mobile Communication
Elective 2 / Elective 3	
23MCAE331	Artificial Intelligence
23MCAE333	Data Visualisation Techniques
23MCAE335	Distributed Computing
23MCAE337	Digital Image Processing
23MCAE339	Big Data Analytics
23MCAE341	Operations Research
23MCAE343	Artificial Intelligence in medicine
23MCAE345	Artificial Intelligence in cyber Security
23MCAE347	Natural Language Processing
23MCAE349	Accountancy and Financial Management
23MCAE351	Optimization Techniques
23MCAE353	Wireless Sensor Networks
23MCAE355	Advanced Computer Graphics
23MCAE357	Internet of Things
23MCAE359	Computer Vision
23MCAE361	Deep Learning

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23MCAE363	Bioinformatics
23MCAE365	Social Network Analysis
23MCAE367	Embedded Systems
23MCAE369	Pattern Recognition
23MCAE371	Business Management
23MCAE373	Cryptography and Cyber Security

SEMESTER-I

SYLLABUS
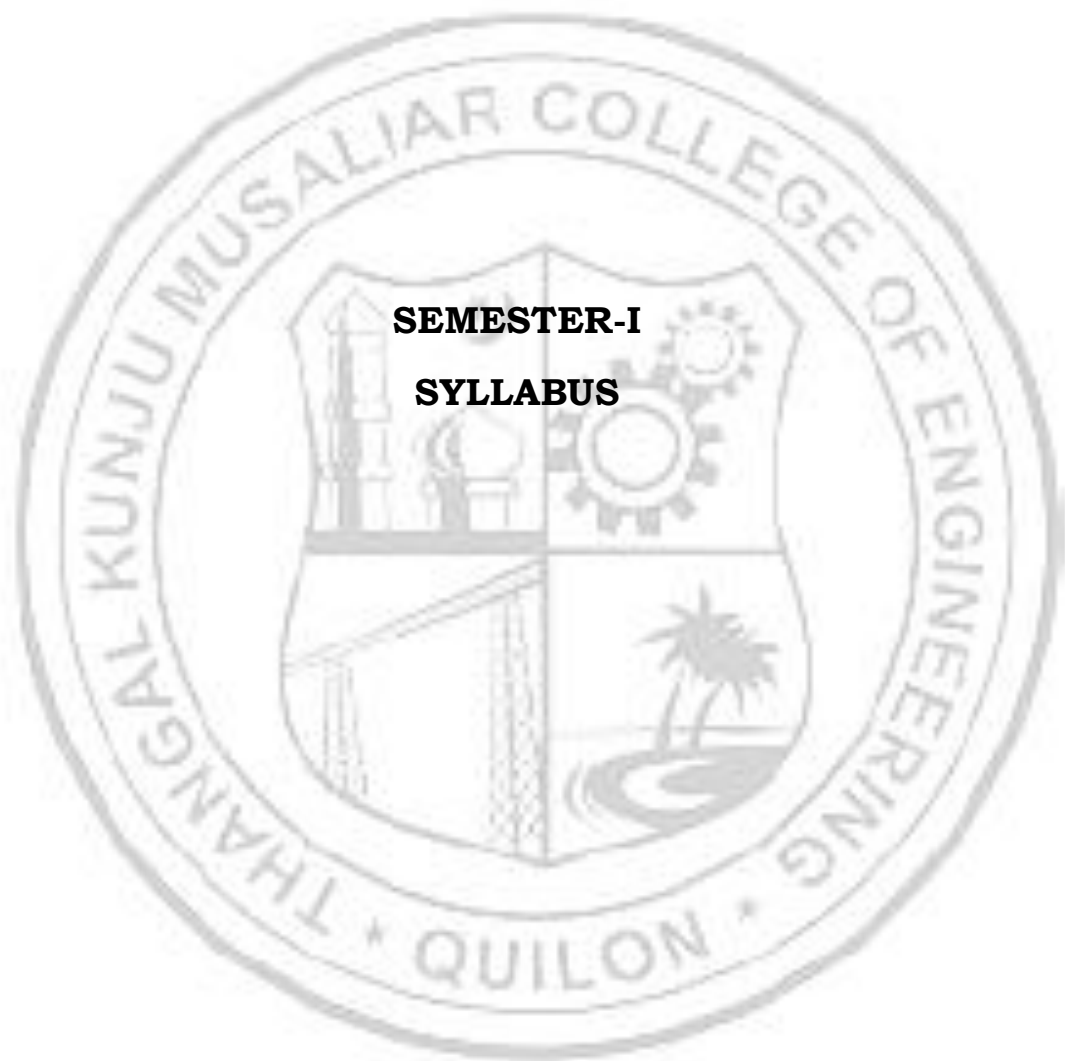
23MCAJ101	PROGRAMMING IN PYTHON	L	T	P	J	S	C	Year of Introduction
		2	0	2	2	5	5	2023

Preamble: The course focuses on setting up a programming environment for Python language, developing programs using data types, control structures, functions, object oriented concepts, exception handling, database and graphic programming. The students will learn to implement Python programs and develop small projects using Python language

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Identify packages and set up programming environment and develop Python programs using data types, control structures and functions from the Python standard library.
CO 2	Implement functions, packages and file handling concepts in Python
CO 3	Design and implement object-oriented Python programs, using classes, inheritance, polymorphism, and other object-oriented concepts including exception handling features.
CO 4	Develop Python programs using regular expressions and interacting with databases
CO 5	Implement GUI programming using Tkinter and Develop programs using NumPy, SciPy and matplotlib

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓			✓							
CO 2	✓	✓			✓		✓		✓		✓	
CO 3	✓	✓	✓		✓		✓		✓		✓	
CO 4	✓	✓	✓	✓	✓		✓		✓		✓	
CO 5	✓	✓	✓	✓	✓		✓		✓		✓	

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember		✓	✓	✓
Understand		✓	✓	✓

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Apply		✓	✓	✓
Analyse			✓	
Evaluate			✓	
Create			✓	

Assessment Pattern for Lab component

Bloom's Category	Continuous Assessment Tools	
	Class work	Test2
Remember		
Understand	✓	✓
Apply	✓	✓
Analyse	✓	✓
Evaluate	✓	
Create	✓	

Assessment Pattern for Project component

Bloom's Category	Continuous Assessment Tools		
	Evaluation 1	Evaluation 2	Report
Remember			
Understand	✓	✓	
Apply	✓	✓	
Analyse	✓	✓	
Evaluate		✓	
Create		✓	

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]		Practical [P]	Project [J]			Total Marks
		Assignment	Test-2	Class work	Evaluation 1	Evalaution-2	Report	
2-0-2-2	5	-	10	20	10	10	5	**60**

Total Marks distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	60	40	2.5 Hrs

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks

PATTERN 2		2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x 8 = 40 marks) Time: 2.5 hours	40
	Total Marks: 0	Total Marks: [5x8 = 40 marks]	

SYLLABUS

MODULE I: Introduction to Python

Introduction: Setting up IDE environment, Features of Python, How to Run Python, Identifiers, Reserved Keywords, Variables, Input, Output and Import functions, Operators.

Data Types: Numbers, Strings, List, Tuple, Set, Dictionary.

Decision making and Loops

MODULE II : Functions and File Handling

Functions: Function definition, arguments, Lambda Functions, Recursive Functions

Modules & Packages: Creating Modules, import Statement, Packages.

File Handling, Pandas, DataFrames.

MODULE III : Object Oriented Programming and Exceptions

Object Oriented Programming: Class definition, Creating objects, Encapsulation, Data hiding, Inheritance, Method overriding, Polymorphism.

Exception Handling: Built-in Exceptions, Handling Exceptions, Raising an Exception, User-defined Exceptions, Assertions.

MODULE IV : Regular Expressions, Database Programming.

Regular expressions: Introduction, match() function, search() function, search and replace, regular expression modifiers, regular expression patterns, Character classes, special character classes, repetition cases, findall() method, compile() method.

Database Programming: Connecting to a database, Creating Tables, INSERT, UPDATE, DELETE and READ operations, Transaction Control, Disconnecting from

a database, Exception Handling in Databases   (interfacing with MySQL and MongoDB)

MODULE V : GUI programming

GUI Programming: Tkinter introduction, Tkinter and Python Programming, Tk Widgets, Tkinter examples

Introduction to SciPy (https://www.scipy.org), NumPy (http://www.numpy.org), matplotlib (https://matplotlib.org).

Text books

1. Jeeva Jose , Taming Python by Programming, Khanna Publishers, New Delhi, 2017
2. Eric Matthes, Python Crash Course: A Hands-On, Project-Based Introduction to Programming, 2nd Edition, No starch Press, 2019.
3. Martic C Brown, Python: The Complete Reference, 4th Edition, McGraw Hill Publishers,
4. Programming, Data Structures and Algorithms using Python-Nptel course (https://nptel.ac.in/courses/106106145)
5. Python for Data Science-Nptel Course (https://nptel.ac.in/courses/106106212)

Reference books

1. Magnus Lie Hetland, Beginning Python: From Novice to Professional, Apress, Third Edition
2. Charles Dierbach, Introduction to Computer Science using Python, Wiley, 2015
3. Wesley J. Chun, Core Python Applications Programming, 3rd Edition , Pearson Education,
4. Downey, A. et al., How to think like a Computer Scientist: Learning with Python, John Wiley, 2015

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours
	MODULE 1	
1.1	Basic Features	1
1.2	Data Types	1
1.3	Data Types (Conti...)	1
1.3	Control structures	1
1.4	Control structures (Conti...)	1
	MODULE II	
2.1	Functions, Arguments	1
2.2	Lambda and Recursive functions	1

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2.3	Modules	1
2.4	Packages	1
2.5	File handling	1
2.6	File handling (Conti...)	1
MODULE III		
3.1	Classes and Objects	1
3.2	Inheritance	1
3.3	Method Overriding	1
3.4	Polymorphism	1
3.5	Exception Handling	1
3.6	User Defined Exceptions, Assertions	1
MODULE IV		
4.1	Introduction, match() function, search() function, search and replace, regular expression modifiers, regular expression patterns	1
4.2	Character classes, special character classes, repetition cases, findall() method, compile() method.	1
4.3	Database Programming: Connecting to a database, Creating Tables, INSERT, UPDATE, DELETE and READ operations	1
4.4	Transaction Control, Disconnecting from a database, Exception Handling in Databases	1
MODULE V		
5.1	GUI Programming: Tkinter introduction, Tkinter and Python Programming	1
5.2	Tk Widgets, Tkinter examples	1
5.3	Introduction to SciPy (https://www.scipy.org), NumPy – functions (http://www.numpy.org), matplotlib (https://matplotlib.org).	1

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LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Setting up programming environment, Data types	2	Implement programs listed under CO1
2	Control Structures	2	
3	Functions	2	Implement programs listed under CO2
4	Modules and Packages	2	
5	File Handling	2	
6	Objects and classes	4	Implement programs listed under CO3
7	Exception Handling	1	
8	Regular Expressions	2	Implement programs listed under CO4
9	Database programming	3	
10	Tkinter	2	Implement programs listed under CO5
11	NumPy, SciPy and Matplotlib	2	

List of Experiments

CO1

1. Display future leap years from current year to a final year entered by user.

2. List comprehensions:

   (a) Generate positive list of numbers from a given list of integers

   (b) Square of N numbers

   (c) Form a list of vowels selected from a given word

   (d) List ordinal value of each element of a word (Hint: use ord() to get ordinal values)

3. Count the occurrences of each word in a line of text.

4. Prompt the user for a list of integers. For all values greater than 100, store 'over' instead.

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5.   Store a list of first names. Count the occurrences of 'a' within the list

6.   Enter 2 lists of integers. Check (a) Whether list are of same length (b) whether list sums to same value (c) whether any value occur in both

7.   Get a string from an input string where all occurrences of first character replaced with '$', except first character.[eg: onion -> oni$n]

8.   Create a string from given string where first and last characters exchanged. [eg: python -> nythop]

9.   Accept the radius from user and find area of circle.

10.   Find biggest of 3 numbers entered.

11.   Accept a file name from user and print extension of that.

12.   Create a list of colors from comma-separated color names entered by user. Display first and last colors.

13.   Accept an integer n and compute n+nn+nnn.

14.   Print out all colors from color-list1 not contained in color-list2.

15.   Create a single string separated with space from two strings by swapping the character at position 1.

16.   Sort dictionary in ascending and descending order.

17.   Merge two dictionaries.

18.   Find gcd of 2 numbers

19.   From a list of integers, create a list removing even numbers.

20.   Program to find the factorial of a number

21.   Generate Fibonacci series of N terms

22.   Find the sum of all items in a list

22. Generate a list of four digit numbers in a given range with all their digits even and the number is a perfect square.

22. Display the given pyramid with step number accepted from user.

Eg: N=4

```
  1
  2 4
  3 6 9
  4 8 12  16
```

23. Count the number of characters (character frequency) in a string.

24. Add 'ing' at the end of a given string. If it already ends with 'ing', then add 'ly'

25. Accept a list of words and return length of longest word.

26. Construct following pattern using nested loop

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```
      *
      * *
      * * *
      * * * *
      * * * * *
      * * * *
      * * *
      * *
      *
```

27.   Generate all factors of a number.

28.   Write lambda functions to find area of square, rectangle and triangle.

CO2

1.   Work with built-in packages

2.   Create a package graphics with modules rectangle, circle and sub-package 3D-graphics with modules cuboid and sphere. Include methods to find area and perimeter of respective figuresin each module. Write programs that finds area and perimeter of figures by different importingstatements. (Include selective import of modules and import * statements)

3.   Write a Python program to read a file line by line and store it into a list.

4.   Write a Python program to copy odd lines of one file to other

5.   Write a Python program to read each row from a given csv file and print a list of strings.

6.   Write a Python program to read specific columns of a given CSV file and print the contentof the columns.

7.   Write a Python program to write a Python dictionary to a csv file. After writing the CSV file read the CSV file and display the content.

8.   Write a Python program to create DataFrame from csv file and perform cleaning operations like removing duplicates, managing empty data, irrelevant colums, rows etc.

CO3

1. Create Rectangle class with attributes length and breadth and methods to find area andperimeter. Compare two Rectangle objects by their area.

2. Create a Bank account with members account number, name, type of account and balance. Write constructor and methods to deposit at the bank and withdraw an amount from the bank.

3. Create a class Rectangle with private attributes length and width. Overload '<'

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operator to compare the area of 2 rectangles.

4. Create a class Time with private attributes hour, minute and second. Overload '+' operator tofind sum of 2 time.

5. Create a class Publisher (name). Derive class Book from Publisher with attributes title and author. Derive class Python from Book with attributes price and no_of_pages. Write a program that displays information about a Python book. Use base class constructor invocation andmethod overriding.

6. Demonstrate the use of Built in Exception classes

7. Write a Python program to throw an exception if the mark scored by the student is less than 50 and display the message 'failed'.

8. Demonstrate the use of Assertions.

CO 4

1. Write a python program to check the validity of password input by users. Validation (At least 1 letter between [a-z] and 1 letter between [A-Z]. At least 1 number between [0-9]. At least 1 character from [$#@]. Minimum length 6 characters. Maximum length 16 characters, must begin with capital letter[A-Z].

2. Develop a database application using a table STUDENT with fields-ROLLNO, NAME, AGE and COURSE. Include connection and disconnection statements to STUDENT database. Write a menu driven python program to implement following operations (MongoDB).

   a) INSERT

   b) UPDATE

   C) DELETE

   D) READ

3. Create a student database with name, rollno and total marks. Apply INSERT operation to insert records. Display the details of students with marks greater than 90%. Update the marks of student with rollno 200(create the record) and display the updated details (MySQL)

CO5

1. Using Tkinter gadgets design a page to accept the name, id, salary and gender of an employee. Use scale widget to display the salary and radio button to identify gender.

2. Write a Python program to identify favorite programming languages from a given set by the user using Checkbutton. Display the languages selected.

3. Draw a barchart showing the sales and expenses of a company for 12 months in 2022.

4. Draw a histogram showing frequency of people having heights between 145 and 180cm from a given list.

5. Create a piechart showing number of sales of different types of cars during the year 2022-23 with suitable labels.

6. Programs for creating, reshaping, extracting and replacing items from a 1D array.

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7. Write a NumPy program to compute the mean, standard deviation and variance of a given array along the second axis.

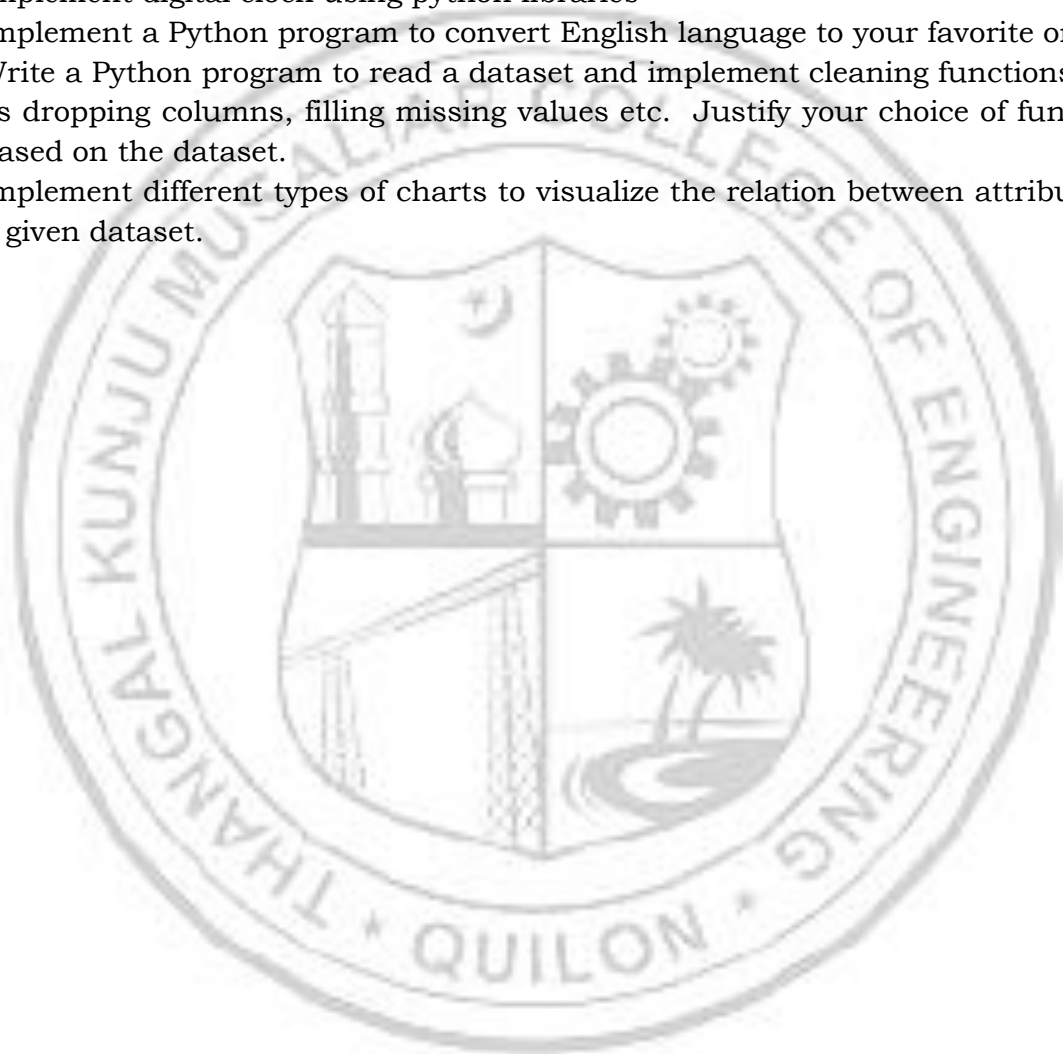|	CO Assessment Questions	
	CO1	
1	Differentiate between list and set data types.	
2	Explain the use of dictionary data type. Write a program to merge two dictionaries.	
3	Explain the syntax of using range function in for loops.	
4	Explain the different types of operators in Python.	
	CO2	
5	List and explain the different types of arguments in Python.	
6	Explain how a module can be located.	
7	List and explain the different file opening modes in Python.	
8	Write a program to count the frequencies of each word from a file.	
	CO3	
9	Explain how constructors and destructors are used in Python programming with examples.	
10	Explain how method overriding is done in Python.	
11	Explain how the values of attributes can be set and displayed	
12	Explain how exception handling is done in Python	
13	Explain the use of assertion in exception handling with an example.	
	CO4	
14	Differentiate between match and search functions in re module.	
15	Explain compile method with an example	
16	List and explain ACID properties of transaction control.	
17	Briefly explain fetchone(), fetchall() and rowcount.	
18	Write a program to retrieve lines with one or more occurrences of the word PYTHON	
	CO5	
19	List the steps in developing GUI using Tkinter and any two Tkinter widgets with the corresponding options.	

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20	List and explain any two functions in matplotlib for drawing graphs and charts?
21	Explain different ways of creating and initializing arrays using NumPy.

Projects (24 Hrs)

1. Implement Binary Search Algorithm using Python
2. Display rank details of students with their rollno, Name, marks of 4 subjects , Total marks, rank and Grade
3. Implement digital clock using python libraries
4. Implement a Python program to convert English language to your favorite one.
5. Write a Python program to read a dataset and implement cleaning functions such as dropping columns, filling missing values etc. Justify your choice of functions based on the dataset.
6. Implement different types of charts to visualize the relation between attributes of a given dataset.

MCA Curriculum 2023 & S1S2 syllabus 23MCAP103 MATHEMATICAL FOUNDATIONS FOR COMPUTING	L	T	P	J	S	C	Year of Introduction
	2	1	2	0	4	4	2023

Preamble:

This course provides an introduction to number theory and linear algebra. It is designed to give the students a comprehensive understanding of the basic principles of these two mathematical disciplines which are at the core of MCA course. Throughout the course, students will be encouraged to apply their knowledge to solve real-world problems.

Prerequisite: A basic course in set theory and matrices.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Apply Division algorithm and Euclidean algorithm to solve problems.
CO 2	Apply the Chinese Remainder Theorem to solve problems in linear congruences.
CO 3	Demonstrate linear system of equations using matrices and solve using the Gauss elimination method.
CO 4	Analyze orthogonality and orthonormal basis and develop the orthonormal basis using the Gram Schmidt process.
CO 5	Compute Eigen values and Eigen vectors and apply them for diagonalization of matrices.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓			✓							✓
CO 2	✓	✓			✓							✓
CO 3	✓	✓			✓							✓
CO 4	✓	✓			✓							✓
CO 5	✓	✓			✓							✓

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse			✓	

| Evaluate | | | ✔ | |
| Create | | | ✔ | |

Assessment Pattern for Lab component				

Bloom's Category	Continuous Assessment Tools	
	Class work	Test1
Remember		
Understand	✔	✔
Apply	✔	✔
Analyse	✔	✔
Evaluate	✔	
Create	✔	

Mark Distribution of CIA							

Course Structure [L-T-P]	Attendance	Theory [L- T]			Practical [P]		Total Marks
		Assignment	Test-1	Test-2	Class work	Lab Exam	
	5	10	10	10	15	10	**60**

Total Marks distribution			

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	60	40	2.5 hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 2		2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x 8 = 40 marks) Time: 2.5 hours	40
	Total Marks: 0	Total Marks: [5x8 = 40 marks]	

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SYLLABUS
MODULE I : (Number Theory I)
Division Algorithm, Greatest Common Divisor, Euclidean algorithm, Diophantine Equation, Fundamental theorem of arithmetic, Primes
MODULE II : (Number Theory II)
Congruence, Properties, Linear Congruence, Chinese Remainder Theorem, Fermat's Theorem, Euler-phi function.
MODULE III : (Linear Algebra I)
System of linear equations, Solution by Gauss elimination, Row echelon form, Finding rank from row echelon form, Vector Spaces, Subspaces -Definition and Examples. Linear independence of vectors, Linear span, Bases and dimension.
MODULE IV : (Linear Algebra II)
Inner Product, properties of inner product, length and distance, Cauchy-Schwarz inequality, Orthogonality , Orthonormal basis, Gram Schmidt orthogonalization process.
MODULE V : (Linear Algebra III)
Eigen values, eigenvectors and Eigen spaces, Properties of Eigen values and Eigen vectors, Diagonalization of matrices, LU-decomposition of matrices, QR-decomposition, Singular value decomposition.

Text books

1. David M. Burton, Elementary Number Theory, Mc Graw Hill, seventh Edition, 2012.
2. Richard Bronson, Gabriel B. Costa, Linear Algebra-an introduction, second edition, Academic press, 2007.
3. David C.Lay, Linear Algebra and its applications, Addison- Wesley publishing company, fourth edition.

Reference books

1. Gilbert Strang, Linear Algebra and It's Applications, 4th edition, Cengage Learning, 2006.
2. Seymour Lipschutz, Marc Lipson, Schaum's outline of linear algebra, 3rd Ed., Mc Graw Hill Edn.2017.
3. W.A. Coppel, Number Theory- An Introduction to Mathematics, Second edition, Springer, 2009.
4. Prof. Gilbert Strang, Linear Algebra [MITOPENCOURSEWARE]
    https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/Relevant
        sections).

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours
MODULE 1		
1.1	Division Algorithm	1
1.2	Greatest Common Divisor	1
1.3	Euclidean algorithm	1
1.4	Diophantine Equation	1
1.5	Fundamental theorem of arithmetic	1
1.6	Primes	1
MODULE II		
2.1	Congruence	1
2.2	Properties of congruences	1
2.3	Linear Congruence	1
2.4	Chinese Remainder Theorem	1
2.5	Fermat's Theorem	1
2.6	Euler-phi function	1
MODULE III		
3.1	System of linear equations	1
3.2	Solution by Gauss elimination	1
3.3	Row echelon form	1
3.4	Finding rank from row echelon form	1
3.5	Vector Spaces, Definition and Examples.	1
3.6	Subspaces	1
3.7	Linear independence of vectors, Linear span	1
3.8	Bases and dimension	1
MODULE IV		
4.1	Inner Product, length and distance,	1
4.2	,properties of inner product	1
4.3	Cauchy-Schwarz inequality	1
4.4	Orthogonality,	1

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4.5	Orthonormal basis	1
4.6	Gram Schmidt orthogonalization process	1
4.7	Problems in Gram Schmidt orthogonalization process	1
MODULE V		
5.1	Eigen values, eigen vectors and eigen spaces,	1
5.2	Properties of eigen values and eigen vectors,	1
5.3	Diagonalization of matrices	1
5.4	LU-decomposition of matrices,	1
5.5	QR-decomposition	1
5.6	Singular value decomposition	1
5.7	Problems in Singular value decomposition	1

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Introduction	2	Introduction to MATLAB\SCILAB and general Syntax
2	Division Algorithm and Euclidean Algorithm	4	Evaluating elementary number-theoretic operations such as LCM, GCD, divisors, max, min, and division algorithm of numbers using software.
3	Euler phi function	2	Find number of relatively prime numbers using Euler phi function. Determine the n^{th} prime, next prime and previous prime numbers.
4	System of linear equations, linear independence	3	Solve system of linear equations using the software.
		2	Determine linear independence and dependence of vectors.

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		2	Compute the rank of a matrix.
		2	Determine subspaces and basis.
5	Eigen values and Eigen vectors	3	Compute eigenvalues and eigenvectors of a matrix.
6	LU decomposition and QR decomposition	2	Find LU decomposition of a given matrix
		2	Find QR decomposition of a given matrix

	CO Assessment Questions	
1	1. Use the Division Algorithm to establish the following: (a) The square of any integer is either of the form 3k or 3k + 1. (b) The cube of any integer has one of the forms: 9k, 9k + 1, or 9k + 8. 2. Use the Euclidean Algorithm to obtain integers x and y satisfying gcd(56,72)=56x + 72y.	

2	1. Solve each of the following sets of simultaneous congruences:
	   (a) x =1 (mod 3), x =2 (mod S), x =3 (mod 7).
	   (b) x = S (mod 11), x =14 (mod 29), x =lS (mod 31).
	2. Solve the linear congruence 17x =3 (mod 2 · 3 · 5 · 7) by solving the system 17x =3 (mod 2), 17x =3 (mod 3), 17x =3 (mod 5), 17x =3 (mod 7).	

3	1. Solve the system of linear equations 3x-y+4z = 1, -4x+y+5z =0, y-3z = 6. 2. Show that the set of vectors (1,2,3) (4,5,6) and (2,1,0) and find a linear relation between them.	
4	1. Determine whether the following vectors (3, 2,-5,0) and (-4,1,-2,6) are orthogonal or not. 2. Show that x = (1,1,1,1) y = (0,1,1,1) and z = (0,0,1,1) is a basis for a subspace W of R^4. Construct an orthogonal basis for W.	
5	1. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 3 & -1 & -1 \\ 0 & 3 & 6 \\ 0 & 0 & 4 \end{bmatrix}$ 2. Diagonalize the matrix $\begin{bmatrix} 1 & 3 & 3 \\ -3 & -5 & -3 \\ 3 & 3 & 1 \end{bmatrix}$.	

23MCAP105	Advanced Data Structures	L	T	P	J	S	C	Year of Introduction
		2	1	2		4	4	2023

Preamble: Advanced Data Structures are used to store and manage data in an efficient and organized way for faster and easy access and modification of Data. This course introduces linear and nonlinear data structures with highly efficient algorithms for fundamental computational problems across a variety of areas. Students are able to understand and apply data structures, including stack, queue, linked list, trees, mergable heaps and apply their knowledge to build robust and scalable software system.

Prerequisite: Basic and discrete mathematics, C programming language

Course Outcomes: After the completion of the course the student will be able to

CO 1	Implement the data structures in various applications.
CO 2	Implement tree structures for the design of efficient algorithms.
CO 3	Develop a deep understanding of heap data structures, including binary heaps, binomial heaps & Fibonacci heaps.
CO 4	Apply advanced graph algorithms and understand their theoretical foundations, algorithmic complexity, and practical applications suitable for solving advanced computational problems.
CO 5	Equip with the knowledge and skills necessary to understand blockchain networks & data structures, and identify potential use cases, opportunities and challenges for blockchain technology in various domains.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓	✓		✓		✓		✓		✓	✓
CO 2	✓	✓	✓		✓		✓		✓		✓	✓
CO 3	✓	✓	✓		✓		✓		✓		✓	✓
CO 4	✓	✓	✓		✓		✓		✓		✓	✓
CO 5	✓	✓					✓					

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓

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Understand	✔	✔	✔	✔
Apply	✔	✔	✔	✔
Analyse			✔	
Evaluate				
Create				

Assessment Pattern for Lab component

Bloom's Category	Continuous Assessment Tools	
	Class work	Test1
Remember		
Understand	✔	✔
Apply	✔	✔
Analyse	✔	✔
Evaluate	✔	
Create	✔	

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]			Practical [P]		Total Marks
		Assignment	Test-1	Test-2	Class work	Lab Exam	
2-1-2-0	5	10	10	10	15	10	60

Total Marks distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	60	40	2.5 hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 2		2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x 8 = 40 marks) Time: 2.5 hours	40
	Total Marks: 0	Total Marks: [5x8 = 40 marks]	

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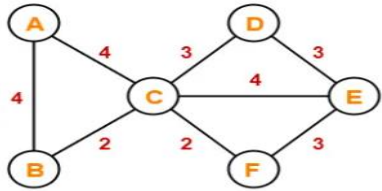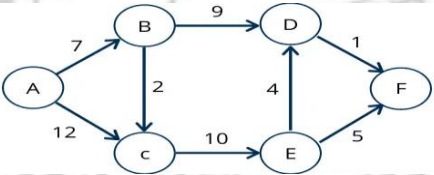TKM College of Engineering, Kollam (Govt. Aided and Autonomous)

SYLLABUS
MODULE I : Review of basic data structures
Array, Sorting-Merge sort, Singly, Doubly and Circular Linked List, Stack and Queue ADTs - Circular Queue, Hashing-Hash functions, Collision Resolution methods- Open Addressing, Chaining. Amortized Analysis- Aggregate, Accounting and Potential Method with multi pop stack example only.
MODULE II : Advanced tree structures
Trees- Ordinary and Binary trees terminology, Binary tree ADT, representations and Properties, tree traversals, Binary Search trees, AVL tree and its rotation, Red-Black trees- Properties of Red Black trees, Rotations, Insertion, Deletion. B-Trees- Basic operations on B-Trees – Insertion and Deletion. Introduction to Splay Trees.
MODULE III : Advanced Heap structures
Binary Heap, Heap Sort, Mergeable Heaps and operations on Mergeable Heaps. Binomial Heaps, Binomial Heap operations, Fibonacci Heaps, Fibonacci Heap operations**.**
MODULE IV : Advanced Graph Structures
Representation of graphs, Depth First and Breadth First Traversals, Topological sorting, Minimum Cost Spanning Tree algorithms- Prim's Algorithm, Kruskal' Algorithm, Shortest Path Finding algorithms – Dijkstra's single source shortest paths algorithm.
MODULE V : Blockchain Data Structure
Blockchain Architecture, Blockchain Data Structures and Data   types, Contract Data, Problems to be solved in Blockchain data analysis.

Text books

1. Cormen T.H., Leiserson C.E, Rivest R.L. and Stein C, *Introduction to Algorithms,* Prentice Hall India, New Delhi, 2004 [Modules 1 to 4]

2. Yang, Xiaojing, Jinshan Liu, and Xiaohe Li. "*Research and Analysis of Blockchain Data." Journal of Physics: Conference Series. Vol. 1237*. No. 2. IOP Publishing, 2019.

Reference books

1. Kleinberg, Jon, and Eva Tardos. ***Algorithm design***. Pearson Education India, 2006.
2. Aho A.V., Hopcroft J.E., and Ullman J.D., ***Data Structures and Algorithms***, Pearson Education, New Delhi, 1983.
3. Sahni S., ***Data Structures, Algorithms, and Applications in C++,*** Mc Graw Hill, Singapore, 1998

MOOC (Reference)

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- https://www.coursera.org/specializations/data-structures-algorithms
- https://nptel.ac.in/courses/106102064
- https://nptel.ac.in/courses/106106133

COURSE CONTENTS AND LECTURE SCHEDULE

No.		No. of Hours
MODULE 1		
1.1	Array	1
1.2	Sorting-Merge sort	1
1.3	Singly Linked List	1
1.4	Doubly & Circular Linked List	1
1.5	Stack	1
1.6	Queue & Circular Queue	1
1.7	Hashing-Hash functions, Collision Resolution methods	1
1.8	Open Addressing and Chaining	1
1.9	Amortized Amalysis- Aggregate, Accounting	1
1.10	Potential Method	1
MODULE II		
2.1	Trees- Ordinary and Binary trees terminology, Binary tree ADT, representations and Properties	1
2.2	Tree traversals	1
2.3	Binary Search trees	1
2.4	AVL tree and its rotation	1
2.5	Red-Black trees- Properties of Red Black trees Rotations	1
2.6	Red-Black trees - Insertion, Deletion	1
2.7	B-Trees- Basic operations on B-Trees – Insertion and Deletion	1
2.8	Introduction to Splay Trees.	1

	MODULE III	
3.1	Binary Heap	1
3.2	Heap Sort	1
3.3	Mergeable Heaps and operations on Mergeable Heaps	1
3.4	Binomial Heaps	1
3.5	Binomial Heap operations	1
3.6	Fibonacci Heaps	1
3.7	Fibonacci Heap operations	1
	MODULE IV	
4.1	Representation of graphs - Depth First	1
4.2	Breadth First Traversals	1
4.3	Topological sorting	1
4.4	Minimum Cost Spanning Tree algorithms- Prim's Algorithm	1
4.5	Kruskal' Algorithm	1
4.6	Shortest Path Finding algorithms – Dijikstra's single source shortest paths algorithm	1
	MODULE V	
5.1	Blockchain Architecture	1
5.2	Blockchain Data Structures and Data types	1
5.3	Data types	1
5.4	Contract Data	1
5.5	Problems to be solved in Blockchain data analysis.	1

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LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiments
1	Array & Merge sort		a) Merge two sorted arrays and store in a third array
2	Singly & doubly linked list linked list		b) Implement a program to store and display contacts on a phone using Singly LL.
3	Stack & Queue	12	c) Implement a program to manage music player application using DLL.
			d) Implement a program to add, delete, search and display the history of visited websites using stack.
			e) Queue - Add, Delete, Search
			f) Singly Linked Stack - Push, Pop, Linear Search
4	Binary search tree		g) Implement a program to create, insert, delete and traverse a binary search tree.
5	Heapsort	12	h) Implement a program for heap sort.
6	Graph traversal & Shortest path		i) Implement BFS and DFS graph traversal.
			j) Implement Dijkstra's shortest path program.

The implementation of Lab component 1,2,3 can be done using C only.

The implementation of Lab component 4,5,6 can be done using C/Python.

CO Assessment Questions

1	a) Develop a program for merge two sorted array into third array with an example. b) In a web browser, you have the choice to go back to the previous page and then move on to the next one as you navigate the web pages. which data structure is appropriate for performing the operations and explain how the operations are performed. Identify the data structure and implement using C.
2	a) Implement binary search tree and its traversals. b) Illustrate and analyze Red Black tree follow the properties by inserting following sequence of keys 8,18,5,15,17,25,40,80.
3	a) Illustrate & solve the process of Decrease key method in a binomial heap with an example. b) Let A = [7,2,4,17,1,11,6,8,15,10,20] Draw a binomial heap whose keys are elements of A.
4	a) Illustrate and solve minimum cost spanning tree using Kruskal's using the following graph given below. b) Suppose Dijkstra's algorithm is run on the following graph, starting at node A, Analyze and illustrate the final shortest path structure.
5	a) Illustrate and explain the need of Merkel tree in blockchain data structure with an example. b) Explain the lifecycle of Blockchain in a banking transaction.

23MCAT107	Computer Networks	L	T	P	J	S	C	Year of Introduction
		3	1			2		2023

Preamble: This course intends to provide insight into Computer Networks. This course provides an insight on the various kinds of network architectures, issues in integrating networks to modern application development, the layered architecture. Students will have an understanding of layered network architecture and the protocols used in different layers.

Prerequisite: Basic concepts of computer operating systems.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Comprehend the terminology and concepts of basic communication model, analyse the protocol layers. (Understand Level)
CO 2	Understand and analyse the various application layer protocols. (Analyse level)
CO 3	Understand and analyse the various transport layer protocols. (Analyse level)
CO 4	Compare and contrast various routing algorithms in the network layer. (Apply level)
CO 5	Understand and analyse the concepts of link layer and physical layer and wireless networks. (Understand Level)

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓			✓	✓	✓		✓			
CO 2	✓	✓			✓	✓			✓			
CO 3	✓	✓	✓		✓	✓	✓		✓			
CO 4	✓	✓	✓			✓			✓			
CO 5	✓	✓				✓			✓			

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse			✓	

Evaluate					
Create					

Mark Distribution of CIA

Course Structure [3-1-0-0]	Attendance	Theory [3- 1]			Total Marks
		Assignment	Test-1	Test-2	
	5	15	10	10	**40**

Total Mark distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	40	60	3 hrs.

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	

SYLLABUS
MODULE I : Computer Networks and the Internet
What Is the Internet? What Is a Protocol?   The Network Edge: Access Networks, Physical Media. The Network Core: Packet Switching, Circuit Switching, A Network of Networks. Types of Delay in Packet-Switched Networks, Packet Loss, End-to-End Delay, Throughput in Computer Networks. Protocol Layers and Their Service Models: Layered Architecture, Encapsulation. Networks Under Attack. History of Computer Networking and the Internet.
MODULE II : Application Layer
Principles of Network Applications, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, SMTP, POP3, IMAP, DNS, Peer-to-Peer Applications, Socket Programming: Socket Programming with UDP, Socket Programming with TCP
MODULE III : Transport Layer
Introduction and Transport-Layer Services, Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet. Multiplexing and Demultiplexing, Connectionless Transport: UDP: UDP Segment Structure, UDP Checksum. Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N (GBN), Selective Repeat (SR). Connection-Oriented Transport: TCP, The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, TCP Congestion Control: Fairness
MODULE IV : The Network Layer
Introduction: Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks: Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks. What's Inside a Router? Input Processing, Switching, Output Processing, Where Does Queuing Occur? The Internet Protocol (IP): Forwarding and Addressing in the Internet, Datagram Format, IPv4 Addressing, Internet Control Message Protocol (ICMP), IPv6. Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing. Routing in the Internet: Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP. Multicast routing.
MODULE V : The Link Layer: Links, Access Networks, and Wireless LANs
Introduction to the Link Layer: The Services Provided by the Link Layer, Where Is the Link Layer Implemented? Error-Detection and -Correction Techniques:

Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) Multiple Access Links and Protocols: Channel Partitioning Protocols, Random Access Protocols, Taking-Turns Protocols Wireless and Mobile Networks: Wireless Links and Network Characteristics, CDMA, WiFi: 802.11 Architecture, The 802.11 MAC Protocol, The IEEE 802.11 Frame. Bluetooth, and cellular networks, Threats and attacks, Firewalls, VPNs, Introduction to network management, SNMP, Traffic analysis tools and Configuration management.

Text books

Computer Networking: A Top-Down Approach Featuring the Internet, J.F. Kurose and K.W.Ross, 8th Ed., Pearson Education, 2020.

Reference books

1. Kevin R. Fall, W. Richard Stevens, "TCP/IP Illustrated, Volume 1 -The Protocols", Pearson Education, 2nd Edition (2014).
2. Larry Peterson, Bruce Davie, "Computer Networks, A systems Approach", Morgan Kaufmann Publishers, 5th Edition (2011).
3. Uyless Black, "Computer Networks: Protocols, Standards and Interface", Prentice HallIndia Learning Private Limited, 8th Edition (2015).
4. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud", Pearson Education, 1st Edition (2016).
5. The Illustrated Network: How TCP/IP Works in a Modern Network 2nd edition Walter Goralski Morgan Kaufmann Publications.

COURSE CONTENTS AND LECTURE SCHEDULE

No.		No. of Hours
	MODULE 1	
1.1	**Computer Networks and the Internet**: What Is the Internet?, What Is a Protocol?	1
1.2	The Network Edge: Access Networks, Physical Media.	1
1.3	Packet Switching, Circuit Switching,	1
1.4	A Network of Networks.	1
1.5	Types of Delay in Packet-Switched Networks,	1
1.6	Packet Loss, End-to-End Delay, Throughput in Computer Networks.	1
1.7	Protocol Layers and Their Service Models: Layered Architecture, Encapsulation.	1
1.8	Networks Under Attack.	1
1.9	History of Computer Networking and the Internet	1

MODULE II		
2.1	**Application Layer** : Principles of Network Applications,	1
2.2	The Web and HTTP	1
2.3	File Transfer: FTP,	1
2.4	Electronic Mail in the Internet, SMTP,	1
2.5	POP3, IMAP	
2.6	DNS,	
2.7	Peer-to-Peer Applications,	1
2.8	Socket Programming: Socket Programming with UDP	1
2.9	Socket Programming with TCP	1
MODULE III		
3.1	Transport Layer: Introduction and Transport-Layer Services Relationship Between Transport and Network Layers	1
3.2	Overview of the Transport Layer in the Internet	
3.2	Multiplexing and Demultiplexing	1
3.4	Connectionless Transport: UDP: UDP Segment Structure, UDP Checksum.	1
3.4	Principles of Reliable Data Transfer :Building a Reliable Data Transfer Protocol,	1
3.5	Pipelined Reliable Data Transfer Protocols,	1
3.6	Go-Back-N (GBN), Selective Repeat (SR)	1
3.6	Connection-Oriented Transport: TCP, The TCP Connection,	1
3.8	TCP Segment Structure, Round-Trip Time Estimation and Timeout,	1
3.9	Reliable Data Transfer, Flow Control, TCP Connection Management	1
3.10	Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, TCP Congestion Control: Fairness	1
MODULE IV		

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4.1	**The Network Layer**: Introduction: Forwarding and Routing, Network Service Models,	1
4.2	Virtual Circuit and Datagram Networks: Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks.	1
4.3	What's Inside a Router? Input Processing, Switching, Output Processing, Where Does Queuing Occur?	1
4.4	The Internet Protocol (IP): Forwarding and Addressing in the Internet,	1
4.5	Datagram Format, IPv4 Addressing, Internet Control Message Protocol (ICMP), IPv6	1
4.6	Routing Algorithms: The Link-State (LS) Routing Algorithm	1
4.7	The Distance-Vector (DV) Routing Algorithm,	1
4.8	Hierarchical Routing.	1
4.9	Routing in the Internet: Intra-AS Routing in the Internet: RIP,	1
4.10	Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP. Multicast routing.	1
MODULE V		
5.1	**The Link Layer: Links, Access Networks, and Wireless LANs:** Introduction to the Link Layer: The Services Provided by the Link Layer, Where Is the Link Layer Implemented?	1
5.2	Error-Detection and -Correction Techniques: Parity Checks,	1
5.3	Check summing Methods, Cyclic Redundancy Check (CRC)	1
5.4	Multiple Access Links and Protocols: Channel Partitioning Protocols,	1
5.5	Random Access Protocols, Taking-Turns Protocols	1
5.6	Wireless and Mobile Networks: Wireless Links and Network Characteristics, CDMA,	1
5.7	WiFi: 802.11 Architecture, The 802.11 MAC Protocol, The IEEE 802.11 Frame.	1
5.8	Bluetooth, and cellular networks, Threats and attacks, Firewalls, VPNs,	1
5.9	Introduction to network management, SNMP,	1
5.10	Traffic analysis tools and Configuration management.	

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	CO Assessment Questions
1	1. Create a script for a role play to mimic the the working of different layers in OSI and TCP/IP network reference models. 2. Conduct a case study and compare Packet Switching and Circuit Switching.
2	1. Design a TCP Socket Program to communicate between two systems in the lab and demonstrate the working of any one application layer protocol. 2. Design a UDP Socket Program to communicate between two systems in the lab and demonstrate the working of any one application layer protocol.
3	1. Role play to demonstrate three-way handshaking in TCP. 2. Prepare charts to compare and contrast Multiplexing and De-multiplexing process in transport layer. 3. Demonstrate using an analogy how TCP is controlling congestion during data transmission.
4	1. Tabulate the forwarding table for router R1 based on destination address for the given figure. 2. Demonstrate and compare the working of LS and DV routing.
5	1. Explain Cyclic Redundancy Check (CRC). Calculate the value of R and the final code word? If D = 101110, d = 6, G = 1001, and r=3. 2. Using any traffic analysis tool, analyse the traffic to a server and briefly explain the different packets between a server and client.

23MCAP09	DATA ANALYTICS AND VISUALIZATION	L	T	P	J	S	C	Year of Introduction
		1	0	2	0	3	2	2023

Preamble: Data Analytics and Visualization is an introductory course designed to equip students with fundamental knowledge and practical skills in analyzing and visualizing data. The course provides a comprehensive overview of key concepts, techniques, and tools used in the field of data analytics and visualization. Students will learn how to collect, clean, analyze, and interpret data to extract meaningful insights and communicate them effectively through visual representations.

Prerequisite: None

Course Outcomes: After the completion of the course the student will be able to

CO 1	Demonstrate a comprehensive understanding of the fundamental concepts of data analytics, its applications and different data types.
CO 2	Apply R programming language concepts such as data types, iteration, control structures, arrays, vectors, functions, packages through examples
CO 3	Implement reading data using R from various sources like CSV files, XMLfiles, Web Data, JSON files, Databases, Excel files.
CO 4	**Implement Data visualization using various charts and graphs**
CO 5	Creating data for analytics through designed experiments, active learning and reinforcement learning

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓										
CO 2	✓	✓	✓		✓		✓					
CO 3	✓	✓	✓		✓		✓					
CO 4	✓	✓	✓		✓		✓					
CO 5	✓	✓	✓	✓	✓		✓					

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓		✓	
Understand	✓		✓	

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Apply	✔		✔	
Analyse			✔	
Evaluate			✔	
Create			✔	

Assessment Pattern for Lab component

Bloom's Category	Continuous Assessment Tools	
	Class work	Test1
Remember		
Understand	✔	✔
Apply	✔	✔
Analyse	✔	✔
Evaluate	✔	
Create	✔	

Mark Distribution of CIA

Total Marks distribution

Course Structure [L-T-P-J] 1-0-2-0	Attendance	Theory [L- T]			Practical [P]		Total Marks
		Assignment	Test-1	Test-2	Class work	Lab Exam	
	5	10	20		25	40	**100**

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	100		

SYLLABUS	54

MODULE I : Introduction to Data Analysis

Overview of Data Analytics, Need of Data Analytics, Nature of Data, Classification of Data: Structured, Semi-Structured, Unstructured, Characteristics of Data, Applications of Data Analytics.

MODULE II : R Programming Basics

Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions, R packages.

MODULE III : Reading Data using R

Reading and getting data into R (External Data): Using CSV files, XML files, Web Data, JSON files, Databases, Excel files.

MODULE IV: Visualization

Working with R Charts and Graphs: Histograms,Boxplots,Bar Charts, Line Graphs, Scatterplots, Pie Charts

MODULE V : Prescriptive Analytics

Creating data for analytics through designed experiments, Creating data for analytics through active learning, Creating data for analytics through reinforcement learning

Text books

6. Bharti Motwani ,"Data Analytics With R", Wiley Publishers,2019
7. Dr.G.Sudhamathy ,Dr.C.Jothi Venkateswaram,"R Programming An Approach to Data Analytics ", Mjp Publisher,2021
8. Introduction to Python for Data Science, NPTEL course, https://nptel.ac.in/courses/106106212
9. Data Analytics with Python-NPTEL course https://nptel.ac.in/courses/106107220

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Reference books

1. Jared P Lander, R for everyone, " Advanced analytics and graphics" , Pearson Education,2013
2. Dunlop, Dorothy D., and Ajit C. Tamhane, "Statistics and data analysis: from elementary to intermediate", Prentice Hall, 2000.
3. Montgomery, Douglas C., and George C. Runger, "Applied statistics and probability for engineers", John Wiley &Sons, 2010
4. Joseph F Hair, William C Black et. al , "Multivariate Data Analysis" , Pearson Education,7th edition, 2013.
5. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley &Sons, Inc., 2012.
6. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R, 2013.

7. Alexandru C. Telea ," Data Visualization: Principles and Practice ", CRC Press

**COURSE CONTENTS AND LECTURE SCHEDULE**	
No.		No. of Hours
**MODULE 1**		
1.1	Overview of Data Analytics, Need of Data Analytics	1
1.2	Classification of Data: Structured, Semi-Structured, Unstructured,	1
1.3	Characteristics of Data, Applications of Data Analytics.	1
**MODULE II**		
2.1	**R Programming Basics** Overview of R programming, Environment setup with R Studio	1
2.2	R Commands, Variables and Data Types, Control Structures,	1
2.3	Array, Matrix, Vectors, Functions R packages.	1
**MODULE III**		
3.1	**Reading and getting data into R (External Data):** Using CSV files, XMLfiles, Web Data, JSON files, Databases, Excel files.	1

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3.2	Web Data, JSON files, Databases, Excel files.	1	
MODULE IV			
4.1	**Working with R Charts and Graphs:** Histograms, Boxplots,Bar Charts,Line Graphs	1	
4.2	Line Graphs, Scatterplots, Pie Charts	1	
MODULE V			
5.1	**Prescriptive Analytics** Creating data for analytics through designed experiments	1	
5.2	Creating data for analytics through active learning,	1	
5.3	Creating data for analytics through reinforcement learning	1	

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Write R commands to perform basic operations such as variable assignment, data manipulation,	1	Experiments based on CO1
2	Write R commands to perform control structures	1	
3	Implement arrays	1	Experiments based on CO2
4	Implement matrices,	1	
5	Implement vector subsetting	1	Experiments based on CO2
6	Implement vector manipulations	1	
7	Implement factors	1	Experiments based on CO2
8	Implement functions in R.	1	

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9	Implement Packages Use the **dplyr** package for efficient data manipulation tasks.(like filtering, sorting, grouping, and summarizing data).	1	Experiments based on CO3
10	Web Data Retrieval	1	
11	JSON Data Parsing	1	Experiments based on CO3
12	Working with REST APIs	1	
13	Database Connectivity	1	Experiments based on CO3
14	SQL Querying and Analysis	1	
15	Excel Data Import	1	Experiments based on CO3
16	Excel Data Export	1	
17	Combining Multiple Data Sources • Merge data from different sources (e.g., JSON file and database) using **dplyr**.	1	Experiments based on CO3, CO4
18	Use the **ggplot2** package to create visually appealing and informative plots.	1	
19	Create different types of charts and graphs in R,histograms, boxplots	1	Experiments based on CO4
20	Customize the appearance of visualizations by adding labels, titles, and legends	1	
21	Create different types of charts and graphs in R bar charts, line graphs, scatterplots, and pie charts.	1	Experiments based on CO4,CO5
22	Utilize the **stats** package to perform statistical analysis on data.	1	

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23	Perform basic statistical tests such as t-tests, ANOVA, and correlation analysis.	1	Experiments based on CO5
24	Calculate summary statistics, confidence intervals, and p-values	1	

List of experiments

CO1

1. Experiment: Factorial of a Number
   - Write a program to take a number as input and calculate its factorial.
   - Display the factorial on the console.
2. Experiment: Fibonacci Series
   - Write a program to generate the Fibonacci series up to a given number of terms.
   - Display the series on the console.
3. Experiment: Prime Number Check
   - Write a program to check if a given number is prime or not.
   - Display the result on the console.
4. Experiment: Largest Number in a List
   - Write a program to find the largest number in a given list of numbers.
   - Display the largest number on the console.
5. Experiment: Average of Numbers in a List
   - Write a program to calculate the average of numbers in a given list.
   - Display the average on the console.
6. Experiment: Power of a Number
   - Write a program to calculate the power of a number raised to a given exponent.
   - Display the result on the console.
7. Experiment: Sum of Odd Numbers
   - Write a program to calculate the sum of all odd numbers between 1 and a given number using a while loop.
8. Experiment: Fibonacci Series
   - Write a program to generate the Fibonacci series up to a given number using a while loop.
9. Experiment: Prime Number Check
   - Write a program to check if a given number is prime or not using a for loop.
10. Experiment: Password Validation
    - Write a program that prompts the user to enter a password and validates it

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using an if-else statement. The password should meet certain criteria (e.g., minimum length, inclusion of special characters).

11. Experiment: Pattern Printing
   - Write a program to print different patterns (e.g., stars, numbers) using nested for loops.

CO2

1. Experiment: Array Manipulation
   - Create a 3-dimensional array and perform operations such as element-wise addition, subtraction, and multiplication.
2. Experiment: Matrix Operations
   - Create two matrices of the same dimensions and perform matrix addition, subtraction, and multiplication.
3. Experiment: Vector Arithmetic
   - Create two vectors of the same length and perform element-wise addition, subtraction, and multiplication.
4. Experiment: Factor Analysis
   - Create a factor variable based on a categorical dataset and perform operations such as counting the frequency of each level and reordering the levels.
5. Experiment: Matrix Transposition
   - Create a matrix and transpose it to interchange rows and columns.
6. Experiment: Vector Subsetting
   - Create a vector of numbers and extract a subset of elements based on specific conditions (e.g., even numbers, numbers greater than a certain value).
7. Experiment: Factor Conversion
   - Create a character vector and convert it to a factor, and vice versa.
8. Experiment: Matrix Multiplication
   - Create two matrices of compatible dimensions and perform matrix multiplication.
9. Experiment: Vector Manipulation
   - Create a vector and perform operations such as sorting, finding the **minimum and maximum values, and calculating the mean and median.**

CO3

1. Experiment 1: Web Data Retrieval
   - Write an R program to scrape data from a website using the **rvest** package.
   - Extract specific information from HTML pages and store it in a data frame.
2. Experiment 2: JSON Data Parsing
   - Load a JSON file into R using the **jsonlite** package.
   - Parse the JSON contents and perform tasks like filtering or aggregating data.
3. Experiment 3: Working with REST APIs
   - Utilize an API (e.g., Twitter API) to fetch data in JSON format.
   - Make API requests, parse the JSON response, and analyze the retrieved data.
4. Experiment 4: Database Connectivity

- Connect R to a database system (e.g., MySQL) using the **RMySQL** package.
- Query the database, retrieve data, and perform basic operations from R.

5. Experiment 5: SQL Querying and Analysis
   - Execute SQL queries within R using packages like **DBI** and **dplyr**.
   - Retrieve data from a database and perform data manipulation tasks.

6. Experiment 6: Excel Data Import
   - Import data from an Excel file into R using the **readxl** package.
   - Handle missing values, clean data, and preprocess it for analysis.

7. Experiment 7: Excel Data Export
   - Export data from R to an Excel file using packages like **writexl**.
   - Create Excel files, define worksheets, and write data frames into specific cells.

8. Experiment 8: Combining Multiple Data Sources
   - Merge data from different sources (e.g., JSON file and database) using **dplyr**.
   - Perform data integration tasks and analyze the combined dataset.

9. Experiment 9: Data Transformation and Cleaning
   - Apply data transformation techniques to external data sources.
   - Handle missing values, remove duplicates, and normalize data using R.

10. Experiment 10: Advanced Data Manipulation
    - Perform advanced data manipulation tasks like reshaping data.
    - Use packages like **tidyr** or **reshape2** to pivot, melt, and cast data.

CO4

1. Experiment: Histogram
   - Generate a histogram to visualize the distribution of a numerical variable, such as the age distribution in a dataset.

2. Experiment: Boxplot
   - Create a boxplot to display the distribution of a numerical variable across different categories, such as comparing the salary distribution for different job titles.

3. Experiment: Bar Chart
   - Generate a bar chart to represent categorical data, such as comparing the sales performance of different products or the population of different countries.

4. Experiment: Line Graph
   - Create a line graph to visualize trends or changes in a numerical variable over time, such as plotting the stock prices of a company over a period of months.

5. Experiment: Scatterplot
   - Generate a scatterplot to visualize the relationship between two numerical variables, such as plotting the relationship between the height and weight of individuals.

6. Experiment: Pie Chart

- Create a pie chart to represent proportions or percentages of different categories, such as displaying the market share of different smartphone brands.

CO5

1. Perform basic statistical tests such as t-tests,

2. ANOVA,

3. Correlation analysis.

4. Calculate summary statistics, confidence intervals, and p-values

CO Assessment Questions	
1	1. List and explain the specific challenges faced by businesses in implementing data analytics solutions? 2. Explain data analytics help in improving customer satisfaction and retention? 3. Explain the key differences between structured, semi-structured, and unstructured data? Provide examples for each type. 4. How does the veracity of data impact the reliability of data analytics results? 5. Explore real-world applications of data analytics in one specific industry and discuss the benefits and outcomes achieved.
2	MODULE II: R Programming Basics 1. Compare and contrast R with other programming languages commonly used for data analysis. 2. Discuss the advantages of using R Studio as an integrated development environment for R programming. 3. Explain the concept of type coercion in R and provide examples of its practical implications. 4. Compare and contrast the usage of for loops and while loops in R programming. 5. Explore different R packages relevant to data analysis and discuss their key features and applications.
3	MODULE ΙII: Reading and Getting data into R 1. a) How can you retrieve data from a website using R? Explain the steps involved. b) Describe the process of web scraping using R. Which R package(s) can be used for web scraping? c) What are the advantages and limitations of web scraping for obtaining data in R? 2. JSON Files: a) How can you read and parse JSON files in R? Provide an example. b) What are the advantages of using JSON files as a data source in R? Compare it with other data formats like CSV or XML. c)

	Explain the steps to extract specific fields from a JSON file in R. 3. Databases: a) How can you connect R to a database system such as MySQL or PostgreSQL? Provide an example. b) What are the benefits of using databases as a data source in R compared to flat files like CSV or Excel? c) Write an R code snippet to retrieve data from a database table and perform a basic analysis on the retrieved data. 4. Excel Files: a) How can you import an Excel file into R? Which R package(s) can be used for this purpose? b) Describe the process of exporting data from R to an Excel file. Which R package(s) can be used for this task? c) Discuss the potential challenges and considerations when working with Excel files in R. 5. Data Integration: a) Explain the concept of data integration using R. How can you combine data from multiple sources like JSON, databases, and Excel files? b) What are some common data integration techniques or functions available in R? c) Provide an example of how you would merge data from a JSON file and a database table using R.
4	MODULE IV: Data Visualization using R 1. Compare and contrast the effectiveness of histogram, boxplot, and bar chart for visualizing different types of data. 2. How can scatterplots be used to identify relationships and patterns in data? Provide examples. 3. Discuss the advantages and limitations of different methods for importing data into R, such as CSV files, XML files, and databases. 4. Compare the suitability of different chart types (e.g., line graphs, pie charts) for representing different types of data. 5. Analyze a dataset of your choice using various R charts and graphs, and interpret the insights gained from the visualizations. 1.
5	MODULE V: Prescriptive Analytics 1. Design and conduct a controlled experiment to collect data for prescriptive analytics. Analyze the results and draw conclusions. 2. Implement an active learning approach to collect data for prescriptive analytics. Assess the effectiveness of the approach. 3. Apply reinforcement learning techniques to a simulated scenario and analyze the impact on decision-making and outcomes. 4. Compare and contrast the advantages and limitations of different approaches for creating data for prescriptive analytics. 5. Evaluate the potential ethical considerations associated with the use of data generated through designed experiments, active learning, and reinforcement learning.

23MCAP11	Linux Commands and Shell Scripting	L	T	P	J	S	C	Year of Introduction
		1	2		3		2	2023

Preamble: This course makes the students to learn the basic concepts and functions of operating systems. This course provides a practical introduction to Linux and commonly used Linux shell commands and it includes shell scripting to automate a variety of tasks.

Prerequisite: Basic understanding of computer programming, Internet and operating systems

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the basic concept of Linux architecture and the basic commands of Linux operating system.
CO 2	Understand the concepts of control structure, loops, case and functions in shell programming and apply them to create shell scripts.
CO 3	Illustrate to manage documents and control process execution.
CO 4	Demonstrate the roles and responsibilities of Linux System Administrator
CO 5	Understand different packages and various server commands.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓			✓							
CO 2	✓	✓			✓							
CO 3	✓	✓			✓							
CO 4	✓	✓	✓		✓		✓	✓	✓			
CO 5	✓		✓	✓	✓							

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse			✓	
Evaluate			✓	
Create			✓	

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Assessment Pattern for Lab component		
Bloom's Category	**Continuous Assessment Tools**	
	Class work	**Test1**
Remember		
Understand	✓	✓
Apply	✓	✓
Analyse	✓	✓
Evaluate	✓	
Create	✓	

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]			Practical [P]		Total Marks
		Assignment	Test-1	Test-2	Class work	Lab Exam	
	5	10	20	--	25	40	**100**

Total Marks distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
	100		

SYLLABUS

MODULE I : Introduction to Linux Operating System 2hrs

History of Linux, Linux Architecture, Features and Facilities in Linux, Shells available in Linux. Managing Files and Directories - Linux File System, Relative Path Names, Types of Files in Linux, Types of Users in Linux, Directory Commands in Linux, File Commands in Linux, Securing Files in Linux -File Access Permissions [FAPs], Viewing File Access Permissions, Changing File Access Permissions.

MODULE II :   Editors Available with Linux 4hrs

Creating Files Using the vi Editor - Text Editors, Functions of a Text Editor, Editors Available with Linux, The vi Editor, Getting Started with the vi Editor, Commands Used in the vi Editor.

Automating Tasks Using Shell Scripts - Introduction, Variables Local and Global Shell Variables, Command Substitution.

Using Conditional Execution in Shell Scripts - Conditional Execution,

Iteration in Shell Scripts, Parameter-Handling in Shell Scripts**.**

MODULE III :   Managing Documents   2hrs

Managing Documents - Locating Files in Linux, Standard Files, Redirection, Filters, Pipes.

Controlling Process Execution - Requesting for Background Processing, checking a Background Processing, The top Command, Terminating a Background Process, Finding the Time Taken to Complete a Command, Scheduling Tasks.

MODULE IV :   Restoring and Compressing Files   2hrs

Backing up, Restoring and Compressing Files :The need for Making Backups, Backup Strategies, Selecting a Backup Medium, Compressing Files.

Using Basic Networking Commands in Linux - Communicating with Other Users in Linux, Using File Transfer Protocol in Linux.

MODULE V :   Installing Packages 2hrs

Installing Packages - Applications in Linux, Red Hat Package Manager (RPM), Working with RPM-Installing Packages, Upgrading Packages, Uninstalling Packages, Querying Packages, Verifying Packages, Checking Signatures, Diagnosing with RPM.

Text books

1. "Operating System - Linux", NIIT Press, PHI Publisher, 2009Edition

2. Evi Nemeth, Garth Snyder, Trent R Hein, "Linux Administration Handbook" Second Edition, Pearson Education, 2009

3. Christopher Negus, "Red Hat Linux Bible", Wiley Dreamtech India

4. Neil Mathew, Richard Stones, "Beginning Linux Programming", Fourth Edition, Wiley Dreamtech.

Reference book

1.Mastering Linux Shell Scripting: - A practical guide to Linux command-line, Bash scripting, and Shell programming. Mokhtar Ebrahim, Andrew Malle

2.Linux Shell Scripting: Clif Flynt, Sarath Lakshman, Shantanu Tushar

MOOC 1. https://www.udemy.com/course/linux-command-line-volume1/

Web Resources 1. https://www.udemy.com/course/linux-shell-scripting-projects/

	COURSE CONTENTS AND LECTURE SCHEDULE	
No.		No. of Hours
MODULE 1		
1.1	The Linux Operating System - The History of Linux, Linux Architecture, Linux Compared to UNIX, Features and Facilities in Linux, Shells Available in Linux	1
1.2	Managing Files and Directories . Securing Files in Linux.	1
MODULE II		
2.1	Creating Files Using the vi Editor - Text Editors, Functions of a Text Editor, Ed Available with Linux, The vi Editor, Getting Started with the vi Editor, Comm Used in the vi Editor	1
2.2	Automating Tasks Using Shell Scripts - Introduction, Variables Local and Global Shell Variables, Command Substitution.	1
2.3	Using Conditional Execution in Shell Scripts - Conditional Execution, case...esac Construct.	1
2.4	Managing Repetitive Tasks Using Shell Scripts -Using Iteration in Shell Scripts, Parameter-Handling in Shell Scripts.	1
MODULE III		
3.1	Managing Documents - Locating Files in Linux, Standard Files, Redirection, Filters, Pipes.	1
3.2	Controlling Process Execution, Finding the Time Taken to Complete a Command, Scheduling Tasks	1
MODULE IV		
4.1	Backing up, Restoring and Compressing Files -The need for Making Backups, Backup Strategies, Compressing Files	1
4.2	Basic Networking Commands in Linux - Communicating with Other in Linux, Using File Transfer Protocol in Linux.	1
MODULE V		
5.1	Installing Packages - Applications in Linux, Red Hat Package ,Upgrading Packages, Uninstalling Packages.	1
5.2	Querying Packages, Verifying Packages, Checking Signatures .	1

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LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Managing Files and Directories.	4	**Experiment 1.** Install Ubuntu Linux and LINUX Commands(File Handling utilities, Text processing utilities, Network utilities, Disk utilities, Backup utilities and Filters)
2	Shell script	10	**Experiment 2**. Write a Shell Script that accepts a file name, starting and ending line numbers as arguments and displays all lines between the given line numbers. **Experiment 3**. Write a shell script that deletes all lines containing the specified word in one or more files supplied as arguments to it. **Experiment 4**. Write a shell script that is plays a list of all files in the current directory to which the user has read, write and execute permissions. **Experiment 5**. Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or directory and reports accordingly. Whenever the argument is a file it reports number of lines present in it. **Experiment 6**. Write a shell script that accepts a list of file names as its arguments, counts and reports the occurrence of each word that is present in the first argument file on other argument files. **Experiment 7**.Write a shell script to find factorial of a given number. **Experiment 8** Write a shell script to list all of the directory files in a directory
3	Managing Documents	4	**Experiment 9** write an awk script to count number of lines in a file that does not contain vowels **Experiment 10**

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| 4 | Functions using Command line arguments | 2 | **Experiment 11**1.Write a C program that takes one or more file/directory names ascommand line input and reports following information

    File Type   B)Number Of Links
    c) Time of last Access   D) Read, write and execute permission. |
| 5 | Inter process communication. | 4 | **Experiment 12**

 1.You are given a bare bone installation of latest version Ubuntu. Assume that the system is accessible from internet. Your task is to successfully install any web application on this server. Clearly indicate the steps taken and software installed for this task. |

CO Assessment Questions	
CO1	1. Write a Shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory and reports accordingly. Whenever the argument is a file, the number of lines on it is also reported. 2. Write a Shell script that displays list of all the files in the current directory to which the user has read, Write and execute permissions.
CO2	1. Write a Shell script to find factorial of a given integer. 2. Write a Shell script to count the number of lines in a file that do not contain vowels.
CO3	1. Write a program that illustrates how to execute two commands concurrently with a command pipe. 2. Write C programs that illustrate communication between two unrelated processes using named pipe(FIFO file).
CO4	1. Write a client and server programs in C for connection oriented communication between server and client process using Linux domain sockets to perform the following: Client process sends a message to the server process. The server receives the message, reverses it and sends it back to the client. The client will then display the message to the standard output device. 2. Write a client and server programs in C for connection oriented communication between server and client process using Internet domain socket to perform the following: Client process sends a message to the server process. The server receives the message, reverses it and sends it back to the

	client. The client will then display the message to the standard output device
CO5	1. Demonstrate the packages in Linux.

23MCAP13	Professional Communication and Business Etiquette.	L	T	P	J	S	C	Year of Introduction
		1	0	2	0	0	2	2023

Preamble: This course enables the student to use basic skills of communication such as listening, reading speaking and writing. This course covers topics such as identifying common errors in writing and vocabulary building, Reading and listening, Oral Presentation, Interview skills and, Formal writing. This course helps learners to communicate effectively with groups, face interviews and prepare technical documentaries

Prerequisite: None.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Use vocabulary and language skills in professional communication [Apply Level]
CO 2	Apply reading skills and comprehend texts in an effective way [Apply Level]
CO 3	Demonstrate technical presentation and speaking skills [Apply Level]
CO 4	Apply listening techniques and make use of interview skills in real life situations. [Apply Level]
CO 5	Create professional and technical documents precisely [Understand]

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1								✔	✔			✔
CO 2								✔	✔	✔		✔
CO 3								✔	✔	✔		✔
CO 4								✔	✔	✔		✔
CO 5									✔	✔		✔

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools		
	Test1	Test 2	Other tools

Remember		✓	✓	
Understand		✓	✓	
Apply		✓	✓	
Analyse			✓	
Evaluate			✓	
Create			✓	

Assessment Pattern for Lab component

Bloom's Category	Continuous Assessment Tools	
	Class work	Test1
Remember	✓	✓
Understand	✓	✓
Apply	✓	✓
Analyse	✓	
Evaluate	✓	
Create	✓	

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]			Practical [P]		Total Marks
		Assignment	Test-1	Test-2	Class work	Lab Exam	
	5	10		20	25	40	**100**

Total Marks distribution

Total Marks	CIA (Marks)
100	100

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SYLLABUS

MODULE I: Identifying Common Errors in Writing and Vocabulary Building.

Subject-verb agreement, tenses, prepositions, synonyms, antonyms, sequence words, misspelt words, technical vocabulary used in letters, and emails.

MODULE II: Reading and Listening

Reading styles, speed reading, critical reading, comprehending longer and shorter technical   articles., note taking.

Active and Passive Listening, Intensive Listening, barriers to effective listening, Listening to technical talks, TED talks, listening to talks and making notes.

MODULE III: Oral Presentation

Presentation skills, Preparation for presentation, Voice modulation and tone, Business presentation, Debate, Group discussion, differences between debate and Group discussion, Brainstorming

MODULE IV: Interview Skills

Interview skills, different types of interviews, interview etiquette, dress code, body language, and FAQs related to job interviews.

MODULE V: Formal Writing

Difference between technical and literary writing, formal letter, email, job application letter, bio-data, C.V, resume and their differences, report writing, types of reports, statement of purpose, and technical proposals.

Reference books

1. Meenakshi Raman and Sangeetha Sharma, Technical Communication: Principles and Practice, 3rd edition, Oxford University Press, 2015
2. Anderson, P.V, Technical Communication, Thomas Wadsworth, Sixth edition, New Delhi, 2007
3. English for Engineers and Technologists (Combined edition, Vol,1 and 2), Orient Blackswann 2010
4. Seely, John, The Oxford Guide to Writing and Speaking, Oxford University Press, 1997
5. Ganguly, Anand, Success in Interview, RPH, Fifth edition, 2006
6. Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
7. Practical English Usage. Michael Swan. OUP. 1995.
8. Remedial English Grammar. F.T. Wood. Macmillan.2007
9. On Writing Well. William Zinsser. Harper Resource Book. 2001
10. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

11. Communication Skills. Sanjay Kumar and Pushplata. Oxford University Press. 2011.
12. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

COURSE CONTENTS AND LECTURE SCHEDULE

No.		No. of Hours
	MODULE 1	**5**
1.1	Subject-verb agreement	1
1.2	Tenses	1
1.3	Prepositions	1
1.4	Synonyms and antonyms, Technical vocabulary used in letters and emails.	1
1.5	Misspelt words, sequence words	1
	MODULE II	**2**
2.1	Reading styles, speed reading, critical reading, note making	1
2.2	Active and passive listening, barriers to effective listening, intensive listening.	1
	MODULE III	**2**
3.1	Presentation skills, business presentation, brainstorming	1
3.2	Debate and group discussion, Differences between debate and G.D.	1
	MODULE IV	**1**
4.1	Interview skills, types of interviews.	1
	MODULE V	**2**
5.1	Difference between technical and literary writing	1
5.2	Difference between C.V., resume and, bio-data, Job application letter.	1

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Comprehending shorter and longer technical articles	1	An excerpt of a text would be provided and the students will comprehend the text and answer questions related to the text.
2	Voice modulation, tone and intonation and effects of body language in public speaking.	1	Analyze a given video of presentation delivered by eminent speakers, technocrats and management experts.
3	Presentation	3	Create and present a PPT based on a given topic.
4	Debate and group discussion	2	Group discussion and debate based on given topics.
5	Interview skills	1	Mock Panel interview
6	Interview body language and etiquette	1	Analyze the given videos of job interview based on the concepts learned.
7	Formal writing – 1	1	Report writing
8	Formal writing – 2	1	Statement of purpose, proposal writing
9	Listening exercise	1	Writing down the excerpts and making notes after listening to an audio played.

CO Assessment Questions	

CO1	1. Find the word with the correct spelling from the following list
	   a) Accommodate b) acommodate c) accomadate d) acomodate
	
	2. Which word in the following list is closest to the meaning of the word 'gloomy'
	   a) Happy b) Sad c) Enthralled d) elated.
	
	3. Select the most suitable preposition for the sentence from the following list
	   I was born _____ May (in / on / at)
	   My friend lives _____ Beach Road (in/on/at)
	4. Group Activity- Direct the student to formulate 4 groups in a class and each group has to prepare quiz questions based on vocabulary building and conduct a quiz based on this.

CO2	1. What is critical reading? What are the advantages of critical reading over speed reading? 2. Write a synopsis of the journal article that you read.
CO 3	1. What is the significance of body language in presentation? 2. Explain the strategies to improve your Debate skills. 3. How important is visual aid for presentations? 4. Group discussion on – "As a student who presented a slide presentation, how will you respond to a disturbed audience?" . Give a report based on the discussion.
CO 4	1. Explain the significance of non- verbal communication in interviews. 2. What are the differences that you will make while attending an online interview instead of an off line interview. 3. How will you politely respond to a question asked to you in an interview to which you don't know the answer? 4. Conduct a mock interview and as a viewer of the mock interview what were the do's and don'ts to be followed in an interview.
CO 5	1. What are the differences between a C.V., Resume and Biodata? 2. Write an email to the manager of ABC Technologies asking for an opportunity to be included in their internship program 3. What are the different types of reports? 4. Build your own resume and CV.

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SEMESTER II

SYLLABUS

23MCAJ202	WEB APPLICATION DEVELOPMENT	L	T	P	J	S	C	Year of Introduction
		2		2	2	5	5	2023

Preamble: The course provides a comprehensive introduction to web application development, focusing on the fundamentals of building dynamic and interactive websites. Students will learn the key technologies and techniques used in modern web development, including HTML, CSS, JavaScript, and server-side programming. Through hands-on projects and assignments, students will gain practical experience in designing, developing, and deploying web applications.

Prerequisite: Basic understanding of computer programming, Internet and Database etc. is very helpful.

Course Outcomes: After the completion of the course the student will be able to

CO1	To understand the concepts of the World Wide Web.
CO2	Apply HTML and CSS effectively to create interactive websites.
CO3	Implement client-side scripting using JavaScript to design dynamic websites.
CO4	Implement server-side scripting using PHP.
CO5	Design PHP application with Database connectivity.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓	✓	✓	✓		✓	✓	✓			
CO3	✓	✓	✓	✓	✓		✓	✓	✓			
CO4	✓	✓	✓	✓	✓		✓	✓	✓			✓
CO5	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓

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Analyse			✓	
Evaluate			✓	
Create			✓	

Assessment Pattern for Lab component

Bloom's Category	Continuous Assessment Tools	
	Class work	Test1
Remember		
Understand	✓	✓
Apply	✓	✓
Analyse	✓	✓
Evaluate	✓	
Create	✓	

Assessment Pattern for Project component

Bloom's Category	Continuous Assessment Tools		
	Evaluation 1	Evaluation 2	Report
Remember			
Understand	✓	✓	
Apply	✓	✓	
Analyse	✓	✓	
Evaluate		✓	
Create		✓	

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]		Practical [P]	Project [J]			Total Marks
		Assignment	Test-1	Class work	Evaluation 1	Evalaution-2	Report	
	5	-	10	20	10	10	5	**60**

Total Marks distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration

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100	60	40	2.5 HRS

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 2		2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x 8 = 40 marks) Time: 2.5 hours	40
	Total Marks: 0	Total Marks: [5x8 = 40 marks]	

SYLLABUS

MODULE I: Introduction To Web
Client/Server concepts, Overview of HTTP - HTTP request – response, Generation of dynamic web pages, Application Servers, Web Security.

MODULE II: Basic HTML and CSS
Basic HTML page, Text Formatting, Table, Headers, Linking, Images, List, Meta Elements, Cascading Style Sheets: Inline, Internal and External Style Sheet

MODULE III : Client Side Scripting using JavaScript
Core features, Data types and Variables, Operators -Expressions and Statements, Functions, Objects, Array, String, Event Handling, Form handling and validations

MODULE IV : Introduction to PHP
Numbers and Strings, Literals and Variables, Operators and Functions, arrays.   Creating Form Controls, Using Values Returned From, Forms Using PHP - User Authentication: Creating Session, Authorization Level.

MODULE V :Connecting to MySQL

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Connecting to MySQL Server, Selecting Databases, Checking for Errors, Closing the MySQL Server Connection, Inserting, Viewing, Updating and Deleting Records, Manipulating joined tables.

Text books

Paul Deitel, Harvey Deitel, Abbey Deitel, Internet & World Wide Web - How to Program, 2020 6th edition, Pearson Education.

Reference books

Fritz Schneider, Thomas Powell, JavaScript – The Complete Reference, 2017, 3 Edition, McGrawHill.

Steven Holzener, PHP – The Complete Reference,2017, 1st Edition, Mc-Graw Hill

David Flanagan, "JavaScript: The Definitive Guide", 6th Edition", O'Reilly Media

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. of Hours
	MODULE 1	
1.1	Introduction To Web: Client/Server concepts	1
1.2	Overview of HTTP - HTTP request – response	1
1.3	Generation of dynamic web pages	1
1.4	Application Servers, Web Security.	1
	MODULE II	
2.1	Basic HTML page, Text Formatting	1
2.2	Table, Headers, Linking	1
2.3	Images, List, Meta Elements	1
2.4	Cascading Style Sheets: Inline, Internal and External Style Sheet	1
	MODULE III	
3.1	Client Side Scripting using JavaScript: Core features, Data types and Variables, Operators	1
3.2	Expressions and Statements, Functions	1

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3.3	Objects, Array, String	1
3.4	Event Handling	1
3.5	Form handling and validations	1
MODULE IV		
4.1	Introduction to PHP, Numbers and Strings	1
4.2	Literals and Variables	1
4.3	Operators and Functions	1
4.4	Arrays	1
4.5	Creating Form Controls, Using Values Returned From.	1
4.6	Forms Using PHP - User Authentication: Creating Session, Authorization Level.	1
MODULE V		
5.1	Connecting to MySQL Server.	1
5.2	Selecting Databases, Checking for Errors	1
5.3	Closing the MySQL Server Connection.	1
5.4	Inserting, Viewing.	1
5.5	Updating and Deleting Records, Manipulating joined tables.	1

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LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	HTML	4	Create a HTML file to link to different HTML page which contains images, tables, and also link within a page. Create a HTML page with different types of frames such as floating frame, navigation frame & mixed frame. Read a matrix from the console and check whether it is symmetric or not
2	CSS,HTML	5	Create a HTML file by applying the different styles using inline, external & internal style sheet Create a registration form using HTML
3	Javascript	5	Create a HTML registration form and to validate the form using JavaScript code Create a HTML page to change the background color for every click of a button using JavaScript Event Handling. Create a HTML page to display a new image and text when the mouse comes over the existing content in the page using JavaScript Event Handling
4	PHP	5	Develop a registration form using PHP and do necessary validations Build a PHP code to store name of students in an array and display it using print_r function. Sort and Display the same using asort & arsort functions.

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			Build a PHP code to store name of Indian Cricket players in an array and display the same in HTML table

Develop a PHP program to connect to a database and retrieve data from a table and show the details in a neat format. |
| 5 | Database Connectivity | 5 | Using PHP and MySQL, develop a program to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings |
| 6 | Students must develop an application that carries all the above concepts | 24 | Sample: Develop and deploy a web application for Airline Reservation System using any PHP framework .(use any latest framework) |

CO Assessment Questions	
1	Explain the need of Application server in developing an application. Explain about HTTP request /response in the development of an application.
2	You are developing a blog website for a company and need to create a form for users to submit comments. Design a form using HTML that includes input fields for the user's name, email address, and comment. Apply appropriate validation to ensure that the name and email address fields are not empty and that the email address follows a valid format. Additionally, style the form using CSS to make it visually appealing and user-friendly.
3	Discuss the event handling model in JavaScript and explain how event listeners are used to respond to user interactions. Provide an example scenario where event listeners are employed to capture and handle user input on a web page.
4	Discuss the role of functions in PHP and their significance in modular and reusable code. Provide an example scenario where you create a custom PHP function to perform a specific task, such as validating user input or manipulating data.
5	Provide a practical example scenario where CRUD operations are used to create, read, update, and delete data in a web application.

23MCAP204	Object Oriented Programming (JAVA)	L	T	P	J	S	C	Year of Introduction
		2	1	2		4	4	2023

Preamble: The course provides an in-depth understanding of Object-Oriented Programming (OOP) concepts using the Java programming language. The course covers topics such as classes, objects, constructors, methods, inheritance, interfaces, packages, exception handling, and file I/O. Through practical exercises, students will gain hands-on experience in designing and implementing Java applications following OOP principles.

Prerequisite: OOPs concept

Course Outcomes: After the completion of the course the student will be able to

CO1	Understand Java Virtual Machine architecture, fundamentals of object oriented programming concept and develop programs using classes and objects.
CO2	Develop Java programs with the concepts of inheritance, interfaces,Arrays and Strings.
CO3	Build Java applications using exceptions, threads and I/O streams
CO4	Develop interactive Java programs using applets and swings.
CO5	Develop a java application using database connection.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔	✔	✔	✔	✔		✔					
CO2	✔	✔	✔	✔	✔		✔		✔			
CO3	✔	✔	✔	✔	✔		✔		✔			
CO4	✔	✔	✔	✔	✔	✔	✔		✔		✔	
CO5	✔	✔	✔	✔	✔	✔	✔		✔		✔	

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test2	Other tools	
Remember	✔	✔	✔	✔
Understand	✔	✔	✔	✔
Apply	✔	✔	✔	✔
Analyse			✔	

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Evaluate			✔	
Create			✔	

Assessment Pattern for Lab component				

Bloom's Category	**Continuous Assessment Tools**	
	Class work	**Test1**
Remember		
Understand	✔	✔
Apply	✔	✔
Analyse	✔	✔
Evaluate	✔	
Create	✔	

Mark Distribution of CIA

Course Structure [L-T-P-J]		Theory [L- T]			Practical [P]		
	Attendance	Assignment	Test-1	Test-2	Class work	Lab Exam	Total Marks
	5	10	10	10	15	10	**60**

Total Marks distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	60	40	2.5

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE MARKS
PATTERN 2	.	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks Marks: (5x 8 = 40 marks) Time: 2.5 hours	40
	Total Marks:0	Total Marks: [5x8 = 40 marks]	

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SYLLABUS

MODULE I :OOPs Concepts

Need for OOP paradigm, Procedural approach vs. Object-Oriented approach.

Object Oriented concepts Java Basics: Java Design goal - Features of Java Language - data types, variables, operators, expressions, control statements, type conversion and casting, Concepts of - classes, objects, constructors, Access Specifiers (public, private, protected, friendly), Access Modifiers (static, final, abstract, native, synchronized), overloading methods, recursion, nested and inner classes

MODULE II :Inheritance and Arrays

Inheritance: Generalizations vs. Specialization, Inheriting data members and methods, Single and Multilevel inheritance, use of super and this keywords. Polymorphism- method overriding, dynamic method dispatch, abstract and final classes .

Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces

Arrays and Strings: One dimensional arrays, Multidimensional arrays, exploring String class and methods.

MODULE III :Thread concept

Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions.

Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.

Multithreading- Java thread model, creating threads, thread priorities, synchronizing threads.

MODULE IV :GUI programming with Java

GUI Programming with Java: The AWT class hierarchy, introduction to Swing, Swing Vs AWT, hierarchy for swing components.

Containers: JFrame, JApplet, JDialog, JPanel, overview of some swing components: JButton, JLabel, JTextField, JTextArea, simple applications.

Layout management: Layout manager types, border, grid and flow.

MODULEV :Introduction to JDBC

Introduction to JDBC, JDBC Drivers & Architecture, CRUD operation Using JDBC

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Text books

Herbert Schildt, "Java: The Complete Reference, Eleventh Edition", Oracle 2018

Reference books

C. Thomas Wu, "An introduction to Object-oriented programming with Java", Fourth Edition, Tata McGraw-Hill Publishing company Ltd.

Y. Daniel Liang, Introduction to Java programming-comprehensive version-Tenth Edition, Pearson ltd 2015

Cay S. Horstmann and Gary Cornell, "Core Java: Volume I – Fundamentals", Eighth Edition, Sun Microsystems Press

K. Arnold and J. Gosling, "The JAVA programming language", Third edition, Pearson Education

No.	COURSE CONTENTS AND LECTURE SCHEDULE	No. ofHours
	MODULE 1	
1.1	Need for OOP paradigm, Procedural approach vs. Object-Oriented approach.	1 hrs
1.2	Object Oriented concepts Java Basics: Java Design goal - Features of Java Language	1 hrs
1.3	Data types, variables, Operators, expressions, control statements	1 hrs
1.4	Type conversion and casting, Concepts of - classes, objects,	1 hrs
1.5	Constructors, Access Specifiers (public, private, protected, friendly)	1 hrs
1.6	Access Modifiers (static, final, abstract, native, synchronized)	1 hrs
1.7	Overloading methods, recursion, Nested and inner classes	1 hrs
	MODULE II	
2.1	Inheritance: Generalizations vs. Specialization, Inheriting data members and methods	1 hrs
2.2	Single and Multilevel inheritance, Use of super and this keywords, Polymorphism- method overriding	1 hrs

2.3	dynamic method dispatch ,Abstract and final classes	1 hrs
2.4	Interfaces – defining an interface, implementing interface, Differences between classes and interfaces and extending interfaces	1 hrs
2.5	Arrays and Strings: One dimensional arrays, Multidimensional arrays, Exploring String class and methods	1 hrs
MODULEIII		
3.1	Exceptions – exception hierarchy – throwing and catching exceptions, Built-in exceptions, creating own exceptions	1 hrs
3.2	Input / Output Basics – Streams – Byte streams and Character streams, Reading and Writing Console – Reading and Writing Files	1 hrs
3.3	Multithreading- Java thread model, creating threads, Thread priorities, synchronizing threads	1 hrs
MODULEIV		
4.1	GUI Programming with Java: The AWT class hierarchy, introduction to Swing	1 hrs
4.2	Swing Vs AWT, hierarchy for swing components	1 hrs
4.3	Containers: JFrame, JApplet, JDialog, JPanel	1 hrs
4.4	Overview of some swing components: JButton, JLabel, JTextField, JTextArea, simple applications	1hrs
4.5	Layout management: Layout manager types, border, grid and flow	1hrs
MODULEV		
5.1	Introduction to JDBC	1 hrs
5.2	JDBC Drivers & Architecture	1hrs
5.3	CRUD operation Using JDBC	1hrs
5.4	CRUD operation Using JDBC	1 hrs

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Classes and Objects	3	Define a class 'product' with data memberspcode, pname and price. Create 3 objects of the class and find the product having the lowest price. Read a matrix from the console and check whether it is symmetric or not.
2	Inheritance	3	Create a class 'Employee' with data members Empid, Name, Salary, Address and constructors to initialize the data members. Create another class 'Teacher' that inherit the properties of class employee and contain its own data members department, Subjects taught and constructors to initialize these data members and also include display function to display all the data members. Use array of objects to display details of N teachers. Create a class 'Person' with data members Name, Gender, Address, Age and a constructor to initialize the data members and another class 'Employee' that inherits the properties of class Person and also contains its own data members like Empid, Company_name, Qualification, Salary and its own constructor. Create another class 'Teacher' that inherits the properties of class Employee and contains its own data members like Subject, Department, Teacherid and also

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			contain constructors and methods to display the data members. Use array of objects to display details of N teachers. Account Manipulation using Abstract Class
3	Interface	3	Create an interface having prototypes of functions area() and perimeter(). Create two classes Circle and Rectangle which implements the above interface. Create a menu driven program to find area and perimeter of objects. Vehicle-loan-insurance Using interface
4	Arrays and Strings	3	Program to create a class for Employee having attributes eNo, eNameeSalary. Read n employ information and Search for an employee given eNo, using the concept of Array of Objects. Perform string manipulations (*More programs based on the concept should be done)*
5	Exception Handling	3	Write a user defined exception class to authenticate the user name and password. Find the average of N positive integers, raising a user defined exception for each negative input.
6	Multithreading and Inter thread communication	3	Define 2 classes; one for generating Fibonacci numbers and other for displaying even numbers in a given range. Implement using threads Producer/Consumer using ITC

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7	GUI programming with Swing	3	Programs based on swing(GUI concept)
8	CRUD operation	3	Write a java program that connects to a database using JDBC Write a java program to connect to database using JDBC &insert values into table Write a java program to connect to a database using JDBC and delete values from table

	CO Assessment Questions	
1	a) Read 2 matrices from the console and perform matrix addition. b) Consider a library management system where you need to design classes to represent books, library members, and library staff. Illustrate the relationships between these classes and their key attributes and methods. Also, describe how objects of these classes would interact in a typical scenario of a library member borrowing a book.
2	a) Explain the suitable java oops concepts to implement KFC brand with different outlets.Note KFC has its own certain standards, keep those in different franchise.
3	a) A process is divided into different jobs and they have its own stack.Explain the suitable concept in Java that helps to run multiple jobs at a time .Based on this concept, read some numbers from a file having positive and negative numbers. b) Consider a banking application where customers can transfer funds between their accounts. Describe a scenario where exception handling plays a crucial role in ensuring the integrity of the transaction and preventing unauthorized access or loss of funds. Explain how exception handling can be used to handle such scenarios effectively.
4	a) Explain the difference between Java applets and Swing applications. Discuss the advantages and disadvantages of each approach when developing interactive Java programs. Provide an example scenario where you would choose to use an applet,and another scenario where you would choose to use a Swing application.
5	a) Design a scenario that involves all four CRUD operations, and explain how you would implement each operation using JDBC in your Java application.

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23MCAP206	ADVANCED DATABASE MANAGEMENT SYSTEMS	L	T	P	J	S	C	Year of Introduction
		2	1	2		4	4	2023

Preamble: This course provides the students with database ideas and design along with practical experience in database concepts. It includes the study of information concepts and the realization of those concepts using the relational data model. Students will gain a practical experience in designing and constructing data models by using SQL in both multi-user DBMS packages and desktop DBMS packages. The concept of advanced DBMS techniques and new generation databases like MongoDB, HBase and Cassandra are also introduced. This course serves as a prerequisite for many advanced courses in Data Science and Machine Learning areas.

Prerequisite: Basic knowledge in Database Management Systems

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the fundamentals of relational database systems including: data models, database architectures.
CO 2	Model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model.
CO 3	Analyze and apply the different normalization techniques.
CO 4	Assess the basic issues of transaction processing and concurrency control.
CO 5	Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✔	✔					✔				✔	
CO 2	✔	✔	✔		✔		✔				✔	✔
CO 3	✔	✔	✔		✔		✔				✔	✔
CO 4	✔	✔					✔				✔	
CO 5	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✔	✔	✔	✔

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Understand	✔	✔	✔	✔
Apply	✔	✔	✔	✔
Analyse			✔	
Evaluate			✔	
Create			✔	

Assessment Pattern for Lab component		
Bloom's Category	**Continuous Assessment Tools**	
	Class work	**Test1**
Remember		
Understand	✔	✔
Apply	✔	✔
Analyse	✔	✔
Evaluate	✔	
Create	✔	

Mark Distribution of CIA						
Course Structure [L-T-P-J]	**Attendance**	**Theory [L- T]**			**Practical [P]**		**Total Marks**
		Assignment	**Test-1**	**Test-2**	**Class work**	**Lab Exam**	
2-1-2-0	5	10	10	10	15	10	**60**

Total Marks distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	60	40	2.5 hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 2		2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x 8 = 40 marks) Time: 2.5 hours	40
	Total Marks: 0	Total Marks: [5x8 = 40 marks]	

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SYLLABUS
MODULE I: Relational Databases 8hrs
Introduction - Purpose of Database System – Database System Applications - View of data: Data Abstraction, Instances and Schemas, Data Models – Database Architecture - Database Users and Administrators: Database Users and Interfaces, DBA – Introduction to the Relational Model: Structure of Relational Database, database Schema, Keys,The Entity- Relationship model: Entity Set, Relationship Set, Attributes – Constraints: Mapping cardinalities, Key Constraints, Participation Constraints - E-R Diagrams: Basic structure, Complex attributes, Roles, Non binary relationship sets, Weak Entity Set, Relational Database Design using ER- to Relational Mapping
MODULE II : Database Design   7hrs
Database Design:- Database Tables and Normalization – The Need for Normalization – The Normalization Process: Inference Rules for Functional Dependencies (proof not needed) -Conversion to First Normal Form, Conversion to Second Normal Form, Conversion to Third Normal Form - Improving the Design - Surrogate Key Considerations - Higher Level Normal Forms: Boyce/Codd Normal Form, Fourth Normal Form.
MODULE III : Advanced SQL 6hrs
Relational Set Operators, Joining tables.Different types of joins, Subqueries and Correlated Queries, Views, Updatable Views, Functions and Procedures, Cursors, Triggers..
MODULE IV : File Organization 7hrs
Transaction: Evaluating Transaction Results, Transaction Properties, Transaction Management with SQL, The Transaction Log – Concurrency Control: Lost Updates, Uncommitted Data, Inconsistent Retrievals, The Scheduler– Concurrency Control with Locking Methods: Lock Granularity, Lock Types, Two Phase Locking to Ensure Serializability, Database Recovery Management.
MODULE V : Distributed Databases 8hrs
Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions - Object Based Databases: Overview, Complex Data types, Structured types and inheritance in SQL, Table Inheritance, Array and Multiset types in SQL, Object identity and reference types in SQL, New generation databases like MongoDB, HBase and Cassandra are also introduced

Text books

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan," ***Database System Concepts***", McGraw Hill Education, 6th Edition, 2011.
2. Ramez Elmasri, Shamkant B.Navathe, " ***Fundamentals of Database Systems*** ", Pearson Education, 5th Edition.

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3. Guy Harrison, "***Next Generation Databases: NoSQL, NewSQL, and Big Data***", Apress, 1st Edition, 14 December 2015. *Refer Chapters 8 and 3 (for Module 5 - Next Generation Databases and CAP Theorem).*

Reference books

1. Ashutosh Kumar Dubay, "***Database Management Concepts***", S.K. Kataria & Sons, 1st Edition (2012).

2. Raghu Ramakrishnan and Johannes Gehrke, "***Database Management Systems***", McGraw Hill, 3rd Edition (2014).

3. Thomas M Connolly and Carolyn E Begg, "***Database systems- A Practical Approach to Design, Implementation and Management***", Pearson Education, 4th Edition (2014).

4.

Web Resources

1. Introduction to Databases (nptel) https://nptel.ac.in/courses/106/106/106106220/

2. Database Design (nptel) https://nptel.ac.in/courses/106/106/106106093/

3. Introduction to Database Systems and Design https://nptel.ac.in/courses/106/106/106106095/

4. Fundamentals of Database Systems https://nptel.ac.in/courses/106/104/106104135/#

No.		No. of Hours(36)
COURSE CONTENTS AND LECTURE SCHEDULE		
MODULE 1 8hrs		
1.1	Introduction - Purpose of Database System - Database System Applications	1hr
1.2	Database Architecture	1hr
1.3	Database Users and Administrators: Database Users and Interfaces, DBA	1hr
1.4	Introduction to the Relational Model: Structure of Relational database, database schema, Keys, Relational Query language	1hr
1.5	The Entity-Relationship model: Entity Set, Relationship Set,	1hr

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	Attributes	
1.6	Constraints: Mapping cardinalities, Key Constraints, Participation Constraints	1hr
1.7	E-R Diagrams: Basic structure, Complex attributes, Roles, Non binary relationship sets, Weak Entity Set	1hr
1.8	Relational Database Design using ER- to Relational Mapping	1hr
MODULE II 7hrs		
2.1	Database Tables and Normalization - The Need for Normalization	1hr
2.2	The Normalization Process: Inference Rules for Functional Dependencies (proof not needed	1hr
2.3	Conversion to First Normal Form, Conversion to Second Normal Form	1hr
2.4	Conversion to Third Normal Form	1hr
2.5	Higher Level Normal Forms: Boyce/Codd Normal Form	1hr
2.6	Fourth Normal Form	1hr
2.7	Database Tables and Normalization - The Need for Normalization	1hr
MODULE III 6hrs		
3.1	Joining Database Tables	1hr
3.2	Subqueries and Correlated Queries	1hr
3.3	Views, Updatable Views	1hr
3.4	Cursors	1hr
3.5	Cursors	1hr
3.6	Triggers	1hr
MODULE IV 7hrs		
3.1	Transaction: Evaluating Transaction Results, Transaction	1hr

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	Properties		
3.2	Transaction Management with SQL, The Transaction Log	1hr
3.3	Concurrency Control: Lost Updates, Uncommitted Data, Inconsistent Retrievals, The Scheduler	1hr
3.4	Concurrency Control with Locking Methods	1hr
3.5	Lock Granularity	1hr
3.6	Lock Types, Two Phase Locking to Ensure Serializability	1hr
3.7	Deadlocks	1hr
MODULE V 8hrs		
5.1	Distributed Databases: Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions	1hr
5.2	Distributed Data Storage, Distributed Transactions	1hr
5.3	Object Based Databases: Overview, Complex Data types	1hr
5.4	Structured types and inheritance in SQL	1hr
5.5	Table Inheritance	1hr
5.6	Next generation databases	1hr
5.7	Mongo DB	1hr
5.8	HBase	1hr

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Data Definition Commands	2	Experiment 1: Relational database design using MySQL/ MariaDB/ PostgreSQL etc. a. DDL Commands

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2	Creation of a database design a. Row insertion, deletion and updating b. Retrieval of data Simple select query Sub query (returning single row, multiple rows, more than one column) Joining tables	8	Experiment 2 (Apply the queries on an Employee/ Student database etc.) Accessing database (SELECT, Filtering using WHERE, HAVING, GROUP BY, ORDER BY Clauses, Subquery and View) Optimizing databases (Join, Aggregate & Set operations, Other operators like arithmetic, logical, special etc.)
3	Cursor	2	Experiment 3 Construct PL/SQL code for sample databases using cursors.
4	Triggers	2	Experiment 4 Construct PL/SQL code for sample databases using triggers
5	Micro project: Students can be given a group micro project, so that they learn to work in a team	10	Experiment 5 Development of sample applications using Oracle/ MySql / MongDB as back end. Sample applications may include Payroll Information Student Information System Bank Transaction Library Information System etc

CO Assessment Questions	
CO1	1.Analyze the graphic depiction of relationships among the entities and examine how these depictions help in the database design process
	2.Describe the basic features of the relational data model and discuss their importance to the end user and the designer
CO2	1. Evaluate and design good table structures to control data redundancies and anomalies.
CO3	1.The relational set operators UNION, INTERSECT, and MINUS work properly only when the relations are union-compatible. What does union-compatible mean, and how would you check for this condition?
CO4	1.Describe concurrency control and analyze the role it plays in maintaining the database integrity.
	2. Examine how database recovery management is used to maintain database integrity.
CO5	1. Analyze the concept of object oriented databases and distributed databases.
	2. Development of sample applications using Oracle/ MySql / MongDB as back end.

23MCAP208	Cloud Computing	L	T	P	J	S	C	Year of Introduction
		1	2		3		2	2023

Preamble: The syllabus is prepared with a view to equip the students to learn basic concepts in cloud computing - compute, storage, networking. Students should gain basic understanding of orchestration, HA and failover.

Prerequisite:: Awareness in Virtualization and Containers is desirable.

Course Outcomes: After the completion of the course the student will be able to

CO1	Understand the basic concepts in cloud computing and Open Stack logical architecture
CO2	Discuss Open Stack cloud controller and common services
CO3	Compare different Open Stack compute service components and storage types
CO4	Describe the Open Stack Networking- Connection types and networking services
CO5	Discuss orchestration, HA and failover in Open Stack

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓							
CO2	✓	✓			✓							
CO3	✓	✓			✓							
CO4	✓	✓	✓		✓							
CO5	✓	✓	✓		✓							

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse			✓	
Evaluate			✓	
Create			✓	

Assessment Pattern for Lab component		
Bloom's Category	**Continuous Assessment Tools**	
	Class work	**Test1**
Remember		
Understand	✓	✓
Apply	✓	✓
Analyse	✓	✓
Evaluate	✓	
Create	✓	

Mark Distribution of CIA						

Course Structure [L-T-P-J]	Attendance	Theory [L- T]			Practical [P]		Total Marks
		Assignment	Test-1	Test-2	Class work	Lab Exam	
	5	10	20		25	40	**100**

Total Marks distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
	100	--	

SYLLABUS

MODULEI : Overview of cloud computing (2 Hours)

Introduction to cloud computing, private cloud, public cloud, hybrid cloud architecture. Cloud Services - Infrastructure as a Service, Platform as a Service, Storage as a Service.

MODULE II :Open Stack(3hours)

Designing Open Stack Cloud Architectural Consideration – Open Stack - The new data center paradigm – Open Stack logical architecture - Nova - Compute Service.

MODULE III :Cluster(3hrs)

Open Stack Cluster – The Cloud Controller and Common Services- Asymmetric clustering, Symmetric clustering, The cloud controller - The keystone service.

MODULE IV: Network service(2hrs)
The nova-conductor service, The nova-scheduler service, The API services, Image management, The network service, The horizon dashboard, The telemetry services.

MODULE V :Open Stack Compute (2hrs)
Open Stack Compute -The compute service components - Deciding on the hypervisor – Open Stack Magnum Project - Segregating the compute cloud – Over commitment considerations - Storing instances' alternatives - Understanding instance booting - Planning for service recovery.

Text books

  1.Omar Khedher, Chandan Datta Chowdhury, Mastering OpenStack, 2nd Edition,

  Packt Publishing, 2017

Reference books

1.Tom Fifield, Diane Fleming, Anne Gentle,Lorin Hochstein, Jonathan Proulx, Everett

Toews, and Joe Topjian, OpenStack Operations Guide, O'REILY,1/e, 2014.

 2. Uchit Vyas, Applied OpenStack Design Patterns, Apress, 1/e, 2016.

 3. V. K. Cody Bumgardner, OpenStack in action, Manning, 2016.

4. Amar Kapadia, Sreedhar Varma, Kris Rajana, Implementing Cloud Storage with

OpenStack Swift, Packt Publishing, 2014

COURSE CONTENTS AND LECTURE SCHEDULE

No.		No. ofHours
MODULE 1		
1.1	Introduction to cloud computing, private cloud, public cloud, hybrid cloud architecture.	1
1.2	Cloud Services - Infrastructure as a Service, Platform as a Service, Storage as a Service	1
MODULE II		
2.1	Designing Open Stack Cloud Architectural Consideration – Open Stack	1
2.2	The new data center paradigm –Open Stack logical architecture	1

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2.3	Nova - Compute service	1
MODULEIII		
3.1	Open Stack Cluster –Asymmetric clusters, Symmetric clusters.	1
3.2	The Cloud Controller and Common Services	1
3.3	The cloud controller - The keystone service	1
MODULEIV		
4.1	The nova-conductor service, The nova-scheduler service, The API services, Image management.	1
4.2	The network service	1
MODULEV		
5.1	The compute service components-Deciding on the hypervisorOpenStack Magnum project	1
5.2	Segregating the compute cloud	1

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Cloud Services	4	1. Create VMs in your physical machine using OpenStack to set up the following services: Moodle, MySQL Server, Samba.
2	Designing OpenStack Cloud Architecture	4	2. Design the desired configuration of the physical machine to handle the requirements of the entire college.
3	Storage services	4	3.Set up storage services for storing External files for Moodle.
4	Firewall rules	4	4. Set up firewall rules for samba, MySQL server, allow the connection to MySQL server only to Moodle VM.
5	Recovery plans	4	5. Set up recovery plans for the above services

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6	Scope of HA in Open Stack	4	6. Convert the MySQL server to HA MySQL server.

CO Assessment Questions	
CO1	1. Identification of different cloud services. 2. Install Virtual box/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
CO2	1. List and explain various components of Nova compute service. 2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
CO3	1. Explain the telemetry services in Open Stack. 2. Use Google App Engine launcher to launch the web applications.
CO4	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
CO5	Find a procedure to transfer the files from one virtual machine to another virtual machine.

23MCAP210	Applied Statistics with R	L	T	P	J	S	C	Year of Introduction
		1	0	2	0	3	2	2023

Preamble: This course introduces probability theory and statistics from a computational perspective. It will also prepare students for learning advanced courses like machine learning and big data.

Prerequisite: Basic knowledge of probability and statistics.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Analyze various data using measures of central tendency.
CO 2	Apply the concept of discrete probability distribution to solve real life problems.
CO 3	Apply the concept of continuous probability distribution to solve real life problems.
CO 4	Perform statistical inferences concerning characteristics of a population based on attributes of samples drawn from the population
CO 5	Compute correlation coefficient for the given data.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓			✓							✓
CO 2	✓	✓			✓							✓
CO 3	✓	✓			✓							✓
CO 4	✓	✓			✓							✓
CO 5	✓	✓			✓							✓

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓		✓	
Understand	✓		✓	
Apply	✓		✓	
Analyse			✓	
Evaluate			✓	

Create			✓	

Assessment Pattern for Lab component		

Bloom's Category	Continuous Assessment Tools	
	Class work	Test1
Remember		
Understand	✓	✓
Apply	✓	✓
Analyse	✓	✓
Evaluate	✓	
Create	✓	

Mark Distribution of CIA							
Course Structure [L-T-P]	Theory [L- T]				Practical [P]		Total Marks
	Attendance	Assignment	Test-1	Test-2	Class work	Lab Exam	
	5	10	20	–	25	40	**100**

Total Marks distribution			
Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	100	–	–

SYLLABUS

MODULE I : (Descriptive Statistics)

(Text-1: Relevant topics from sections 2.2-2.4)

Diagrammatic representation of data, graphical representation of data. Measures of central tendency- mean , median, mode.

MODULE II : (Discrete Probability distributions)

(Text-1: Relevant topics from sections 3.2-3.4)

Probability – Definition and properties. Probability distributions, probability mass function, cumulative distribution function. Some special discrete distribution- binomial and poisson.

	MODULE III : (Continuous probability distributions)	

(Text-1: Relevant topics from sections 3.3-3.6)

Continuous probability distributions, probability density functions, Some special continuous distributions- normal and exponential.

	MODULE IV : (Statistical inference)	

(Text-1: Relevant topics from section 4.2)

Sampling distribution of sample mean-sample drawn from normal population, sampling distribution of mean when standard deviation is unknown

	MODULE V : (Correlation and regression)	

(Text-1: Relevant topics from section 5.2)

Correlation-positive and negative correlation, coefficient of correlation-properties and interpretation. Spearman's rank correlation coefficient.

Text book

> 1. Sudha G. Purohit, Sharad D. Gore, Shailaja R. Deshmukh, Statistics using R, 2nd Edition, Narosa Publishing house, 2015.

Reference books

> 5. G. Jay Kerns, "Introduction to Probability and Statistics Using R", Chapman & Hall (2010)
> 6. -Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", Wiley India, 5th Edition (2012).

COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. of Hours
MODULE 1		
1.1	Diagrammatic representation of data, graphical representation of data.	1
1.2	Measures of central tendency- mean	1
1.3	median, mode	1
MODULE II		
2.1	Probability – Definition and properties. Probability distributions, probability mass function, cumulative distribution function.	1
2.2	Some special discrete distribution- binomial	
2.3	Poisson distribution	1
MODULE III		

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3.1	Continuous probability distributions, probability density functions	1
3.2	Some special continuous distributions- normal.	1
3.3	Exponential distribution	1
MODULE IV		
4.1	Sampling distribution of sample mean-sample drawn from normal population	1
4.2	sampling distribution of mean when standard deviation is unknown	1
MODULE V		
5.1	Correlation-positive and negative correlation, coefficient of correlation-properties and interpretation.	1
5.2	Spearman's rank correlation coefficient.	1

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Visualizing data	3	Creating tables, charts and plots.
2	Measures of Central tendency and variation	3	Finding mean, median, mode
3	Measures of dispersion	2	Finding various measures of dispersion
3	Probability distributions	3	Set operations, simulation of various properties.
4	Binomial and Poisson distribution	2	Demonstration of CDF and PMF of binomial and Poisson distribution
5	Normal and exponential distribution.	2	Demonstration of CDF and PDF of normal and exponential distribution.
6	Sampling distribution of sample mean (both large and small sample)	4	Solving problems related to sampling distribution of sample mean

| 8 | Correlation | 3 | To find correlation |
| 9 | Spearman's rank correlation coefficient. | 2 | Problems related to Spearman's rank correlation coefficient. |

CO Assessment Questions	
1	1. Twenty students, graduates and undergraduates, were enrolled in a statistics course. Their ages were: 18 19 19 19 19 20 20 20 20 20 21 21 21 21 22 23 24 27 30 36 a) Find the median age of all students. b) Find median age of all students under 25 years. c) Find modal age of all students. d) Find mean age for all students. 2. A survey of 25 faculty members is taken in a college to study their vocational mobility. They were asked the question "In addition to your present position, at how many educational institutes have you served on the faculty?" Following is the frequency distribution of their responses. x: 0 1 2 3 f: 8 11 5 1 Compute mean, median and mode

2	1. According to the Mendelian theory of inheritance, a cross fertilization of related species of red and white flowered plants produces offsprings of which 25% are red flowered plants. Suppose that a horticulturist wishes to cross 5 pairs of red and white flowered plants. Of the 5 offsprings, what is the probability that (i) there will be no red flowered plants? and (ii) there will be 4 or more red flowered plants?
	 2. The average number of accidents occurring in an industrial plant during a day is 3. Assuming Poisson distribution for the number (X) of accidents during a day, compute the probability that
	    a. no accident occurs on a day
	    b. at most two accidents occur on a day

3	1. A large-scale survey conducted in a city revealed that 30 % adult males were found to be smokers. What is the probability that, in a random sample of 1000 adults from the same city, there will be
	    a.more than 315 smokers?
	    b.less than 280 smokers?
	 2. Suppose, on an average, 3 trucks arrive per hour to be unloaded at a ware- house. What are probabilities that times between successive arrival of trucks will be (i) less than 5 minutes and (ii) at least 45 minutes. Assume that the number of arrivals follows an exponential distribution.

4	1. A random variable has continuous distribution with pdf, $f(x)=1/2$ $,-1 \leq x \leq 1$ Find the distribution of mean of a random sample of size n = 40.

	2. Suppose a random variable T follows Student's t distribution with 5 degrees of freedom. Find the probability that T ≥ 1.15.
5	1. Plot the scatter diagram and compute the correlation coefficient between amount (X) of fertilizer and the yield (Y) of potatoes for the data X: 0 4 8 12 Y: 8.34 8.89 9.16 9.50 2. The following data shows the number of minutes it took 10 mechanics to assemble a piece of machinery in the morning, x, and in the evening, y. Compute Spearman's rank correlation coefficient.

x:	11.1	10.3	12.0	15.1	13.7	18.5	17.3	14.2	14.8	15.3
y:	10.9	14.2	13.8	21.5	13.2	21.1	16.4	19.3	17.4	19.0

23MCAP212	Virtualization and containers	L	T	P	J	S	C	Year of Introduction
		1	2		3	2		2023

Preamble:

This course provides an in-depth exploration of virtualization and containerization technologies used in modern computing environments. Students will learn the concepts, principles, and practical applications of virtualization and containers, including virtual machines (VMs), hypervisors, container engines, and orchestration tools. Through hands-on labs, students will gain practical experience in setting up, configuring, and managing virtualized and containerized environments.

Prerequisite: Operating Systems

Course Outcomes: After the completion of the course the student will be able to

CO1	Understand the basics of virtualization technology, architecture, limitations and applications.
CO2	Apply Networking Principles to setup virtual machines and connect to the network
CO3	Understand the basics of VM life cycle, migrations, load balancing
CO4	Understand Container fundamentals including how to configure and set up a container
CO5	Apply the knowledge in Virtualization and docker to setup VM and dockers.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓							
CO2	✓	✓			✓		✓					
CO3	✓	✓			✓		✓				✓	
CO4	✓	✓			✓		✓	✓			✓	
CO5	✓	✓	✓	✓	✓		✓	✓			✓	

Assessment Pattern for Theory component

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓

Apply	✔	✔	✔	✔
Analyse			✔	
Evaluate			✔	
Create			✔	

Assessment Pattern for Lab component		
Bloom's Category	**Continuous Assessment Tools**	
	Class work	**Test1**
Remember		
Understand	✔	✔
Apply	✔	✔
Analyse	✔	✔
Evaluate	✔	
Create	✔	

Mark Distribution of CIA

Course Structure [L-T-P-J]	Theory [L- T]				Practical [P]		
	Attendance	Assignment	Test-1	Test-2	Class work	Lab Exam	Total Marks
	5	10	20		25	40	**100**

Total Marks distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	100		

SYLLABUS

MODULE I : Understanding virtualization

Understanding virtualization, Need and Applications of virtualization, Types of Hypervisors, Hypervisor architecture.

MODULEII :IP addressing

IP addressing - Private address, Public address, virtual LAN, Mapping of LA to PA

MODULEIII :VM Migration and Load Balancing

VM lifecycle, Process and system level VMs, VM migrations, VM scaling, Load balancing: Significance, Types and Algorithms

MODULEIV :Containers

Container fundamentals, Containers versus virtual machines, Different container technologies, Configuring a container engine

MODULEV :Setting up a container

Container virtual networking, Images and containers, Container orchestration and clustering, Case study : Docker

Text books

1. Chris Wolf , Erick M. Halter, Virtualization: From the Desktop to the Enterprise, A Press 2005.
2. Kumar Reddy, Victor Moreno, Network virtualization, Cisco Press, July, 2006.
3. James E. Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005
4. Matthew Portnoy, Virtualization Essentials, Wiley; Second edition (2016)

Sean P. Kane, Karl Matthias, Docker: Up & Running - Shipping Reliable Containers in Production, Second Edition, O'Reilly

5. "Virtualization: A Manager's Guide" by Dan Kusnetzky
6. "Docker Deep Dive" by Nigel Poulton
7. "Kubernetes: Up and Running" by Kelsey Hightower, Brendan Burns, and Joe Beda

Reference books

1. https://www.linux-kvm.org/page/Main_Page
2. https://docs.docker.com/get-started/

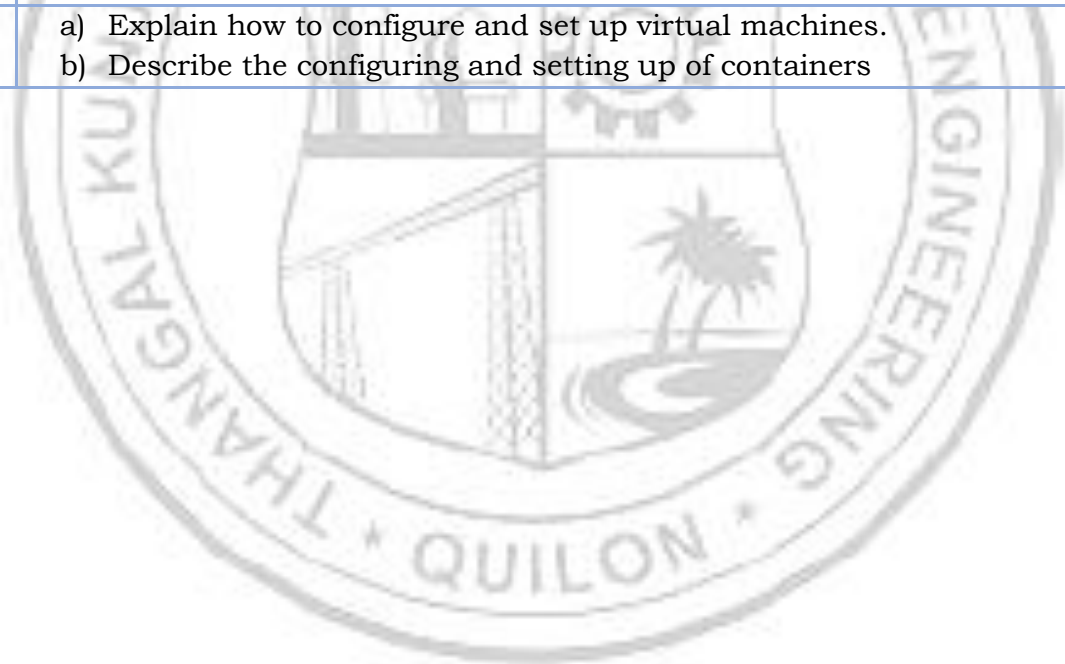| COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. ofHours
MODULE 1		
1.1	Understanding virtualization	1 hr
1.2	Need and Applications of virtualization	1 hr
1.3	Types of Hypervisors, Hypervisor architecture.	1 hr

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MODULE II		
2.1	IP addressing - Private address, Public address, virtual LAN	1 hr
2.2	Mapping of LA to PA	1 hr
MODULE III		
3.1	VM lifecycle, Process and system level VMs	1 hr
3.2	VM migrations, VM scaling	1 hr
3.3	Load balancing: Significance, Types and Algorithms	1 hr
MODULE IV		
4.1	Container fundamentals, Containers versus virtual machines	1 hr
4.2	Different container technologies, Configuring a container engine	1 hr
MODULE V		
5.1	Container virtual networking, Images and containers,	1 hr
5.2	Case study : Docker	1 hr

LESSON PLAN FOR LAB COMPONENT

No.	Topic	No. of Hours	Experiment
1	Type1 and Type 2 Hypervisor (CO1)	5	Students should create Type 1 and Type 2 Virtual machine Sample: a) Setting up a virtualization environment using a hypervisor (e.g., VMware, VirtualBox). b) Setting up a virtualization environment using a hypervisor (e.g. Citrix Hpervisor, VMware ESXi)

2	Virtual Networking , Migration and Load balancing (CO2 and CO3)	8	a) Creating and managing virtual machines using a hypervisor. b) Configuring virtual networks and storage for virtual machines. c) Perform VM migration and live migration. d) Perform Load balancing among different VM's.
3	Docker, Kuberenetes (CO4 and CO5)	11	a) Building container images and pushing them to a container registry. b) Run and manage containers using Docker commands. c) Explore container networking and storage options. d) Create a Docker container image for a simple web application, such as a Node.js or Flask application?(can use any application) Describe the steps involved in creating a Dockerfile and building the Docker image. e) Deploy a container cluster using Kubernetes

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	CO Assessment Questions	
1	a)	You are a system administrator responsible for managing a data center with multiple servers. The company has decided to implement server virtualization using hypervisor technology. Discuss the factors you would consider when selecting a hypervisor for this environment. Compare and contrast Type 1 and Type 2 hypervisors, and explain which type would be more suitable for this scenario.
2	a)	Consider a system with byte-addressable memory, 32 bit logical addresses, 4 kilobyte page size and page table entries of 4 bytes each. Calculate the size of the page table in the system ?
	b)	For the given IP address 192.168.24.3 and 24 bit mask,figure out the network address,class of the addresss,broadcast address,first and last host that can be connected to this address.
3	a)	Illustrate and distinguish between pre-copy, post-copy and hybrid timeline of Virtual machine.
4	a)	Discuss the container fundamentals and different container technologies.
	b)	Steps to set up a container engine.
5	a)	Explain how to configure and set up virtual machines.
	b)	Describe the configuring and setting up of containers

23MCAE232	Design and Analysis of Algorithms	L	T	P	J	S	C	Year of Introduction
		3	1			3	4	2023

Preamble: The design and analysis of algorithms involves understanding the design principles, analyzing the efficiency, and assessing correctness for algorithms. This course introduces a comprehensive understanding of algorithmic paradigms such as divide & conquer, dynamic programming, backtracking, branch and bound and in analyzing and classify decision problems. This knowledge equips students to apply important algorithmic design paradigms and methods of analysis to tackle real-world problems.

Prerequisite: Basic mathematical foundation, Data structures, Programming language, Discrete mathematics etc.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Analyze and evaluate the space and time performance of algorithms using asymptotic notation and recurrence relation
CO 2	Decompose complex problems into smaller sub problems, apply appropriate algorithmic techniques and combine solutions to solve the original problem efficiently.
CO 3	Gain a strong foundation in algorithm design techniques, including dynamic programming and backtracking.
CO 4	Familiarize with branch & bound algorithmic design technique.
CO 5	Develop skills in analyzing and classify decision problems such as NP Complete, NP hard, Network flows and Randomized quicksort into different complexity classes based on their computational requirements.

<div align="center">CO - PO MAPPING</div>

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✔	✔	✔				✔		✔			
CO 2	✔	✔	✔				✔		✔			
CO 3	✔	✔	✔				✔		✔			
CO 4	✔	✔	✔				✔		✔			
CO 5	✔	✔	✔				✔		✔			

<div align="center">Assessment Pattern</div>

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✔	✔	✔	✔

Understand	✔	✔	✔	✔
Apply	✔	✔	✔	✔
Analyse			✔	
Evaluate				
Create				

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]			Total Marks
		Assignment	Test-1	Test-2	
3-1-0-0	5	15	10	10	**40**

Total Mark distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	40	60	3 hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	

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SYLLABUS

MODULE I : Review of Algorithm Analysis

Introduction to Algorithm Analysis : Algorithm and its properties - Apriory and Aposterior analysis of algorithms ,Time and Space Complexity, Asymptotic Notations, Recurrence Equations, Solving Recurrence Equations- Substitution method and Iteration method, Recurrence Tree Method - Master's Theorem (Proof not required)Searching-Linear and Binary.

MODULE II : Divide and Conquer and Greedy strategy

Divide and Conquer: Control Abstraction, Merge Sort, Quick Sort, Matrix Multiplication.

Greedy Strategy: Control Abstraction, Knapsack Problem, Minimal Spanning Tree Algorithms- Prim's and Kruskal's Algorithm, Job Scheduling with deadlines

MODULE III : Dynamic Programming and Backtracking

Dynamic Programming: Control Abstraction, Principle of Optimal Substructure, All Pairs shortest path problem, Travelling Salesman Problem, Bellman-Ford Algorithm
Backtracking: Control Abstraction, N-Queens problem, Sum of Subsets Problem

MODULE IV : Branch and Bound

Branch and Bound: Control Abstraction, Travelling salesman problem, Depth First, Breadth First and Best First Branch and Bound strategies and their control abstractions, The N^2-1 Puzzle Problem.

MODULE V : Complexity Theory and Network flows

Complexity Theory: Class P and NP, Polynomial time reductions, Class NP Hard and NP- Complete, Example Problems- Vertex Cover problem, Clique Problem.
Network Flows: Flow Networks and Network Flow, Max- Flow Min Cut Theorem, Ford Fulkerson method.

Randomized Quick sort- Las-vegas and Montecarlo method

Text books

1. Thomas H. Cormen, et al., "Introduction to Algorithms", Prentice Hall, 3rd Edition
   (2010)
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Orient Longman, Universities Press, 2nd Edition (2008)

Reference books

1. Richard Neapolitan, Kumarss Naimipour, "Foundations of Algorithms", Jones and Bartlett Publishers, Inc, 4th Edition (2011).
2. Sara Baase, Allen Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", Pearson India, 3rd Edition (2002).
3. A. Levitin, "Introduction to the Design & Analysis of Algorithms", Pearson Education,

   3rd Edition (2008).

Suggested MOOC

- https://www.coursera.org/specializations/data-structures-algorithms
- https://onlinecourses.nptel.ac.in/noc19_cs47
- https://nptel.ac.in/courses/106106133
- https://onlinecourses.swayam2.ac.in/cec20_cs03

	COURSE CONTENTS AND LECTURE SCHEDULE	
No.		No. of Hours
	MODULE 1	
1.1	Introduction to Algorithm Analysis : Algorithm and its properties	1
1.2	Apriory and Aposterior analysis of algorithms	1
1.3	Time Complexity	1
1.4	Space Complexity	1
1.5	Asymptotic Notations	1
1.6	Recurrence Equations	1
1.7	Solving Recurrence Equations- Substitution method	1
1.8	Iteration method	1
1.9	Recurrence Tree Method	1
1.10	Master's Theorem	1
1.11	Searching-Linear	1
1.12	Binary search	1
	MODULE II	
2.1	**Divide and Conquer**: Control Abstraction	1

2.2	Merge Sort	1
2.3	Quick Sort	1
2.4	Matrix Multiplication	1
2.5	**Greedy Strategy**: Control Abstraction	1
2.6	Knapsack Problem	1
2.7	Minimal Spanning Tree Algorithms- Prims algorithm	1
2.8	Kruskal's Algorithm	1
2.9	Job Scheduling with deadlines	1
MODULE III		
3.1	**Dynamic Programming**	1
3.2	Control Abstraction	1
3.3	Principle of Optimal Substructure	1
3.4	All Pairs shortest path problem	1
3.5	Travelling Salesman Problem	1
3.6	Bellman-Ford Algorithm	1
3.7	**Backtracking:** Control Abstraction	1
3.8	N-Queens problem	1
3.9	Sum of Subsets Problem	1
MODULE IV		
4.1	**Branch and Bound**	1
4.2	Control Abstraction	1
4.3	TSP problem	1
4.4	Depth First	1

4.5	Breadth First	1
4.6	Best First Branch and Bound strategies	1
4.7	Control abstractions	1
4.8	The N^2-1 Puzzle Problem.	1
MODULE V		
5.1	**Complexity Theory**: Class P and NP	1
5.2	Polynomial time reductions	1
5.3	Class NP Hard and NP- Complete	1
5.4	Example Problems- Vertex Cover problem	1
5.5	Clique Problem	1
5.6	**Network Flows**: Flow Networks and Network Flow	1
5.7	Max- Flow Min Cut Theorem	1
5.8	Ford Fulkerson method	1
5.9	Las-vegas	1
5.10	Montecarlo method	1

CO Assessment Questions	
1	a) Solve the recurrence relation $T(n)=4T(n/2)+n$ using Recursion tree method b) Compare and contrast the different asymptotic notations (Big O, Big Omega, Big Theta) in terms of their definitions and applications.
2	a) Apply Merge sort Algorithm and analyze the time complexity for the following set of elements Set1: 1 4 8 9, Set 2: 2 5 6 7 b) Explain Knapsack problem. Find out the optimal solution for n=5, (P1,P2.....,P5) = (10,15,6,8,4), (w1,w2,.....w5) = (1,6,3,4,2) and m=12 using Fractional knapsack.
3	a) Apply backtracking technique to solve the following instance of Subset Sum problem where w={2,3,4,5,7) and d=9. b) Compare and contrast the Floyd-Warshall and Bellman-Ford algorithms

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		in terms of their strengths and weaknesses.
4		a) Given a specific grid arrangement for the N2-1 Puzzle Problem perform a sequence of valid moves to reach the desired end state.
		b) Analyze depth first, breadth first and best first search in branch and bound algorithmic design
5		a) Illustrate with an example for the concept of augmenting paths and how they are used to increase the flow in the Fulkerson Algorithm. b) Prove that clique problem is NP Complete. c) Given a graph which represents a flow network where every edge has a capacity. Also, given two vertices source 's' and sink 't' in the graph, find the maximum possible flow from s to t with the following constraints: • Flow on an edge doesn't exceed the given capacity of the edge. • Incoming flow is equal to outgoing flow for every vertex except s and t.

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23MCAE234	FUNCTIONAL PROGRAMMING	L	T	P	J	S	C	Year of Introduction
		3	1			3	4	2023

Preamble: Course provides an in-depth exploration of functional programming principles and techniques. The course covers topics such as pure functions, type systems, list processing, pattern matching, functional data structures and Haskell. Through this, students able to write functional programs and solve problems using a functional programming paradigm

Prerequisite: Discrete mathematics

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the principles of functional programming (Module 1)
CO 2	Write purely functional programs, using recursion, pattern matching, and higher-order functions ((Module 2) .
CO 3	Design immutable data structures like lists. (Module 3)
CO 4	Understand generic types for functional programs (Module 4)
CO 5	Write programs using Haskell (Module 5)

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✔	✔	✔			✔			✔			
CO 2	✔	✔	✔			✔			✔			
CO 3	✔	✔	✔			✔			✔			
CO 4	✔	✔	✔			✔			✔			
CO 5	✔	✔	✔		✔	✔	✔		✔			✔

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✔	✔	✔	✔
Understand	✔	✔	✔	✔
Apply	✔	✔	✔	✔

Analyse			✓		
Evaluate					
Create					

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Assignment	Theory [L- T] Test-1	Theory [L- T] Test-2	Total Marks
3-1-0-0	5	15	10	10	**40**

Total Mark distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	40	60	3 hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	

SYLLABUS

MODULE I : Review of recursion

Tail recursion -recursive program design- Functional Programming: Introduction, λ calculus, λ expressions, Identity function, Self application function, Function application function, Notation for naming functions and application reduction, Functions from functions, Argument selection and argument pairing functions,Free

and bound variables, Name clashes and α conversion, Simplification through eta reduction, Conditions, Booleans and Integers, Recursion and Arithmetic, Expressions and values, Basic Data Types , Names and values in programming- Data structures in functional languages - Names and values in imperative and functional languages- Execution order in imperative and functional   languages- Repetition in imperative and functional languages- Functions as values.

(Note : Recursion is a very important technique in functional programming, hence high importance needs to be given to make students understand the essentials of recursive thinking and program design, Basic Lambda (λ) calculus needs to be taught.)

MODULE II : Functions

Functions and definitions, Functional composition, Operators, Inverse functions, Strict and non-strict functions, Type Inference.

(Note : Basic ways of defining functions, how to infer the types of variables and function needs to be taught)

MODULE III : Lists

List notation, List comprehensions, Operations on lists, Map and filter, List patterns

Recursion and Induction: Over natural numbers, Over lists. Operations on lists

(Note : Mathematical Induction based Proofs needs to be taught from the reference text book.)

MODULE IV : New Types

Enumerated types , Composite types , Recursive types , Abstract types , Trees: Binary trees , Binary search trees

(Note : Various definitions of properties of these new types, their property proofs etc needs to be taught.)

MODULE V : Programming with Haskell

Introduction to Haskell, Defining functions: guards, pattern matching and recursion, Lists, strings and tuples, Types and polymorphism, Higher order functions on lists: map, filter, list comprehension, User defined data types:lists, queues, trees

(Note : Students need to be taught how to program using Haskell in this module.)
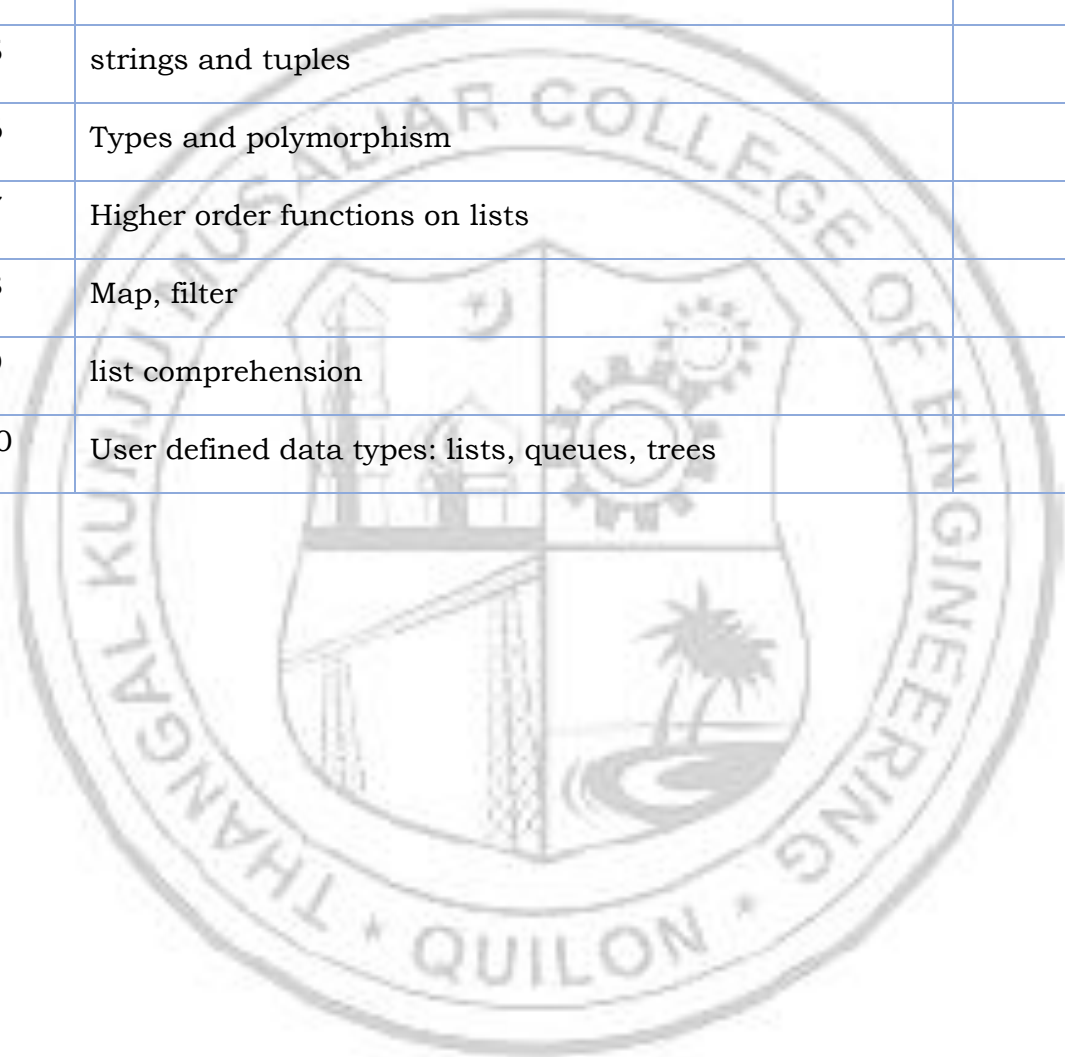
Text books

1. Richard S. Bird, Philip Wadler, "Introduction to Functional Hall, 1988 Programming",Prentice(Module 1,2,3,4)
2. Greg Michaelson, "An introduction to functional programming through lambdacalculus", Dover Publications, 2011 (Module 1)
3. Miran Lipovaca "Learn You a Haskell for Great Good!: A Beginner's

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	Guide", NoStarch Press, 1st Edition (15 March 2011) (Module 5)	

Reference books

1. Simon Peyton Jones , "The Implementation of Functional Languages" , Prentice Hall.

2. Benjamin C. Pierce, " Types and Programming Languages", MIT Press, 2002

3. https://www.haskell.org/

4. http://learnyouahaskell.com

<div align="center">

COURSE CONTENTS AND LECTURE SCHEDULE

</div>

No.		No. of Hours
	MODULE 1	
1.1	Review of recursion -Tail recursion -recursive program design	1
1.2	Introduction, λ calculus, λ expressions, Identity function	1
1.3	Self-application function, Function application function, Notation for naming functions and application reduction	1
1.4	Functions from functions, Argument selection and argument pairing functions, Free and bound variables	1
1.5	Name clashes and α conversion, Simplification through eta reduction, Conditions, Booleans and Integers	1
1.6	Recursion and Arithmetic, Expressions and values, Basic Data Types	1
1.7	Names and values in programming- Data structures in functional languages	1
1.8	Names and values in imperative and functional languages	1
1.9	Execution order in imperative and functional languages	1
1.10	Repetition in imperative and functional languages- Functions as values	1
	MODULE II	
2.1	Functions and definitions	1
2.2	Functional composition	1

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2.3	Functional composition (Conti…)	1
2.4	Operators	1
2.5	Inverse functions	1
2.6	Inverse functions (Conti…)	
2.7	Strict and non-strict functions	1
2.8	Type Inference	1
MODULE III		
3.1	List notation	1
3.2	List comprehensions	1
3.3	Operations on lists	1
3.4	Map and filter	1
3.5	List patterns	1
3.6	Recursion and Induction	1
3.7	Over natural numbers	1
3.8	Over lists	1
3.9	Operations on lists	1
3.10	Operations on lists (Conti…)	1
MODULE IV		
4.1	New Types: Enumerated types	1
4.2	New Types: Composite types	1
4.3	New Types: Recursive types	1
4.4	New Types: Abstract types	1
4.5	Trees: Binary trees	1
4.6	Trees: Binary trees (Conti…)	1
4.7	Trees: Binary trees (Conti…)	1
4.8	Trees: Binary search trees	1
4.9	Trees: Binary search trees (Conti…)	1
4.10	Trees: Binary search trees (Conti…)	1

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	MODULE V	
5.1	Programming with Haskell: Introduction to Haskell	1
5.2	Defining functions: guards	1
5.3	pattern matching and recursion	1
5.4	Lists	1
5.5	strings and tuples	1
5.6	Types and polymorphism	1
5.7	Higher order functions on lists	1
5.8	Map, filter	1
5.9	list comprehension	1
5.10	User defined data types: lists, queues, trees	1

	CO Assessment Questions	
1	a) Design a recursive function to add two numbers. b) Design a tail recursive function to find the nth Fibonacci number. c) Explain the basic differences between imperative style programming and functional styleprogramming d) Analyse each of the following lambda expressions to clarify its structure. If the expressionis a function, identify the bound variable and the body expression, and then analyse the body expression. If the expression is an application, identify the function and argument expressions, and then analyse the function and argument expressions: i) λa.(a λb.(b a)) ii) λx.λy.λz.((z x) (z y)) iii) (λf.λg.(λh.(g h) f) λp.λq.p) iv) λfee.λfi.λfo.λfum.(fum (fo (fi fee)) v) (λp.(λq.p λx.(x p)) λi.λj.(j i))	
2	a) Explain with the help of examples the various forms of function definitions. b) Explain functional composition with the help of examples c) Deduce the type of the following expression: (.) f g x = f (g x) where . -> Functional Composition	

3	a) Predict the output of the following along with detailed explanation on how did you arriveat the answer:
	    A. [(a,b) | a <- [1 . . 8] ; even a; b <- [a + 3. . 4] ; odd b]
	    B. ["Party" | k <- [1 .. 5]]
	    C. [' * ' | i <- [1 .. 3] ; j <- [1, 2]]	

	b) Explain any three list operations along with function definitions and examples Note: Questions can be asked to solve problems using list comprehensions, to prove propertieson list operations and functions on natural numbers using Mathematical Induction	
4	a) Define Natural numbers as a Recursive Type and explain how this definition enumerates allNatural numbers. b) Find the equivalent decimal representation of this value: Succ (Succ (Succ (Succ (Succ Succ Zero))))) c) Define Fibonacci numbers using Pattern matching. Natural numbers should be represented as aRecursive type. Note: Questions can be asked to prove properties on Binary Trees and Binary Search Trees usingStructural Induction (Variant of Mathematical Induction	

| 5 | a) Duplicate only even numbers among the elements of a list using a Haskell function and explain. You need to do this in two ways; 1. Recursion 2. List Comprehension |
| | Example :   λ> dupli [1, 2, 3]   ANS: [2,2] |

23MCAE236	ADVANCED OPERATING SYSTEMS	L	T	P	J	S	C	Year of Introduction
		3	1			3	4	2023

Preamble: This course provides an in-depth study of advanced concepts and techniques in operating system design and implementation. Students will explore advanced topics such as synchronization mechanisms, distributed mutual exclusion, distributed resource management, multiprocessor operating system and concurrency control. Through theoretical discussions, students will develop a deep understanding of operating system internals and gain skills in analyzing, designing, and optimizing operating systems.

Prerequisite: Basic concepts of desktop computer operating systems

Course Outcomes: After the completion of the course the student will be able to

CO 1	Identify synchronization problems in operating systems and issues in distributed systems.
CO 2	Explain classification of mutual exclusion algorithms and security violations.
CO 3	Explain the design of distributed shared memory and issues in load distribution
CO 4	Explain design issues and synchronization in multiprocessor systems.
CO 5	Explain synchronization and concurrency control in database systems.

<div align="center">CO - PO MAPPING</div>

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓			✓				✓			
CO 2	✓	✓							✓			
CO 3	✓	✓							✓			
CO 4	✓	✓							✓			
CO 5	✓	✓			✓		✓		✓			

<div align="center">Assessment Pattern</div>

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	**Test 2**	**Other tools**	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse			✓	

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Evaluate					
Create					135

<div align="center">

Mark Distribution of CIA

Total Mark distribution

</div>

Course Structure [L-T-P-J]	Attendance	Theory [L- T]			
		Assignment	Test-1	Test-2	
3-1-0-0	5	15	10	10	**40**

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	40	60	3 hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	

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SYLLABUS

MODULE I : Overview

Overview: Functions of Operating System –DesignApproaches –Types of Advanced Operating Systems.

Synchronization Mechanisms: Concept of Processes andThreads –The Critical Section Problem – Other Synchronization Problems:– Monitor –Serializer – Path Expressions.

Distributed Operating Systems:- Issues in Distributed Operating System – Communication Networks And Primitives –Lamport's Logical clocks – Causal Ordering ofMessages

MODULE II : Distributed Mutual Exclusion

Requirements – Measuring Performance – Lamport's Algorithm – Rickart-Agarwala Algorithm – Suzuki- Kasami's Broadcast Algorithm.

: <u>**Security**</u> Potential Security Violations – Design Principles for Secure Systems –The Access Matrix Model and Implementation- The Access Control list Method.

MODULE III : Distributed Resource Management

Mechanisms for building Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for ImplementingDistributed Shared memory – Issues in Load Distributing – Components of Load Distributing Algorithm – Sender- Initiated Algorithm – Receiver- Initiated Algorithm

MODULE IV : Multiprocessor Operating Systems

Multiprocessor System Architectures – Interconnection Networks – Structures – Design Issues – Threads – Process - Synchronization – Processor Scheduling – Memory Management – Virtualization – Types of Hypervisors – Paravirtualization – Memory Virtualization – I/O Virtualization

MODULE V : Database Systems

Problem of Concurrency Control – Serializability – Basic Synchronization Primitives for Concurrency Control – Lock-Based Algorithms – Time-Stamp Based Algorithms – Optimistic Algorithms.

Text books

1. Mukesh Singhal and Niranjan G. Shivaratri, "***Advanced Concepts in OperatingSystems***
   – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill,2001.

2. Andrew S. Tanenbaum, "***Modern Operating Systems***", 3rd Edition, Prentice Hall,2012.

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Reference books

1. Pradeep K Sinha, "***Distributed Operating Systems: Concepts and Design***", PrenticeHall of India, 2007.
2. George Coulouris, Jean Dollimore,Tim Kindberg, Gordon Blair, ***"Distributed Systems,Concepts and Design"***, 5th Edtn,Pearson, 2019
3. https://www.classcentral.com/course/udacity-advanced-operating-systems-1016
4. https://www.my-mooc.com/en/mooc/advanced-operating-systems--ud189/

COURSE CONTENTS AND LECTURE SCHEDULE

No.		No. of Hours
MODULE 1		
1.1	**Overview**: Functions of Operating System –Design Approaches	1
1.2	Typesof Advanced Operating Systems	1
1.3	**Synchronization Mechanisms**: Concept of Processes and Threads	1
1.4	The Critical Section Problem	1
1.5	Other Synchronization Problems:– Monitor –Serializer	1
1.6	Path Expressions	1
1.7	**Distributed Operating Systems**:- Issues in Distributed OperatingSystem ——	1
1.8	Communication Networks And Primitives	1
1.9	Lamport's Logicalclocks	1
1.10	Causal Ordering of Messages	1
MODULE II		
2.1	**Distributed Mutual Exclusion**:- Classification - Requirements –	1
2.2	Measuring Performance – Lamport's Algorithm	1
2.3	Rickart-Agarwala Algorithm	1

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2.4	Rickart-Agarwala Algorithm	1
2.5	Algorithm–Suzuki-Kasami's Broadcast	1
2.6	**Security :**Potential Security Violations	1
2.7	Design Principles for Secure Systems	1
2.8	The Access Matrix Model and Implementation	1
2.9	The Access Matrix Model and Implementation (Conti...)	1
2.10	The Access Control list Method	1
MODULE III		
3.1	**Distributed Resource Management:** Mechanisms for building Distributed File Systems – Design Issues	1
3.2	Mechanisms for building Distributed File Systems	1
3.3	Design Issues	1
3.4	**Distributed Shared Memory** – Algorithms for ImplementingDistributed Shared memory	1
3.5	Algorithms for ImplementingDistributed Shared memory	1
3.6	Algorithms for ImplementingDistributed Shared memory (Conti...)	1
3.7	**Load Distribution** : Issues in Load Distributing	1
3.8	Components of Load Distributing Algorithm	1
3.9	Sender- Initiated Algorithm	1
3.10	Receiver- Initiated Algorithm	1
MODULE IV		
4.1	**Multiprocessor Operating Systems**: Basic Multiprocessor SystemArchitectures	1
4.2	Interconnection Networks	1
4.3	Structures	1
4.4	Design Issues – Threads	1
4.5	Process Synchronization	1
4.6	Processor Scheduling – Memory Management	1
4.7	Virtualization – Types of Hypervisors	1

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4.8	Paravirtualization – MemoryVirtualization – I/O Virtualization	1
MODULE V		
5.1	**Database Systems**: Problem of Concurrency Control	1
5.2	Serializability	1
5.3	Serializability	1
5.4	Basic Synchronization Primitives for Concurrency Control	1
5.5	Lock-Based Algorithms	
5.6	Time-Stamp Based Algorithms	1
5.7	Time-Stamp Based Algorithms (Conti...)	1
5.8	Time-Stamp Based Algorithms (Conti...)	1
5.9	Optimistic Algorithms	1
5.10	Optimistic Algorithms (Conti...)	1
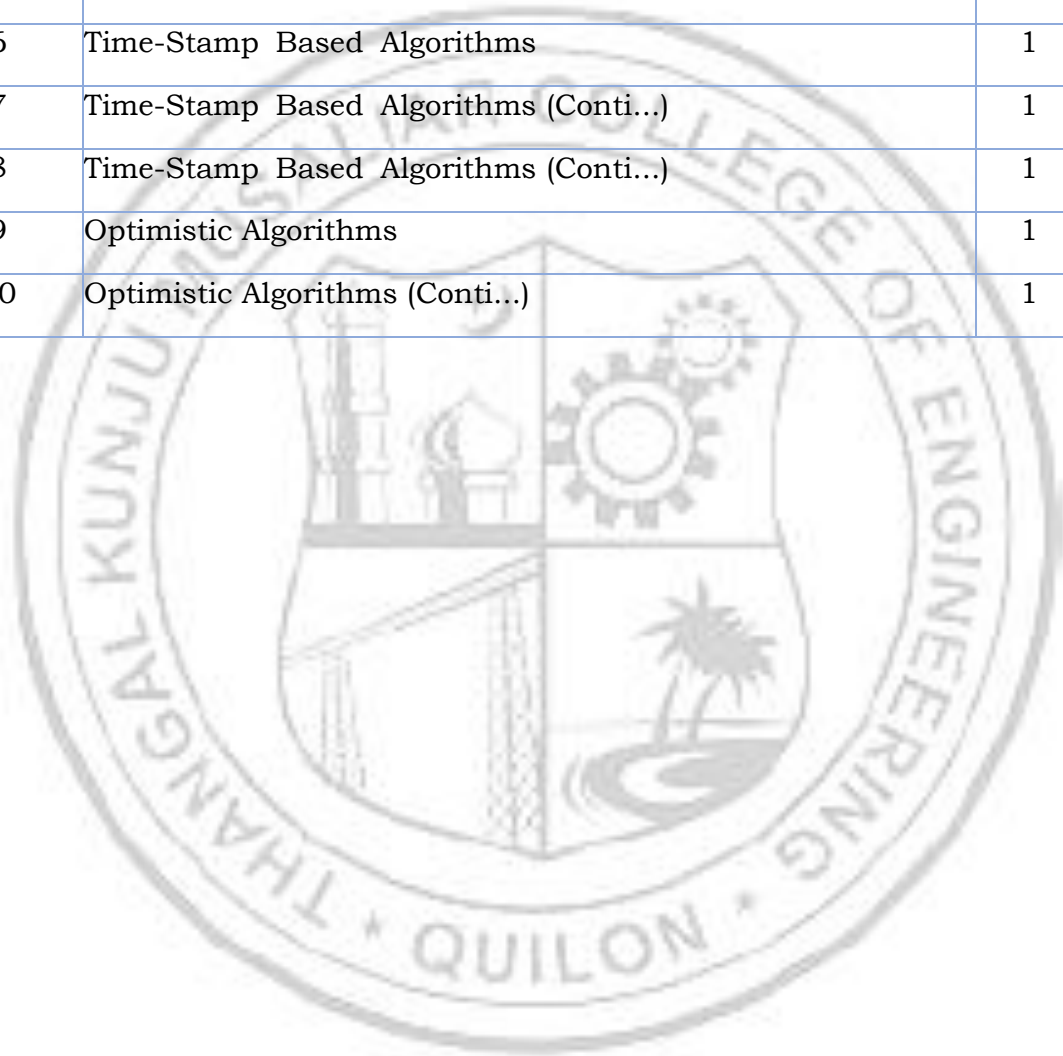
CO Assessment Questions	
CO1	
1	Explain synchronization using semaphore.
2	Classify Advanced operating systems.
3	Illustrate limitation of Lamports clocks.
CO2	
1	Explain some of the algorithms for mutual exclusion.
2	Explain potential security violations.
3	Compare the Lamport's algorithm and Rickart-Agarwala algorithm.
CO3	
1	Explain major design issues and building mechanisms in Distributed file systems.
2	Explain important algorithms for implementing DSM
3	Explain issues in load distribution.
CO4	
1	Explain system architecture of Multiprocessor systems.
2	Explain design issues in Database Multiprocessor Systems.
3	Explain how virtualization is implemented.
CO5	
1	Explain Lock based algorithms for concurrency control in Database Systems.
2	Illustrate Timestamp based algorithms for concurrency control in Database Systems.
3	Explain design issues in Database Systems.

23MCAE238	Compiler Design	L	T	P	J	S	C	Year of Introduction
		3	1			3	4	2023

Preamble: The objective of this course is to explore the principles, algorithms and data structures involved in the design of compilers. It includes lexical analysis, parsing techniques, generating grammars, intermediate code generation, code optimization and code generation phases.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain different phases of compiler and perform lexical analysis using the concepts of regular expressions and finite automata.
CO 2	Develop top down and bottom-up parsers to perform syntaxanalysis using context free grammar.
CO 3	Explain syntax directed translation schemes and type checking for a given grammar.
CO 4	Distinguish different intermediate code representations and generate intermediate code for statements in high level languages.
CO 5	Describe various code optimization techniques and generatemachine dependent code.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✔	✔					✔					
CO 2	✔	✔	✔				✔					
CO 3	✔	✔					✔					
CO 4	✔	✔	✔				✔					
CO 5	✔	✔					✔					

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✔	✔	✔	✔
Understand	✔	✔	✔	✔

Apply	✔	✔	✔	✔
Analyse			✔	
Evaluate			✔	
Create			✔	

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]			Total Marks
		Assignment	Test-1	Test-2	
3-1-0-0	5	15	10	10	**40**

Total Mark distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	40	60	3 hrs

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	

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<div align="center">SYLLABUS</div>

MODULE I : Introduction

Introduction to compilers: Analysis of the source program, Phases of a compiler, Grouping of phases

Lexical analysis: role of lexical analyser, input buffering, specification of tokens, recognition of tokens, Deterministic and Non-Deterministic Finite automata, Regular expression to NFA and DFA

MODULE II : Syntax analysis

Syntax analysis: Role of parser, Context free grammars

Top down parsing: Recursive Descent parsing, Predictive parsing, LL(1) Grammars. Bottom-up parsing: Shift Reduce Parsing, Operator Precedence Parsing (concepts only),

LR parsing – Constructing SLR parsing tables, Constructing Canonical LR parsing tables and Constructing LALR parsing tables.

MODULE III : Syntax directed translation

Syntax directed translation: Syntax directed definitions, Bottom-up evaluation of S-attributed definitions, L- attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes.

Type Checking: Type systems, Specification of a simple type checker.

MODULE IV : Intermediate code generation

Intermediate code generation: Graphical representations, Three address code - Quadruples -triples - Indirect triples, Assignment Statements, Boolean Expressions, Control flow statements

MODULE V : Code Generation

Code generation: Issues in the design of a code generator, The target machine, Basic blocks and flow graphs, A simple code generator, Peephole optimization.

Text books

Alfred V.Aho , Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers – Principles,Techniques and Tools, Addison Wesley, 2nd Edition,2006.

Reference books

1. V Raghavan- Principles of Compiler Design – Tata McGraw Hill, 2nd edition,2011
2. Jean Paul Tremblay and Sorenson., The Theory and Practice of Compiler Writing

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,McGraw Hill,2nd Edition,2006

3. Nandini Prasad, Principles of compiler design, Elsevier, 2nd Edition,2012
4. Kenneth C. Louden, Compiler Construction-Principles and Practice, 2nd Edition,Cengage, 2010.
5. Keith Cooper and Linda Torczon, Engineering a Compiler , 2nd Edition, Elsevier, 2011

	COURSE CONTENTS AND LECTURE SCHEDULE	
No.		No. of Hours 48
	MODULE 1 Introduction	
1	**Lexical Analysis**	**8 Hours**
1.1	Lexical Analysis: Analysis of the source program	1
1.2	Phases of a compiler, Grouping of phases	1
1.3	Lexical analysis: role of lexical analyser, input Buffering	1
1.4	specification of tokens, recognition of tokens	1
1.5	Deterministic and Non-Deterministic Finite automata	1
1.6	Deterministic and Non-Deterministic Finite automata (Conti...)	1
1.7	Regular expression to NFA and DFA	1
1.8	Regular expression to NFA and DFA (Conti...)	1
	MODULE II	
2	**Syntax Analysis**	**14 Hours**
2.1	Syntax analysis: Role of parser, Context free grammars	1
2.2	Top-down parsing: Recursive Descent parsing	1
2.3	Top-down parsing: Recursive Descent parsing (Conti...)	1
2.4	Predictive parsing, LL(1) Grammars	1
2.5	Predictive parsing, LL(1) Grammars Operator Precedence Parsing	1
2.6	Bottom-up parsing: Shift Reduce Parsing	1

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2.7	Operator Precedence Parsing	1
2.8	Operator Precedence Parsing (Conti...)	1
2.9	LR parsing – Constructing SLR parsing tables	1
2.10	LR parsing – Constructing SLR parsing tables (Conti...)	1
2.11	Constructing Canonical LR parsing tables	1
2.12	Constructing Canonical LR parsing tables (Conti...)	1
2.13	Constructing LALR parsing tables.	1
2.14	Constructing LALR parsing tables. (Conti...)	1
MODULE III		
3	**Syntax directed translation and Type Checking**	**8 Hours**
3.1	Syntax directed translation: Syntax directed definitions	1
3.2	Bottom- up evaluation of S attributed definitions, L- attributed definitions	2
3.3	Top-down translation, Bottom-up evaluation of inherited attributes.	2
3.4	Type Checking: Type systems	1
3.5	Specification of a simple type checker.	2
MODULE IV		
4	**Intermediate code generation**	**8 Hours**
4.1	Intermediate code generation: Graphical representations	1
4.2	Intermediate code generation: Graphical representations (Conti...)	1
4.3	Three address code-quadruples -triples-Indirect triples	1
4.4	Three address code-quadruples -triples-Indirect triples (Conti...)	1
4.5	Assignment Statements, Boolean Expressions, Control flow statements	1
4.6	Assignment Statements, Boolean Expressions, Control flow statements	1

	(Conti…)	
4.7	Control flow statements	1
4.8	Control flow statements (Conti…)	1

	MODULE V	
5	**Code Optimization and Code Generation**	**10 Hours**
5.1	Code Optimization: Principal sources of optimization	1
5.2	Code Optimization: Principal sources of optimization (Conti…)	1
5.3	Optimization of Basic blocks,	1
5.4	Global data flow analysis	1
5.5	Global data flow analysis (Conti…)	1
5.6	Code generation: Issues in the design of a code generator.	1
5.7	Code generation: Issues in the design of a code generator.	1
58	The target machine, Basic blocks and Flow graphs	1
5.9	The target machine, Basic blocks and Flow graphs	1
5.10	Peephole optimization	1

	CO Assessment Questions
CO1	
1	Explain how the regular expressions and finite automata are used for specification and recognition of tokens.
2	State the role of lexical analyser. Identify the lexemes and their corresponding tokens in the following statement: printf ("Simple Interest=%f\n", si)
3	Draw the DFA for the regular expression (a | b) * (abb | a+ b).
CO2	

4	Find the LR (0) items for the grammar S->SS | a| €.
5	Show the steps involved in recursive descent parsing with backtracking for the string cad with the given grammar: S -> cAd, A -> ab | a
6	Construct the predictive parsing table for the following grammar: S -> (L) | a
CO3	
7	Write the S-attributed SDD of a simple desk calculator and show annotated parse tree for the expression (3+4) *(5+6).
8	Explain bottom- up evaluation of S- attributed definitions.
9	Explain the specification of a simple type checker
CO4	
10	Draw DAG for the expression (a/10 + (b -10)) *(a/10 + (b-10)). Also write the sequence of instructions used for the DAG construction.
11	Write the three-address code sequence for the statement x=y*z + y*-z. Also give its triple representation.
12	Write syntax directed definitions to construct syntax tree and three address code
CO5	
13	Using code generation algorithm generate code sequence for the expression x = (a – b)+ (a + c).
14	With suitable example of a basic block, explain the code-improving transformations of a basic block.
15	Explain common sub expression elimination with an example.

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23MCAE240	Object Oriented Modelling and Design	L	T	P	J	S	C	Year of Introduction
		3	1			3	4	2023

Preamble: Object-oriented design and modeling are fundamental concepts in software engineering that facilitate the development of robust, scalable, and maintainable software systems. Object-oriented modeling paradigm provides a powerful framework for object oriented concepts class & behavioral modeling, system conception, domain analysis, use case realization, design patterns. Object-oriented modeling provides students to understand and apply techniques for visualizing and create well-structured, maintainable software systems.

Prerequisite: OOPS concept

Course Outcomes: After the completion of the course the student will be able to

CO 1	Gain a thorough understanding of fundamental object-oriented concepts and class modelling.
CO 2	Apply Unified Modeling Language as a standard notation for visualizing, specifying, and documenting object-oriented systems.
CO 3	Familiarize the various approaches such as process overview, system conception and domain analysis.
CO 4	Devise Use case realization approaches.
CO 5	Choose and apply a befitting design pattern for the given problem.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓					✓		✓		✓	
CO 2	✓	✓	✓				✓		✓		✓	✓
CO 3	✓	✓					✓		✓		✓	
CO 4	✓	✓					✓		✓		✓	
CO 5	✓	✓					✓		✓		✓	✓

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓

Analyse					
Evaluate					
Create					

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]			Total Marks
		Assignment	Test-1	Test-2	
3-1-0-0	5	15	10	10	40

Total Mark distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	40	60	3 hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	

SYLLABUS

MODULE I : Introduction, Modelling Concepts and Class Modelling

Object orientation, OO development, OO Themes; Evidence for usefulness of OO development; OO modeling history. Modeling as Design technique: Modeling; abstraction; The Three models. Class Modeling: Object and Class Concept; Link and associations concepts; Generalization and Inheritance; A sample class model; Navigation of class models; Advanced Class Modeling, Advanced object and class concepts;

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Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages.

MODULE II : Business Modeling

General View of the System, Business Use Case Diagram, Activity Diagram, State Machine Diagram. High-Level Requirements- System Actors, System Use Cases, How to Find System Use Cases in the Business Model, Requirements ,Preliminary Conceptual Model.

MODULE III : Process Overview, System Conception and Domain Analysis

Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis.

MODULE IV : Use case Realization

Use case Realization :The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design.

MODULE V : Introduction to design patterns

Design Patterns: Introduction; what is a design pattern? Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design pattern, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only).

Text books

1. Michael R Blaha, James R Rumbaugh , Object-Oriented Modeling and Design with UML, Pearson,Second Edition,2005.
2. Wazlawick, Raul Sidnei. *Object-Oriented Analysis and Design for Information Systems: Modeling with UML, OCL, and IFML.* Amsterdam: Morgan Kaufmann, 2014.
3. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning,2005.
4. Erich Gamma, Richard Helm, Ralph Johnson and john Vlissides : Design Patterns – Elements of Reusable Object-Oriented Software, Pearson Education,2007.

Reference books

1. Grady Booch et.al.: Object-Oriented Analysis and Design with Applications,3rd Edition, Pearson Education,2007. 2.

2. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern –Oriented Software Architecture. A system of Patterns , Volume 1, John Wiley and Sons.2007.

3. Booch, Jacobson, Rambaugh: Object-Oriented Analysis and Design with Applications, 3rd edition, pearson, Reprint 2013, Pearson, Second Edition,2005.

Suggested MOOC

https://www.coursera.org/specializations/software-design-architecture

COURSE CONTENTS AND LECTURE SCHEDULE

No.		No. of Hours
MODULE 1		
1.1	Object orientation, OO development, OO Themes	1
1.2	Evidence for usefulness of OO development; OO modeling history	1
1.3	Modeling as Design technique: Modeling; abstraction	1
1.4	The Three models -Class Modeling: Object and Class Concept	1
1.5	Link and associations concepts	1
1.6	Generalization and Inheritance	1
1.7	A sample class model; Navigation of class models	1
1.8	Advanced Class Modeling, Advanced object and class concepts; Association ends; N-ary association	1
1.9	Abstract classes; Multiple inheritance; Metadata; Reification;	1
1.10	Constraints; Derived Data; Packages.	1
MODULE II		
2.1	General View of the System	1
2.2	Business Use Case Diagram	1
2.3	Activity Diagram	1
2.4	State Machine Diagram	1
2.5	High-Level Requirements- System Actors	1
2.6	System Use Cases	1
2.7	How to Find System Use Cases in the Business Model	1
2.8	Requirements	1
2.9	Preliminary Conceptual Model.	1
MODULE III		

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3.1	Process Overview	1
3.2	Development stages	1
3.3	Development life Cycle	1
3.4	System Conception: Devising a system concept	1
3.5	elaborating a concept; preparing a problem statement	1
3.6	Domain Analysis: Overview of analysis	1
3.7	Domain Class model: Domain state model	1
3.8	Domain interaction model	1
3.9	Iterating the analysis.	1
MODULE IV		
4.1	Use case Realization :The Design Discipline within up iterations	1
4.2	Object Oriented Design-The Bridge between Requirements and Implementation	1
4.3	Design Classes and Design within Class Diagrams	1
4.4	Interaction Diagrams	1
4.5	Realizing Use Case and defining methods	1
4.6	Designing with Communication Diagrams	1
4.7	Updating the Design Class Diagram	1
4.8	Package Diagrams-Structuring the Major Components	1
4.9	Implementation Issues for Three-Layer Design	1
MODULE V		
5.1	Design Patterns: Introduction	1
5.2	Describing design patterns	1
5.3	Catalogue of design patterns	1

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5.4	How design patterns solve design problems	1
5.5	How to select a design pattern	1
5.6	How to use a design pattern	1
5.7	Creational patterns: prototype and singleton (only	1
5.8	Structural patterns adaptor	1
5.9	Proxy	1

CO Assessment Questions	
1	a) Develop a system that use concept of inheritance in modeling real-world scenarios b) Discuss the relationship between classes and objects in object-oriented programming
2	a) Design a state machine diagram and activity diagram for a ATM transaction system. b) Create a UML class diagram representing a banking system with classes for customers, accounts, and transactions.
3	a) Design a system that address the key concepts and principles of object-oriented modeling. b) Apply domain analysis techniques to identify and capture requirements for a specific system.
4	a) Describe the implementation issues in three layer design. b) Apply the concept of use case realization to map use cases to class diagrams, sequence diagrams, and other UML diagrams
5	a) Compare and contrast different design patterns and their use cases, highlighting their strengths and weaknesses. b) Design a class diagram that incorporates one or more design patterns to address a set of requirements.

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23MCAE242	ORGANIZATIONAL BEHAVIOUR	L	T	P	J	S	C	Year of Introduction
		3	1			3	4	2023

Preamble: Course provides a comprehensive understanding of individual and group behavior within organizations. The course covers topics such as motivation, leadership, communication, teamwork, organizational culture, and change management. Through case studies, group discussions, and experiential exercises, students will develop skills in analyzing and managing behavior in organizational settings.

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Identify managers' challenges and opportunities in applying OB concepts.
CO 2	Analyse various characteristics of individual behaviour and its impact on organizational performance.
CO 3	Acquire knowledge about the complexities associated with management of individual behaviour in the organization
CO 4	Understand group behaviour and develop inter-personal skills and group dynamics
CO 5	Understand organizational structures and analyze the behavioral implications of different organizational designs

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓	✓			✓		✓	✓		✓	✓
CO 2	✓	✓				✓	✓	✓	✓		✓	✓
CO 3	✓	✓				✓	✓	✓	✓		✓	✓
CO 4	✓	✓				✓		✓	✓		✓	
CO 5	✓	✓	✓		✓	✓		✓	✓		✓	

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓

Apply	✔	✔	✔	✔	
Analyse			✔		
Evaluate					
Create					

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]			Total Marks
		Assignment	Test-1	Test-2	
3-1-0-0	5	15	10	10	**40**

Total Mark distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	40	60	3 hours

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	

SYLLABUS

MODULE I : Nature of Organisational Behaviour

What are Organisations? – Why do Organisations Exist?

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Nature of Organisational Behaviour – Foundations of OB – Contemporary OB –

Scope ofOrganisational Behaviour – Contextual Perspectives of OB – Evolution of OB – OB Model

Management and Managers: Functions of Management – Manager's Roles – Types of Manager, Evolution of Management Theory – Contemporary Trends in Management Thinking

Challenges in OB: Managing Inclusivity / Diversity – Career Management – Talent Management, Globalization

MODULE II : Foundations of Individual Behaviour

Foundations of Individual Behaviour: Personal Factors – Environmental Factors –Organisational Systems and Resources – Models of Individual Behaviour

Intelligence: Nature of Intelligence – Types of Intelligence – Model, Theories, Measurement ofIntelligence – Factors Influencing Intelligence

Personality: Nature of Personality – The Shaping of Personality – Determinants of Personality –Personality Structure – OB Related Personality Traits

Perception and Attribution: Perception: Meaning and Definition – Factors InfluencingPerception – Perceptual Process – Perception and OB

Learning: Explicit and Tacit Knowledge – How Learning Occurs? – Principles of Learning –Learning and OB

MODULE III : Attitudes and Values

Attitudes and Values: Nature of Attitudes – Components of Attitudes – Formation of Attitudes –Functions of Attitudes – Changing Attitudes – Work-related Attitudes – Values

Motivation: Nature of Motivation – Importance of Motivation – Motivational Challenges –Theories on Motivation

Applied Motivational Practices: Rewards – Job Design – Behaviour Modification –Empowerment –Problem Employees – Quality of Work Life – Employee Engagement

Work Stress: Work Stress Model – Burnout – Stress Management – Stress and Performance

MODULE IV : Group Dynamics

Group Dynamics: Nature of Groups – Types of Groups – Group Development – Usefulness & Pitfalls of Groups – Determinants of Group Behaviour – Group Structuring – Group Decision Making

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Team Dynamics: Teams vs. Groups – Benefits from Teams – Types of Teams – Implementing Teams in Organisations – Team Properties – Effective Teamwork

Workplace Behaviour: Nature of Conflict – Changing Views of Conflict – Functional and Dysfunctional Conflict – The Process of Conflict – Levels of Conflict – Conflict Resolution – Conflict Management Styles - Managerial Implications – Negotiation and Conflict Resolution

Leadership: Nature of Leadership – Leadership and Management – Importance of Leadership – Formal and Informal Leadership – Leadership Styles and Their Implications – Theories of Leadership – Contemporary Issues on Leadership – Leadership Development

Communication: Interpersonal Communication – Organisational Communication – Communication Networks – Communication Roles – Informal Communication – CommunicationMedia – Information Technologies – Managerial Implications

MODULE V : Organisations

Organisations: Nature of Organisations – Organisational Structure – Key Factors of Organisational Structure – Types of Organisational Structures – Organisations for Future –Informal Organisations – Managerial Implications

Organisational Culture: Cultural Dimensions – How is Culture Created? – Sustaining Culture –Effects of Culture – Changing Organisational Culture – Creativity in Organisations – Innovation in Organisations

Organisational Change and Development: Nature of Change – Levels of Change – Types of Change – Forces for Change in Organisations – Resistance to Change – Force Field Theory of Change - The Change Process – Organisational Development – Managerial Implications

Text books

1. K Aswathappa, *Organizational Behaviour*, Himalaya Publishing House, 2018.

2. Robbins, Stephen, Timothy, A & Sanghi, S. "*Organizational Behavior*",13th Edn,Pearson Education. 2009.

Reference books

1. Mc Shane & Von Glinow, "*Organizational Behavior*", Mc Graw Hill Publications, NewDelhi, 2008

2. *Understanding Organizational Behaviour* by Udai Pareek, Oxford University Press(Third Edition)

3. *Behaviour in Organizations* by Jerald Greenberg and Robert A. Baron, PHI learningprivate Ltd, New Delhi (Ninth Edition).

4. Laurie J. Mullins, *Management and Organisational Behaviour*, Oxford Publishers, NewDelhi, 2007.

5. *ORGB* by Nelson, Quick and Khandelwal, Cengage Learning New

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No.		No. of Hours
	Delhi (second edition).	
COURSE CONTENTS AND LECTURE SCHEDULE		
MODULE 1		
1.1	Nature of Organisational Behaviour	1
1.2	Nature of Organisational Behaviour (Conti...)	1
1.3	Nature of Organisational Behaviour (Conti...)	1
1.4	Management and Managers	1
1.5	Management and Managers (Conti...)	1
1.6	Management and Managers (Conti...)	1
1.7	Challenges in OB	1
1.8	Challenges in OB (Conti...)	1
1.9	Challenges in OB (Conti...)	1
MODULE II		
2.1	Foundations of Individual Behaviour	1
2.2	Foundations of Individual Behaviour (Conti...)	1
2.3	Intelligence	1
2.4	Intelligence (Conti...)	1
2.5	Personality	1
2.6	Personality (Conti...)	1
2.7	Perception and Attribution	1
2.8	Perception and Attribution (Conti...)	1
2.9	Learning	1
2.10	Learning (Conti...)	2
MODULE III		
3.1	Attitudes and Values	1

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3.2	Attitudes and Values (Conti...)	1
3.3	Motivation	1
3.4	Motivation (Conti...)	1
3.5	Applied Motivational Practices	1
3.6	Applied Motivational Practices (Conti...)	1
3.7	Applied Motivational Practices	1
3.8	Work Stress	1
3.9	Work Stress (Conti...)	1
MODULE IV		
4.1	Group Dynamics	1
4.2	Group Dynamics (Conti...)	1
4.3	Team Dynamics	1
4.4	Team Dynamics (Conti...)	1
4.5	Workplace Behaviour	1
4.6	Workplace Behaviour (Conti...)	1
4.7	Workplace Behaviour (Conti...)	1
4.8	Leadership	1
4.9	Leadership (Conti...)	1
4.10	Leadership (Conti...)	1
4.11	Communication	1
4.12	Communication (Conti...)	
MODULE V		
5.1	Organisations	1
5.2	Organisations (Conti...)	1
5.3	Organisations (Conti...)	1
5.4	Organisational Culture	1
5.5	Organisational Culture (Conti...)	1
5.6	Organisational Culture (Conti...)	1

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5.7	Organisational Change and Development	1
5.8	Organisational Change and Development (Conti...)	1
5.9	Organisational Change and Development (Conti...)	1

CO Assessment Questions	
1	a) Describe the importance of inter-personal skills in the workplace. b) Analyse the challenges and opportunities for managers in using OB concepts. c) "The workplace discriminations undermine organisational performance", Justify.
2	a) Identify the major job attitude and job satisfaction parameters. b) How to apply concepts about emotions and moods to specific OB issues. c) Differentiate between person fit for job and person fit for organisation.
3	a) What is learning and what are the theories of learning? b) How do individual differences and organisational constraints influence decision making? c) Identify how employee involvement measures motivate employees.
4	a) Differentiate group and team. b) Relate the contemporary theories of leadership to earlier foundational theories. c) What are three types of conflicts and the three loci of conflict?
5	a) What are the functional and dysfunctional effects of organisational culture? b) What are your suggestions to overcome resistance to change in an organization? c) Identify the potential environmental, organisational and personal sources of stress atwork.

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23MCAE244	Data Mining	L	T	P	J	S	C	Year of Introduction
		3	1			2		2023

Preamble: Analyzing large amounts of data is a necessity. We are deluged by data—scientific data, medical data, demographic data, financial data, and marketing data. People have no time to look at this data. This course will give an introduction to data mining, Data warehouse & OLAP, Association rule mining, Classification, Prediction and Clustering methods. Basic knowledge about the different ways to automatically analyze the data, to automatically classify it, to automatically summarize it, to automatically dis-cover and characterize trends in it, and to automatically flag anomalies is one of the most active and exciting areas of the database research community.

Prerequisite: Data Base Management System.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the basics of Data Mining, functionality, classification and issues in data mining and data preprocessing. (Understand Level)
CO 2	Understand the different concepts of Data Warehouse & OLAP. (Understand Level)
CO 3	Solve and find the association between the different items in transactions using Association Rule Mining. (Apply Level)
CO 4	Classify and predict to which class a new data tuple belongs to using Classification and Prediction in Data Mining. (Apply Level)
CO 5	Cluster the given set of dataset and group it using the concepts of Clustering in Data Mining. (Apply Level)

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✔				✔	✔	✔		✔			
CO 2	✔	✔			✔	✔			✔			
CO 3	✔	✔	✔		✔	✔	✔		✔			
CO 4	✔	✔	✔			✔			✔			
CO 5	✔	✔	✔			✔			✔			

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Assessment Pattern				
Bloom's Category	**Continuous Assessment Tools**			**End Semester Examination**
	Test1	**Test 2**	**Other tools**	
Remember	✔	✔	✔	✔
Understand	✔	✔	✔	✔
Apply	✔	✔	✔	✔
Analyse			✔	
Evaluate				
Create				

Mark Distribution of CIA					
Course Structure [L-T-P-J]	**Attendance**	**Assignment**	**Theory [L- T]**		**Total Marks**
			Test-1	**Test-2**	
3-1-0-0	5	15	10	10	**40**

Total Mark distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	40	60	3 hrs

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	

SYLLABUS

MODULE I : Introduction to Data mining

Data mining Introduction. Data - Data mining Functionalities -Classification of Data mining systems - Issues in Data mining - Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity - Data Preprocessing.

MODULE II : Data Warehouse & OLAP

Introduction to Data Warehouse & OLAP - Data Warehousing - Multidimensional data models - data warehouse architectures - Implementation - Data Warehousing to Data mining- Data Cube Computation Methods - Data mining query languages - Architectures of data mining systems.

MODULE III : Association Rule Mining

Mining Frequent Patterns, Associations and Correlations - Mining Methods - Mining Various Kinds of Association Rules - Correlation Analysis - Pattern Mining in Multilevel, Multidimensional Space - Constraint-Based Frequent Pattern Mining - Semantic Annotation of Frequent Patterns

MODULE IV : Classification and Prediction

Basic Concepts - Decision Tree Induction - Bayesian Classification - Rule Based Classification - Classification by Back propagation - Support Vector Machines - Associative Classification-Lazy Learners - Other Classification Methods - Prediction.

MODULE V : Clustering

Cluster Analysis - Types of Data - Categorization of Major Clustering Methods - K-means Partitioning Methods - Hierarchical Methods - Density-Based Methods

	-Grid Based Methods - Model- Based Clustering Methods -Clustering High Dimensional Data - Constraint - Based Cluster Analysis -Outlier Analysis Data Mining Applications.	

Text books

Jiawei-Han - Micheline Kamber - Jian Pei - Data Mining - Concepts and Techniques 3rd Edition - Morgan Kaufmann - 2011.

Reference books

1. G.K. Gupta - Introduction to Data Mining with case Studies, PHI, New Delhi - 2006.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction To Data Mining", Person Education, 2007.
3. H.M. Dunham & S. Sridhar - Data Mining, Pearson Education, New Delhi, 2006.

COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. of Hours
MODULE 1		
1.1	Data mining Introduction	1
1.2	Data - Data mining Functionalities	1
1.3	Classification of Data mining systems,	1
1.4	Issues in Data mining -	1
1.5	Data Objects and Attribute Types,	1
1.6	Basic Statistical Descriptions of Data.	1
1.7	Data Visualization,	1
1.8	Measuring Data Similarity and Dissimilarity.	1
1.9	Data Preprocessing.	1
MODULE II		
2.1	Introduction to Data Warehouse & OLAP	1
2.2	Data Warehousing	1
2.3	Multidimensional data models	1
2.4	Data warehouse architectures -	1
2.5	Data warehouse architectures - Implementation	1
2.6	Data Warehousing to Data mining	1

2.7	Data Cube Computation Methods	1
2.8	Data mining query languages -	1
2.9	Architectures of data mining systems.	1
MODULE III		
3.1	**Association Rule Mining**	1
3.2	Mining Frequent Patterns,	1
3.3	Associations and Correlations -	1
3.4	Mining Methods.	1
3.5	Mining Various Kinds of Association Rules.	1
3.6	Correlation Analysis -	1
3.7	Pattern Mining in Multilevel, Multidimensional Space.	1
3.8	Multidimensional Space.	1
3.9	Constraint-Based Frequent Pattern Mining -	1
3.10	Semantic Annotation of Frequent Patterns.	1
MODULE IV		
4.1	Basic Concepts -	1
4.2	Decision Tree Induction -	1
4.3	Bayesian Classification -	1
4.4	Rule Based Classification	1
4.5	Classification by Back propagation -	1
4.6	Support Vector Machines -	1
4.7	Associative Classification	1
4.8	Lazy Learners	1
4.9	Other Classification Methods -	1
4.10	Prediction.	1
MODULE V		
5.1	Cluster Analysis - Types of Data -	1
5.2	Categorization of Major Clustering Methods -	1
5.3	K-means Partitioning Methods -	1

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5.4	Hierarchical Methods - Density-Based Methods -	1
5.5	Grid Based Methods -	1
5.6	Model Based Clustering Methods -	1
5.7	Clustering High Dimensional Data -	1
5.8	Constraint Based Cluster Analysis -	1
5.9	Outlier Analysis	1
5.10	Data Mining Applications.	1

CO Assessment Questions	
1	1. Explain with example where data mining is crucial to the success of a business. What data mining functionalities does this business need (e.g., think of the kinds of patterns that could be mined)? Can such patterns be generated alternatively by data query processing or simple statistical analysis? 2. Explain the major research challenges of data mining in one specific application domain, such as stream/sensor data analysis, spatiotemporal data analysis, or bioinformatics.
2	1. Briefly compare the following concepts. You may use an example to explain your point(s). (a) Snowflake schema, fact constellation, starnet query model (b) Data cleaning, data transformation, refresh (c) Discovery-driven cube, multifeature cube, virtual warehouse 2. Suppose that a data warehouse for Big University consists of the four dimensions student, course, semester, and instructor, and two measures count and avg grade. At the lowest conceptual level (e.g., for a given student, course, semester, and instructor combination), the avg grade measure stores the actual course grade of the student. At higher conceptual levels, avg grade stores the average grade for the given combination. Draw a snowflake schema diagram for the data warehouse
3	1. A database has five transactions. Let min sup = 60% and min conf = 80%. TID items bought T100 {M, O, N, K, E, Y} T200 {D, O, N, K, E, Y } T300 {M, A, K, E} T400 {M, U, C, K, Y} T500 {C, O, O, K, I, E} (a) Find all frequent itemsets using Apriori and FP-growth, respectively. Compare the efficiency of the two mining processes.

	(b) List all the strong association rules (with support s and confidence c) matching the following metarule, where X is a variable representing customers, and item$_i$ denotes variables representing items (e.g., "A," "B,"): $\forall x \in$ transaction, buys(X,item1) $\land$ buys(X,item2) $\Rightarrow$ buys(X,item3) [s,c]. 2. An itemset X is called a generator on a data set D if there does not exist a proper sub-itemset $Y \subset X$ such that support(X) = support(Y). A generator X is a frequent generator if support(X) passes the minimum support threshold. Let G be the set of all frequent generators on a data set D. (a) Can you determine whether an itemset A is frequent and the support of A, if it is frequent, using only G and the support counts of all frequent generators? If yes, present your algorithm. Otherwise, what other information is needed? Can you give an algorithm assuming the information needed is available? (b) What is the relationship between closed itemsets and generators?
4	1. Design an efficient method that performs effective na¨ıve Bayesian classification over an infinite data stream (i.e., you can scan the data stream only once). If we wanted to discover the evolution of such classification schemes (e.g., comparing the classification scheme at this moment with earlier schemes such as one from a week ago), what modified design would you suggest?
5	1. Suppose that the data mining task is to cluster points (with (x, y) representing location) into three clusters, where the points are A1(2,10),A2(2,5),A3(8,4),B1(5,8),B2(7,5),B3(6,4),C1(1,2),C2(4,9). The distance function is Euclidean distance. Suppose initially we assign A1, B1, and C1 as the center of each cluster, respectively. Use the k-means algorithm to show only (a) The three cluster centers after the first round of execution. (b) The final three clusters. 2. Both k-means and k-medoids algorithms can perform effective clustering. (a) Illustrate the strength and weakness of k-means in comparison with k-medoids. (b) Illustrate the strength and weakness of these schemes in comparison with a hierarchical clustering scheme (e.g., AGNES).

23MCAE246	IPR and Cyber Laws		L	T	P	J	S	C	Year of Introduction
			3	1			3	4	2023

Preamble: This course intends to provide insight into Intellectual Property Rights and Cyber Laws. It includes detailed discussion on various intellectual property rights, procedures to apply for copyrights &patents, legalities of intellectual property to avoid plagiarism and other IPR related crimes. Effectiveness of cyber-laws and other countermeasures against cybercrime and cyber warfare are discussed in detail. Various kinds of Intellectual Property issues in cyberspace and the growth and development of the law in this regard are included to the level possible within the scope of a single course. More detailed treatment can be done through seminars, assignments and talks by eminent external experts including industry.

Prerequisite: General awareness on internet essentials, web technologies, e-commerce.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain the fundamentals of IPR and patents.
CO 2	Apply intellectual property related tools such as trademark and copyright to real problems.
CO 3	Apply IPR tools such as Industrial designs, trade secret and geographic Indications to real life applications.
CO 4	Explain laws governing cyberspace and analyze the role of Internet Governance in framing policies for Internet security.
CO 5	Explain different types of cybercrimes and penalties under IT Act.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✔	✔				✔						
CO 2	✔	✔	✔	✔		✔						
CO 3	✔	✔	✔	✔		✔						
CO 4	✔	✔	✔			✔						
CO 5	✔	✔	✔			✔						

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✔	✔	✔	✔
Understand	✔	✔	✔	✔
Apply	✔	✔	✔	✔

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Analyse			✔	
Evaluate			✔	
Create			✔	

Mark Distribution of CIA

Course Structure [L-T-P-J]	Attendance	Theory [L- T]			Total Marks
		Assignment	Test-1	Test-2	
3-1-0-0	5	15	10	10	**40**

Total Mark distribution

Total Marks	CIA (Marks)	ESE (Marks)	ESE Duration
100	40	60	3 hrs

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	

SYLLABUS

MODULE I : Introduction

Fundamentals of IPR:-Introduction – Intellectual property – Need for protection of intellectual property – WIPO – Intellectual property rights and development – Rationale of protection – TRIPS Agreement - **Patents : –** Introduction **–** Patentable and Non-patentable Invention – Types of patent applications – Guidelines for registration of patent – patent filing – grant of patent – types of patent documents.

MODULE II : Trademarks and Copyright

Trademarks:– Introduction – Guidelines for registration- Requirements for filing trademarks – Trademark Infringement – Protection of trademarks – **Copyright –** Introduction – Rights conferred by copyright – registration – ownerships – terms – transfer of copyrights – copyright infringement – databases and copyright- **Software Copyright:**–Introduction – Need of software copyright – classification of software according to copyright – software auditing
–copyright notice – transfer of copyright.

MODULE III : Industrial Designs and GeographicIndications

Industrial Designs– Introduction – Need for protection of design –requirements for registration of designs – Design Act,2000 – Duration of registration of design – application procedure – **GeographicIndications –**Introduction **–** Filing – **Granting** – Protection of geographic indications**.**
Trade Secret – definition – discovering and protecting of trade secret.

MODULE IV : Cyber laws

Cyber law - Need for cyber laws - Historical perspective - cyberspace - deception by squatting in cyberspace - protection of copyright on cyberspace - infringement of copyright on cyberspace- linking, hyperlinking and framing - ISP in cyberspace – cyber space and protection of patents in India.

MODULE V : Information Technology Act and Punishments

Information Technology Act and Punishments- Introduction to IT Act 2000- Amendments on IT Act - Violation of the right of privacy in cyberspace/internet- punishment for violation of privacy, breach of confidentiality and privacy under IT act-Terrorism on cyberspace Overview of cybercrimes-offences by intermediaries- offences related to protected system- offences of misrepresentation- punishment for Abetment and Attempt to commit offences under the IT act.

Text books

1.Dr. R. Radhakrishnan and Dr. S. Balasubramanian, "**Intellectual Property Rights: Text and Cases**", Excel Books
2.Harish Chander, "**Cyber Law and IT Protection**", PHI Learning Pvt.Ltd.

Reference books

1. D.Bainbridge, "**Introduction to Computer Law**", Pearson Education
2. RohasNagpal, "**Cyber Crime & Corporate Liability**", CCH, 2008
3. https://www.udemy.com/course/cyber-security-law/
4. https://www.coursera.org/specializations/introduction-intellectual-property

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No.		No. of Hours 48
	COURSE CONTENTS AND LECTURE SCHEDULE	
	MODULE 1 Introduction	
1.1	Introduction – Intellectual property	1
1.2	Need forprotection of intellectual property	1
1.3	WIPO – Intellectual property rights and development	1
1.4	Rationale of protection – TRIPS Agreement	1
1.5	**Patents –** Introduction **–** Patentable and Non-patentable Invention	1
1.5	Types of patent applications	1
1.6	Guidelines for registration of patent – patent filing	1
1.7	Guidelines for registration of patent – patent filing (Conti…)	1
1.8	Grant of patent – types of patent documents	1
1.9	Grant of patent – types of patent documents (Conti…)	1
	MODULE II	
2.1	**Trademarks**– Introduction – Guidelines for registration	1
2.2	**Trademarks**– Introduction – Guidelines for registration (Conti…)	1
2.2	Requirements for filing trademarks	1
2.3	Trademark Infringement – Protection of trademarks	1
2.4	**Copyright –** Introduction – Rights conferred by copyright	1
2.5	Registration– ownerships – terms- transfer of copyrights	1
2.6	Copyright infringement –databases and copyright	1
2.7	**Software Copyright**– Introduction – Need of software copyright – classification of software according to copyright	1

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2.8	**Software Copyright**– Introduction – Need of software copyright – classification of software according to copyright (Conti…)	1
2.9	Software auditing – copyright notice – transfer of copyright.	1
MODULE III		
3.1	**Industrial Designs**– Introduction – Need for protection of design	1
3.2	**Industrial Designs**– Introduction – Need for protection of design (Conti…)	1
3.3	Requirements for registration of designs – Design Act,2000 – Duration of registration of design – application procedure	1
3.4	Requirements for registration of designs – Design Act,2000 – Duration of registration of design – application procedure (Conti…)	1
3.5	**Geographic Indications** – Introduction – Filing -Examples	1
3.6	**Geographic Indications** – Introduction – Filing –Examples (Conti…)	1
3.7	**Granting** – Protection of geographic indications.	1
3.8	**Granting** – Protection of geographic indications. (Conti…)	1
3.9	**Trade Secret –** definition – discovering and protecting of trade secret-Examples	1
3.10	**Trade Secret –** definition – discovering and protecting of trade secret-Examples (Conti…)	1
MODULE IV		
4.1	**Cyber law** - Need for cyber laws - Historical perspective	1
4.2	Cyberspace -deception by squatting in cyberspace.	1
4.3	Cyberspace -deception by squatting in cyberspace. (Conti…)	1
4.3	Protection of copyright on cyberspace	1
4.4	Infringement of copyright on cyberspace - linking, hyper linking and framing	1
	Infringement of copyright on cyberspace - linking, hyper linking and framing (Conti…)	1
4.5	ISP in cyberspace - cyberspace and protection of patents in India.	1
	ISP in cyberspace - cyberspace and protection of patents in India (Conti…)	1

	MODULE V	
5.1	**Information Technology Act and Punishments**- Introduction to ITAct2000- Amendments on IT Act	1
5.2	Introduction to ITAct2000- Amendments on IT Act (Conti...)	1
5.3	Violation of the right of privacy in cyberspace/internet	1
	Violation of the right of privacy in cyberspace/internet	1
5.4	Punishment for violation of privacy, breach of confidentiality and privacy under IT act-Terrorism on cyberspace overview of cybercrimes	1
5.5	Punishment for violation of privacy, breach of confidentiality and privacy under IT act-Terrorism on cyberspace overview of cybercrimes (Conti...)	1
5.6	Offences by intermediaries- offences related to protected system- offences of misrepresentation	1
5.7	Offences by intermediaries- offences related to protected system- offences of misrepresentation (Conti...)	1
5.8	Punishment for Abetment and Attempt to commit offences under the IT act.	1
5.9	Punishment for Abetment and Attempt to commit offences under the IT act. (Conti...)	1

CO Assessment Questions	
CO1	
1	Discuss the need for protection of intellectual property.
2	Explain TRIPS Agreement.
3	Illustrate types of patent applications.
4	IFB develps a technology to improve the cleanliness of washing. Which intellectual property they use to prevent others from imitating their technology. Justify.
5	All IP rights are territorial in nature. Explain
CO2	

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6	Explain Trademark Infringement and Protection of trademarks.
7	Explain the rights conferred by copyright, registration and ownerships of copyrights.
8	Discuss about software copyright.
9	Anu creates a painting and she wants to protect it from copying. Which type of IP she can use? Justify.
CO3	
10	Discuss the need for protection of design and explain Design Act, 2000.
11	Explain basic concepts of Geographic Indications such as filing, granting and Protection of geographic indications.
12	Describe the procedure of discovering and protecting of trade secret.
13	A company has decided to invest in outer shape design of bottle in which they would fill the perfume produced by them, and which is distinctive, and they wish to ensure that they have sole use. How they can ensure this?
CO4	
14	Explain the need for cyber laws.
15	Discuss protection of copyright on cyberspace.
16	Explain ISP in cyberspace.
CO5	
17	Explain different amendments on IT Act 2000.
18	Discuss Terrorism on cyberspace.
19	Explain offences of misrepresentation.

23MCAE248	Cyber Forensics	L	T	P	J	S	C	Year of Introduction
		3	1		3		4	2023

Preamble: This course helps the learner to understand the fundamentals of cyber forensics. Student will learn common approaches, practices and techniques used for collecting and preserving digital evidences in this course.

Prerequisite: Basic knowledge in operating systems & computer networks.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain a computer crime and the concept of rules or policy violations.
CO 2	Gather evidences and preserve the collected evidence with the required knowledge on various storage format choices.
CO 3	Describe digital storage and file systems and extract data using Autopsy.
CO 4	Explain mobile device forensics and practice data acquisition procedures for network forensics using Wireshark.
CO 5	Prepare forensics reports both using tools and manually and explain ethics and code for expert witness.

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	✓	✓		✓		✓	✓		✓			
CO 2	✓	✓		✓	✓		✓					
CO 3	✓	✓		✓	✓		✓					
CO 4	✓	✓		✓	✓		✓					
CO 5	✓	✓		✓	✓	✓	✓		✓			

Assessment Pattern

Bloom's Category	Continuous Assessment Tools			End Semester Examination
	Test1	Test 2	Other tools	
Remember	✓	✓	✓	✓
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓
Analyse			✓	

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| Evaluate | | | ✔ | |
| Create | | | ✔ | |

| **Mark Distribution of CIA** | | | | | |

Course Structure [L-T-P-J]	**Attendance**	**Theory [L- T]**			**Total Marks**
		Assignment	**Test-1**	**Test-2**	
3-1-0-0	5	15	10	10	**40**

| **Total Mark distribution** | | | |

Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	40	60	3 hrs

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	

| **SYLLABUS** | |

MODULE I : Introduction

Overview of computer crime, Overview of company policy violation, Preparing a case - Planning an investigation, Securing evidence. Industrial espionage investigation.

Conducting an investigation: Gathering evidence, Bit-stream copy of evidence.

Storage formats for storing collected digital evidence - Raw format, Proprietary formats, Advanced Forensic Format (AFF). Acquisition tools and methods. Digital evidence

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validation methods and tools.

Storing Digital evidence- Evidence Retention.

Familiarizing Autopsy for Windows - a free forensics tool.

MODULE II : Digital data and storage systems

Understanding Digital data and storage systems: Understanding boot sequence, Understanding Disk Drives - Solid-state Storage Devices (SSDs).

Microsoft File Systems - Disk partitions, Understanding FAT, Understanding NTFS, MFT - file attributes, file data, NTFS compressed files, NTFS encrypted file system, Deleting NTFS file system, ReFS.

Whole disk encryption, Microsoft BitLocker. Understanding Windows Registry. Microsoft Windows startup tasks.

A practical assignment may be given in encrypting a partition of your computer hard diskdrive/ encrypting USB flash drive to avoid firm-level attack.

MODULE III : Data acquisition and validation

Linux file structures - File structures in Ext4, Hard links and Symbolic links. Macintosh (MacOS) file structures - Forensic procedures in MacOS.

Setting up Sleuth Kit and Autopsy - Examining a case with Sleuth Kit and Autopsy, Importance of Write-blocker.

Acquiring data with a Linux boot CD - Preparing a target drive for data acquisition, Using dd and dcfldd commands.

Validating data acquisitions - Linux validation methods, Windows validation methods. Following practical assignments may be given:

   i.   *Recover deleted files from pen drive*
   ii. *Extract camera information from recovered images*
   iii. *Extract deleted internet browsing history*
Recover deleted files from unallocated space using Autopsy

MODULE IV : Mobile Device Forensics

Understanding Mobile Device forensics - Mobile phone basics, Understanding Mobile phone hardware.

Acquisition procedures for Mobile devices, Mobile Forensic equipment, SIM card readers, Mobile phone Forensics tools and methods.

Network Forensics - The Need for Established Procedures, Securing a Network, Developing Procedures for Network Forensics, Wireshark packet analyser.

Practical assignments may be given:

i.	*Identify students who use college lab facility to browse shopping websites*	
ii.	*Identify the hacking attempt on a closed port using ping sweep*	
	Using Wireshark retrieve the username and password of users who browse less secure website with Wi- Fi connection	

MODULE V : Forensics Report and Ethics

Understand the importance of Forensics Reports, Types of reports, Guidelines for writing reports, Layout and presentation of reports, Generating reports with Autopsy.

Ethics and codes for Expert Witness - Forensics Examiner's role in testifying, Considerationsin disqualification, Determining admissibility of evidence. Ethical difficulties in Expert Testimony, Ethical responsibilities.

Text books

1. Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics andInvestigations", Cengage Learning, 6th Edition.

Reference books

1. Marjie T. Britz, "Computer Forensics and Cyber Crime", Pearson Third Edition 2013.

2. Marie - Helen Maras "Computer Forensics: Cybercriminals, Laws, and Evidence",
   Jones & Bartlett Learning, Second Edition 2015.

3. https://www.wireshark.org/download/docs/user-guide.pdf (Reference for Wireshark)

4. http://www.open.edu/openlearn/futurelearn/cyber-security

COURSE CONTENTS AND LECTURE SCHEDULE		
No.		No. of Hours 48
MODULE 1 Introduction		
1		**10 Hours**
1.1	An overview of computer crimes and company policy violations	1
1.2	Preparing a case - Planning an investigation, Securing evidence.	1
1.2	Industrial espionage investigation	1
	Conducting an investigation: Gathering evidence, Bit-stream copy ofevidence	

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1.3		1
1.4	Storage formats for storing collected digital evidence - Raw format, Proprietary formats, Advanced Forensic Format (AFF)	1
1.5	Acquisition tools and methods	1
1.6	Digital evidence validation methods and tools	1
1.7	Storing Digital evidence -Evidence Retention	1
1.8	Familiarizing Autopsy for Windows - a free forensics tool	1
1.9	Familiarizing Autopsy for Windows - a free forensics tool (Conti...)	1
MODULE II Digital data and storage systems		
2		**10 Hours**
2.1	Understanding Digital data and storage systems, Understanding boot sequence	1
2.2	Understanding Disk Drives	1
2.3	Solid-state Storage Devices (SSDs)	1
2.4	Microsoft File Systems - Disk partitions	1
2.5	Understanding FAT	1
2.6	Understanding NTFS, MFT - file attributes, file data	1
2.7	NTFS compressed files, NTFS encrypted file system	1
2.8	Deleting NTFS file system, ReFS	1
2.9	Whole disk encryption, Microsoft BitLocker	1
2.10	Understanding Windows Registry, Microsoft Windows startup tasks	1
MODULE III Data acquisition and validation		
3		**10 Hours**

3.1	Linux file structures - File structures in Ext4	1
3.2	Hard links and Symbolic links	1
3.3	Macintosh (MacOS) file structures - Forensic procedures in MacOS	1
3.4	Setting up Sleuth Kit and Autopsy - Examining a case with Sleuth Kit and Autopsy	1
3.5	Importance of Write-blocker	1
3.6	Acquiring data with a Linux boot CD	1
3.7	Preparing a target drive for data acquisition	1
3.8	Using dd and dcfldd commands	1
3.9	Validating data acquisitions - Linux validation methods	1
3.10	Windows validation methods	1
MODULE IV Mobile Device Forensics		
4		**10 Hours**
4.1	Understanding Mobile Device forensics - Mobile phone basics	1
4.2	Understanding Mobile phone hardware	1
4.3	Acquisition procedures for Mobile devices	1
4.4	Mobile Forensic equipment	1
4.5	SIM card readers	1
4.6	Mobile phone Forensics tools and methods	1
4.7	Network Forensics - The Need for Established Procedures	1
4.8	Securing a Network	1
4.9	Developing Procedures for Network Forensics	1
4.10	Wireshark packet analyzer	1

MODULE V Forensics Report and Ethics		
5		**8 Hours**
5.1	Understand the importance of Forensics Reports, Types of reports	1
5.2	Understand the importance of Forensics Reports, Types of reports (Conti...)	1
5.2	Guidelines for writing reports, Layout and presentation of reports	1
5.3	Generating reports with Autopsy	1
5.4	Ethics and codes for Expert Witness - Forensics Examiner's role in testifying	1
5.5	Considerations in disqualification, Determining admissibility of evidence	1
5.6	Ethical difficulties in Expert Testimony	1
5.7	Ethical responsibilities	1

CO Assessment Questions	
CO1	
1	Explain how to perform industrial espionage investigation?
2	Identify real-time scenarios that is considered as company policy violation.
3	Explain the various steps involved in cyber forensics investigation.
CO2	
4	List and explain the advantages of proprietary evidence format over row format?

5	Differentiate static acquisitions from live acquisitions.
6	Explain how to ensure the integrity of collected digital evidence? List the techniques employed to validate the collected evidence.
CO3	
7	Describe the various activities involved while starting a windows operating system.
8	Explain how to ensure the integrity of collected evidences?
9	Explain the various file system organization used in windows operating system.
10	Differentiate the forensics procedure in Linux and MacOS.
11	Explain the importance of windows registry analysis in forensic investigation?
CO4	
12	Explain the mobile forensics procedure in detail.
13	Explain the forensics acquisition method in mobile differs from that in computer system?
14	Illustrate the use of Wireshark packet analyser.
CO5	
15	Explain how to write an investigation report that can sustain in court of law?
16	Address the difficulties that occurred while preparing an Expert Testimony.
17	Discuss how Autopsy tool is used to generate forensics report.

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23MCAE250	**Mobile Communication**	**L**	**T**	**P**	**J**	**S**	**C**	**Year of Introductio n**
		3	**1**			**2**		**2023**

Preamble: The basic principle of mobile computing is transfer of voice, data, images, videos, files, or web pages and transfer of data for transactions, such as e-payment or e-commerce transactions between two or more terminal devices out of which at least one using the wireless is mobile and without deploying any guided physical medium consisting of wire or fibers. This course covers the technical aspects of mobile computing environment and recent technical advancements in this area. This course gives an insight to how mobile devices communicate.

Prerequisite: Computer networks.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand communication technologies and telecommunication systems.(Understand Level)
CO 2	Understand and learn the concepts of Mobile Communication Architecture. .(Understand Level)
CO 3	Understand and learn Second-generation mobile Architecture. (Understand Level)
CO 4	Understand Wireless Medium Access Control, CDMA, 3G, WiMax, 4G and 5G Networks. (Understand Level)
CO 5	Understand Mobile IP Network Layer & Transport Layer (Understand Level).

CO - PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO1 1	PO1 2
CO 1	✔				✔	✔	✔		✔			
CO 2	✔				✔	✔			✔			
CO 3	✔	✔			✔	✔	✔		✔			
CO 4	✔	✔				✔			✔			
CO 5	✔	✔			✔	✔			✔			

Assessment Pattern

Bloom's Category	**Continuous Assessment Tools**			**End Semester Examination**
	Test1	**Test 2**	**Other tools**	

Remember	✔	✔	✔	✔
Understand	✔	✔	✔	✔
Apply	✔	✔	✔	✔
Analyse				
Evaluate				
Create				

Mark Distribution of CIA					
Course Structure [3-1-0-0]	Attendance	Theory [3- 1]			Total Marks
		Assignment	**Test-1**	**Test-2**	
	5	15	10	10	**40**

Total Mark distribution			
Total Marks	**CIA (Marks)**	**ESE (Marks)**	**ESE Duration**
100	40	60	3 hrs

End Semester Examination [ESE]: Pattern

PATTERN	PART A	PART B	ESE Marks
PATTERN 1	10 Questions, each question carries 2 marks Marks: (2x10 =20 marks)	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. Marks: (5x8 = 40 marks) Time: 3 hours	60
	Total Marks: 20	Total Marks: [5x8 = 40 marks]	

SYLLABUS
MODULE I: Mobile Communication: An Overview
Mobile Communication - Frequencies for Signal Propagation - Propagation of Signals - Modulation - Multiplexing (SDMA, TDMA, FDMA, and CDMA) and Examples - Circuit and Packet Switching Networks - Global System for Mobile Communication (GSM) - Mobile Voice and Data Communication Standards—Enhanced Data Rates for GSM Evolution, GPRS, and 2.5G – New-generation Mobile Communication Standards: 3G Networks - 4G—LTE Advanced and WiMax 802.16m Features
MODULE II: Mobile Computing Architecture: An Overview
Mobile IP, Cellular and WLAN Wi-Fi IEEE 802.11X Networks - Ad Hoc Networks - Wireless Personal Area Network - Mobile Enterprise Network - Mobile Cloud Network - Mobile Computing - Mobile Computing Operating System - Mobile Computing Architecture - Client–Server Computing using Mobile - WAP and HTTP Protocols - Design Considerations for Mobile Computing - Mobile Computing and the Apps - Limitations of Mobile Devices - Security Issues
MODULE III: Second-generation Architecture—GSM, GPRS, and Others
GSM Services - GSM System Architecture - Space Division Multiple Access, Time Division Multiple Access, and Frequency Division Multiple Access - Call Routing - Public Land Mobile Network (PLMN) Interface - GSM Subscriber Addresses and Identities - Protocols - Call Handling – Handover. General Packet Radio Service - High-speed Circuit-switched Data - Digital Enhanced Cordless Telecommunications.
MODULE IV: Wireless Medium Access Control, CDMA, 3G, WiMax, 4G and 5G Networks
Medium Access Control - Exposed and Hidden Terminal Problem, Near and Far Terminal Problem, and Power Control for Medium Access - WLAN and CSMA/CA Wireless Protocols - SDMA, TDMA, FDMA and CDMA - Code Division Multiple Access - Applications of 3G Mobile Services - 3G Mobile Services: IMT2000 and UMTs - CDMA 2000: 3G - WCDMA 3G - OFDM - High-speed Packet Access - Long-term Evolution and WiMax 16E - Ultra-wide Band and Broadband Wireless Access - 4G Networks: HS-OFDM, LTE Advanced and WiMax 16M - Upcoming 5G Network Features
MODULE V: Mobile IP Network Layer & Transport Layer

Functioning of OSI Layers, and TCP/IP, IP, UDP and ICMP Protocols - Mobile IP - Packet Delivery and Handover Management - Location Management - Registration - IP Header: Encapsulation and Routes Optimization - Mobility Binding, Tunneling, and Reverse Tunneling - Dynamic Host Configuration Protocol - Cellular IP - Mobile IP with IPv6 - Voice over IP.

Conventional Transport Layer Protocols: UDP and TCP - Indirect TCP - Snooping Transmission Control Protocol - Mobile TCP - Other Transmission Methods at TCP Layer for Mobile Networks - TCP over 2.5G/3G Mobile Networks

Text books

1. RAJ KAMAL, "Mobile Computing "Third Edition, Oxford University Press (2018)

Reference books

1. Iti Saha Misra, "Wireless Communication and Networks – 3G and Beyond", Mc Graw Hill Education, Second Edition, 2013.
2. Jochen Schiller, "Mobile Communications", Pearson Education, Second Edition, 2012.
3. Andreas F.Molisch "Wireless Communications", Wiley, Second Edition, 2014.
4. E.Dahlman et. al. "3G Evolution: HSPA and LTE for Mobile Broadband", Elsevier, Second Edition, 2008.
5. G.Sasibhushana Rao, "Mobile Cellular Communication", Pearson, 2013.

COURSE CONTENTS AND LECTURE SCHEDULE

No.		No. of Hours
	MODULE 1	
1.1	Mobile Communication - Frequencies for Signal	1
1.2	Propagation - Propagation of Signals - Modulation -	1
1.3	Multiplexing (SDMA, TDMA, FDMA, and CDMA) and Examples - Circuit and Packet Switching Networks - Global	1
1.4	System for Mobile Communication (GSM) -	1
1.5	Mobile Voice and Data Communication Standards—	1
1.6	Enhanced Data Rates for GSM Evolution,	1
1.7	GPRS, and 2.5G –	1
1.8	New-generation Mobile Communication Standards: 3G Networks -	1
1.9	4G—LTE Advanced and WiMax 802.16m Features	

	MODULE II	
2.1	Mobile IP, Cellular and WLAN Wi-Fi IEEE 802.11X Networks	1
2.2	Ad Hoc Networks - Wireless Personal Area Network -	1
2.3	Mobile Enterprise Network - Mobile Cloud Network -	1
2.4	Mobile Computing - Mobile Computing Operating System -	1
2.5	Mobile Computing Architecture -	1
2.6	Client–Server Computing using Mobile -	
2.7	WAP and HTTP Protocols	1
2.8	Design Considerations for Mobile Computing - Mobile Computing and the Apps	1
2.9	Limitations of Mobile Devices - Security Issues	1
	MODULE III	
3.1	GSM Services - GSM System Architecture -	1
3.2	Space Division Multiple Access,	1
3.3	Time Division Multiple Access, and Frequency Division Multiple Access -	1
3.4	Call Routing - Public Land Mobile Network (PLMN) Interface	1
3.5	GSM Subscriber Addresses and Identities -	1
3.6	Protocols -	
3.7	Call Handling – Handover.	1
3.8	General Packet Radio Service -	1
3.9	High-speed Circuit-switched Data	
3.10	Digital Enhanced Cordless Telecommunications.	1
	MODULE IV	
4.1	Medium Access Control -	1
4.2	Exposed and Hidden Terminal Problem,	1
4.3	Near and Far Terminal Problem, and Power Control for Medium Access -	1

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4.4	Android Application Components – Android Software Stack Structure	1
4.5	WLAN and CSMA/CA Wireless Protocols - SDMA, TDMA, FDMA and CDMA -	1
4.6	Code Division Multiple Access - Applications of 3G Mobile Services -	1
4.7	3G Mobile Services: IMT2000 and UMTs - CDMA 2000: 3G - WCDMA 3G - OFDM -	1
4.8	High-speed Packet Access - Long-term Evolution and WiMax 16E -	1
4.9	Ultra-wide Band and Broadband Wireless Access - 4G Networks: HS-OFDM, LTE Advanced and WiMax 16M -	1
4.10	Upcoming 5G Network Features	1
MODULE V		
5.1	Functioning of OSI Layers, and TCP/IP, IP, UDP and ICMP Protocols -	1
5.2	Mobile IP - Packet Delivery and Handover Management - Location Management - Registration -	1
5.3	IP Header: Encapsulation and Routes Optimization -	1
5.4	Mobility Binding, Tunneling, and Reverse Tunneling -	1
5.5	Dynamic Host Configuration Protocol - Cellular IP -	1
5.6	Mobile IP with IPv6 - Voice over IP.	1
5.7	Conventional Transport Layer Protocols: UDP and TCP -	1
5.8	Indirect TCP - Snooping Transmission Control Protocol -	1
5.9	Mobile TCP - Other Transmission Methods at TCP Layer for	1
5.10	Mobile Networks - TCP over 2.5G/3G Mobile Networks	1

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	CO Assessment Questions
1	1. A signal s(t) = a1 sin(2p × f × t) + 0.5 a1 sin(2p × × f × t) + 0.25 a1 sin(2p × 5 × f × t). Show the frequency spectrum of the signal. If signal is amplitude modulated with a signal s(t) = +0.5 a1 sin(2p × 2000 × t), what will be the new frequency spectrum? 2. Assume that a 24-symbol code (111000011110000111100001) is used with chipping frequencies of 900.000, 900.020, 900.040, …, MHz. (a) What will be the bandwidth used in CDMA transmission of the signal? (b) Assume that the symbols are transmitted after 8-PSK modulation. What will be the new carrier signal bandwidth? What will be the phase angles and amplitudes of the resulting signal? (c) Assume that the symbols are transmitted after QAM modulation. What will be the new carrier signal bandwidth? What will be the phase angles and amplitudes of the resulting signal? (d) Assume that the four sub-carriers are used for transmission. What will be the frequencies in the frequency spectrum of the transmitted signal?
2	1. Develop a client server application using mobile and communicate. 2. Write a role play script to differentiate Ad Hoc Networks & Wireless Personal Area Network
3	1. Compare GSM and GRPS with an analogy. 2. Mimic Call Handling and handover from one BS to another.
4	1. Demonstrate using role play the Exposed and Hidden Terminal Problem. 2. Case study on the evolution of Wireless networks.
5	1. Implement a DHCP server in the lab and assign IPs for the systems connected to it.