NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS

CURRICULUM STRUCTURE

and

DETAILED SYLLABI

(R24)

of

MCA

(Master of Computer Applications)

Applicable for the Batches Admitted from 2024-25)

Affiliated to JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
ACADEMIC REGULATIONS R24 FOR M.C.A. (REGULAR) DEGREE COURSE

Applicable for the students of M.C.A. Course from the Academic Year 2024-25 onwards. The M.C.A. Degree of Narasaraopeta Engineering College (Autonomous) affiliated to Jawaharlal Nehru Technological University Kakinada shall be conferred on candidates who are admitted to the program and who fulfil all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS

Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by the University from time to time.
Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test (AP ICET) conducted by the University/APSCHE or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt. from time to time.

2.0 AWARD OF M.C.A. DEGREE

2.1 A student shall be declared eligible for the award of the M.C.A... Degree, if he pursues a course of study in not less than two and not more than four academic years.
2.2 The student shall register for all 80 credits and secure all the 80 credits.
2.3 The minimum instruction days in each semester are 90.

3.0 MCA SUBJECT CATOGORY

Different types of Subject categories are noted below:

Code	Subject Category
PC	PROFESSIONAL CORE
PE	PROFESSINAL ELECTIVE
BH	BASIC SCIENCES AND HUMANITIES
NC	NON-CREDIT COURSE
PW	PROJECT WORK
MO	MOOC COURSE (ONLINE COURSE)
IN	INTERNSHIP

4.0 ATTENDANCE

4.1 A student shall be eligible to write end semester examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects/courses, and with minimum 50% in each and every course including practicals.
4.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester shall be granted by the College Committee.

4.3 Shortage of Attendance **below** 65% in aggregate shall not be condoned and not eligible to write their end semester examination of that class.

4.4 A prescribed fee shall be payable towards Condonation of shortage of attendance.

4.5 A student shall not be promoted to the next semester unless, he satisfies the attendance requirement of the present semester, as applicable. They may seek re-admission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for re-admission into the same class.

5.0 EVALUATION

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practical, on the basis of Internal Evaluation and End Semester Examination.

5.1 For the theory subjects **60 marks** shall be awarded based on the performance in the End Semester Examination and **40 marks** shall be awarded based on the Internal Evaluation. The internal evaluation shall be made based on the **weighted average (80% best + 20% of least)** of the marks secured in the two Mid Term-Examinations conducted-one in the middle of the Semester and the other immediately after the completion of instruction. Each mid- term examination shall be conducted for a total duration of 120 minutes with 4 questions (without choice) each question for 10 marks. Two questions from first units and 3rd question from 2.0 to 2.5 unit and 4th question may be from any of the first 2 units. End semester examination is conducted for **60 marks.** Five questions (one question from each unit) to be answered (either or).

5.2 For practical subjects, **60 marks** shall be awarded based on the performance in the End Semester Examinations and **40 marks** shall be awarded based on the day-to-day performance as Internal Marks. The internal evaluation based on the day to day work-10 marks, record- 10 marks and the remaining 20 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the examiners, with a breakup marks of Procedure-20, Experimentation-20, Results-10, Viva-voce-10.

5.3 For Mini Project with Seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, supervisor/mentor and two other senior faculty members of the department. For Mini Project with Seminar, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

5.4 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of **40% of marks** in the End semester Examination and a minimum aggregate of **50% of the total marks** in the End Semester Examination and Internal Evaluation taken together. In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.4) he has to re-appear for the End semester Examination in that subject. A candidate shall be given **one** chance to re-register for each subject provided the internal marks secured by a candidate **are less than 50% and has failed in the end examination.** In such a case, the candidate must re-register for the subject(s) and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon his eligibility for writing the end examination in those subject(s). In the event of the student taking another chance, his internal marks and end examination marks obtained in the previous attempt shall stands cancelled. For re- registration the candidates have to apply by paying the requisite fees and get approval from the Principal before the start of the semester in which re- registration is required.

5.5 In case the candidate secures less than the required attendance in any re-registered subject(s), he shall not be permitted to write the End Examination in that subject. He shall again re-register the subject when next offered.

5.6 Laboratory examination for M.C.A. courses must be conducted with two Examiners, one of them being the Laboratory Class Teacher and the second examiner shall be external from the other reputed institutions.

6.0 EVALUATION OF PROJECT/DISSERTATION WORK

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

6.1 A Project Review Committee (PRC) shall be constituted with Head of the Department and two other senior faculty members in the department.

6.2 Registration of Dissertation/Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects, both theory and practical.

6.3 After satisfying 6.2, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work for approval. The student can initiate the Project work, only after obtaining the approval from the Project Review Committee (PRC).

6.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the Project Review Committee (PRC). However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

6.5 Continuous assessment of Project Work will be monitored by the PRC.

6.6 A candidate shall submit his status report in two stages to the PRC, at least with a gap of 3 months between them.

6.7 A candidate is permitted to submit Project Thesis only after the approval of PRC.

6.8 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College.

6.9 The thesis shall be adjudicated by one examiner selected by the Principal. For this, the HOD shall submit a panel of 3 examiners, eminent in that field, with the help of the guide concerned.

6.10 If the report of the examiner is not favorable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected. The candidate has to re- register for the project and complete the project within the stipulated time after taking the approval from the Principal.

6.11 The Head of the Department shall coordinate and make arrangements for the conduct of Viva-Voce examination.

6.12 If the report of the examiner is favorable, Viva - Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the Examiner who adjudicated the Thesis. The Board shall jointly report the candidate's work for a maximum of 200 marks.

6.13 If the report of the Viva -Voce is unsatisfactory (i.e., <50 % of marks), the candidate shall retake the Viva-Voce examination, only after three months. If he fails to get a satisfactory report at the second Viva-Voce examination, the candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the Principal.

7.0 Cumulative Grade Point Average (CGPA)

Marks Range Theory/ Laboratory (Max – 100)	**Marks Range Mini Project/ Project Work or Dissertation (Max – 100)**	**Letter Grade**	**Level**	**Grade Point**
≥ 90	≥ 90	A	Excellent	10
≥80 to <90	≥80 to <90	B	Very Good	9
≥70 to <80	≥70 to <80	C	Good	8
≥60 to <70	≥60 to <70	D	Fair	7
≥50 to <60	≥50 to <60	E	Satisfactory	6
<50	<50	F	Fail	0
		AB	Absent	0

Computation of SGPA

- The following procedure is to be adopted to compute the Semester Grade Point Average(SGPA) and Cumulative Grade Point Average(CGPA):
- The **SGPA** is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e
- SGPA (Si) = $\sum$ (Ci X Gi) / $\sum$ Ci
- Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Computation of CGPA

- The **CGPA** is also calculated in the same manner taking into account all the courses undergone by a student over all the semester of a Programme, i.e.
- CGPA = $\sum$ (Ci X Si) / $\sum$ Ci
- Where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.
- The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
- Equivalent Percentage = (CGPA – 0.75) x 10

8.0 AWARD OF DEGREE AND CLASS

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M.C.A. Degree he shall be placed in one of the following four classes:

Class Awarded	**CGPA to be secured**	
First Class with Distinction	≥ 7.75 (Without any supplementary appearance)	**From the CGPA secured from 80 Credits.**
First Class	≥ 6.75	
Second Class	≥ 6.0 to < 6.75	

The Grades secured, Grade points and Credits obtained will be shown separately in the memorandum of marks.

9.0 WITHHOLDING OF RESULTS

If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

10.0 TRANSITORY REGULATIONS (for R24)

10.1 Discontinued or detained candidates are eligible for readmission (within the duration as mentioned in item 2.1) as and when next offered.

10.2 The readmitted students will be governed by the regulations under which the candidate has been admitted.

11.0 GENERAL

11.1 Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

11.2 The academic regulation should be read as a whole for the purpose of any interpretation.

11.3 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

11.4 The College may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the College.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.

2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant –	In case of students of the college, they shall be expelled from examination halls and

	Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer- in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
   (i) A show cause notice shall be issued to the college.
   (ii) Impose a suitable fine on the college.
   (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year

I SEMESTER

S.No	Course Code	Course Name	Category	L	T	P	Credits
1	R24MCA101	Data Structures	PC	3	0	0	3
2	R24MCA102	Computer Organization	PC	3	0	0	3
3	R24MCA103	Database Management Systems	PC	3	0	0	3
4	R24MCA104	Operating Systems	PC	3	0	0	3
5	R24MCA105	Mathematical and Statistical Foundations	BS&H	3	1	0	4
6	R24MCA1L1	Database Management Systems Lab	PC	0	0	3	1.5
7	R24MCA1L2	Data Structures using C Lab	PC	0	0	4	2
8	R24MCA1L3	Operating Systems and Linux Lab	PC	0	0	3	1.5
			Total	15	1	10	21

II SEMESTER

S.No	Course Code	Course Name	Category	L	T	P	Credits
1	R24MCA201	Computer Networks	PC	3	0	0	3
2	R24MCA202	Network Security and Cyber Security	PC	3	0	0	3
3	R24MCA203	Object Oriented Programming Using JAVA	PC	3	0	0	3
4	R24MCA204	Software Engineering	PC	3	0	0	3
5	R24MCA205	Artificial Intelligence	PC	3	0	0	3
6	**Program Elective-1**						
	R24MCA206	1. Design and Analysis of Algorithms	PC/ PE	3	0	0	3
	R24MCA207	2. Advanced Unix Programming					
	R24MCA208	3. Data Warehousing and Data Mining					
	R24MCA209	4. Web Technologies					
	R24MCA2MC	5. MOOCS-1(NPTEL/SWAYAM) (Recommended 12 week course with 3 credits)					
7	R24MCA2L1	Object Oriented Programming Using JAVA Lab	PC	0	0	3	1.5
8	R24MCA2L2	Networks and Security Lab	PC	0	0	3	1.5
9	R24MCA2MNC	Employability Skills-1[$]	AC	1	0	0	0
			Total	19	0	6	21

*This may be conducted in Zero Hour.
[$]Internal Evaluation

III SEMESTER

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S.No	Course Code	Course Name	Category	L	T	P	C
1	R24MCA301	Machine Learning using Python	PC	3	0	0	3
2	R24MCA302	Full Stack Development	PC	3	0	0	3
3	R24MCA303	Big Data Technologies	PC	3	0	0	3
4	**Program Elective-2**						
	R24MCA304	Cloud Computing	PE	3	0	0	3
	R24MCA305	Image Processing					
	R24MCA306	Internet of Things					
	R24MCA307	DevOps					
	R24MCA3MC	MOOCS-2(NPTEL/SWAYAM) (Recommended 12 week course with 3 credits)					
5	R24MCA308	Human Resource Management	BS&H	3	0	0	3
6	R24MCA3L1	Full Stack Development Lab	PC	0	0	3	1.5
7	R24MCA3L2	Machine Learning with Python Lab	PC	0	0	4	2
8	R24MCA3L3	Big Data Technologies Lab	PC	0	0	3	1.5
9	R24MCA3MNC	Employability Skills–2[$]	AC	1	0	0	0
10	R24MCA3IN	Internship/Industry Oriented Mini Project#	MC	0	0	0	2
			Total				22

[$]Internal Evaluation

#This can be done during *semester break* and evaluated at the end of 3rd Sem.

IV Semester

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S.No	Course Code	Course Name	Category	L	T	P	C
	Program Elective-3						
1	R24MCA401	Unified Modeling Language	PE	3	0	0	3
	R24MCA402	Blockchain Technologies					
	R24MCA403	Advanced UNIX Programming					
	R24MCA404	Data Science Applications					
	R24MCA4MC1	MOOCs-3 NPTEL/SWAYAM) Recommended 12 week course with 3 credits					
	Program Elective-4						
2	R24MCA405	Mobile Adhoc Networks	PE	3	0	0	3
	R24MCA406	Quantum Computing					
	R24MCA407	Agile Methodologies					
	R24MCA408	E-Commerce					
	R24MCA4MC2	MOOCs-4 (NPTEL/SWAYAM) Recommended 12 week course with 3 credits					
3	R24MCA4PW	Project Work/Dissertation		0	0	0	10
			Total	6	0	0	16

***Students going for Industrial Project/ Thesis will complete these courses through MOOCs (or even in earlier semester)**

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I MCA I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA101	3	0	0	40	60	100	3
DATA STRUCTURES							

Course Objectives:

The objective of this course is to explore basic data structures such as stacks and queues, introduce a variety of data structures such as hash tables, search trees, tries, heaps, graphs, sorting and pattern matching algorithms

Course Outcomes:

After completion of the course, the students would be able to:

CO1: Make use of control structures and arrays in developing modular programs. [K3]

CO2: Make use of functions, structures, pointers and files to write well-structured programs. [K3] CO3: Analyze basic data structures and Linked List. [K4]

CO4: Analyze Stacks, Queues and Hashing techniques to solve problems. [K3]

CO5: Apply Sorting techniques to solve problems and involve advanced concepts of Trees. [K3]

UNIT-I:

Introduction to C: Constants and variables, Operators and Expressions, Managing Input and Output operators, Decision making-branching and looping, Arrays

UNIT-II:

Functions, Structures and Unions, Pointers, File handling in C.

UNIT–III:

Data structure: Definition, types of data structures Recursion Definition, Design Methodology and Implementation of recursive algorithms, Linear and binary recursion. Preliminaries of algorithms, analysis and complexity. **Linear list**–singly linked list, Double linked list and circular linked list -implementation, insertion, deletion and searching operations on linear list.

UNIT-IV:

Stacks-Operations, array and **Queues**-operations, array and linked representations of stacks, stack applications, linked representations. **Hash Table Representation:** hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing and rehashing, extendible hashing.

UNIT-V:

Sorting Techniques: Insertion sort, selection sort, exchange-bubble sort, quick sort and merge sort Algorithms. **Trees:** Binary Trees,terminology,representation and traversals- pre, posts in order traversals. **Search Trees:** Binary Search Trees, Definition, Implementation, Operations-Searching, Insertion and Deletion, AVL Trees, Red-Black Trees

Text Books:

1. Programming in ANSI C,5e, E.Balagurusamy,TMH
2. Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press.
3. Data Structures using C – A. S. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education.

Reference Books:

1. Data Structures: A Pseudocode Approach with C,2nd Edition, R.F.Gilberg and
B. A. Forouzan, Cengage Learning.

WEB REFERENCES:

1. https://archive.nptel.ac.in/courses/106/102/106102064/
2. https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring- 2020/video_galleries/lecture-videos/
3. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
4. https://visualgo.net/en
5. https://elearn.daffodilvarsity.edu.bd/course/view.php?id=11771

I MCA I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA102	3	0	0	40	60	100	3
COMPUTER ORGANIZATION							

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**Course Objectives:**

**The objectives of this course are to**

- Conceptualize the basics of organizational and architectural issues of a digital computer.
- Learn the function of each element of a memory hierarchy.
- Study various data transfer techniques in digital computers.

**Course Outcomes:**

After completion of the course, the students would be able to:

**CO1**: Interpret the basic structure of computers and its operational concepts. [K2]

**CO2**: Develop the assembly language programming and demonstrate the addressing modes used in instructions. [K3]

**CO3**: Interpret various I/O interface devices. [K2]

**CO4**: Develop Main Memory Interfacing Circuit and can apply various cache memory mapping techniques. [K3]

**CO5**: Summarize the parallel processing and pipelining concepts. [K2]

**UNIT I:**

**Basic Structure Of Computers: Computer:** Types, Functional units, Basic Operational concepts, Bus structures, Software, Performance, multiprocessor and multi computers, Historical perspective.

**UNIT II:**

**Machine Instructionsand Characters, Memory locations**

**Programs:** Numbers, Arithmetic Operations, and and addresses, Memory operations, Instructions and Instruction sequencing, Addressing Modes, Assembly Languages, stacks and Queues Basic Input/output Operations, role of Stacks and Queues Additional Instructions

**UNIT III:**

**Input/ Output Organization:** Accessing I/O Devices, Interrupts, Processor examples, Direct Memory Access, Buses, Interface Circuits, and Standard I/O Interfaces

**UNIT IV:**

**The Memory Systems:** Some Basic concepts, Semiconductor RAM memories,
Memory System Consideration, Read-Only Memories**,** Speed, Size, and cost, Cache Memories, Performance considerations, Virtual Memories, Memory Management Requirements, Secondary Storage

UNIT IV:

**Parallel Processing:** Basic concepts, Pipeline Processors, Multiprocessors

**Text Books:**

1. Computer Organization, Carl Hamacher, ZvonksVranesic, Safea Zaky,5th Edition, McGraw Hill.
2. Computer Architecture and Organization, John P. Hayes,3rdEdition, McGraw Hill
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Reference Books:

1. Computer Organization and Architecture, William Stallings Sixth Edition, Pearson/PHI
2. Structured Computer PHI/Pearson Organization, Andrew S. Tanenbaum, 4th Edition
3. Fundamentals of Computer Organization and Design, Siva ramaDandamudi Springer Int. Edition.

WEB REFERENCES:

1. https://nptelvideos.com/course.php?id=396
2. https://onlinecourses.nptel.ac.in/noc20_cs64/preview
3. https://www.learncomputerscienceonline.com/computer-organization-and- architecture/
   http://williamstallings.com/COA/COA8e-student/index.html

I MCA I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA103	3	0	0	40	60	100	3
DATABASE MANAGEMENT SYSTEMS							

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**Course Objectives:**
This Course will enable students to

- Explain the concept of data bases, database management systems, database structures and how they work.
- Make use of Entity-Relationship Modeling and Relational Modeling for creating simple databases from the real world scenarios.
- Write relational algebra and structured query language(SQL)statements.
- Normalize a database using Normalization Rules.
- Discuss the issues associated with Transaction Management and Recovery, Tree Structured and Hash-Based Indexing

**Course Outcomes**
After completion of the course, the students would be able to:
**CO1**: Interpret the fundamentals of DBMS. [K2]
**CO2**: Analyze DB design methodology and normalization process. [K4]
**CO3**: Develop Queries in RDBMS. [K3]
**CO4**: Compare and Contrast various transaction and concurrency management techniques. [K2]
**CO5**: Analyze various file organizations and indexing techniques. [K4]

**UNIT – I: Overview of Database System:** Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators, History of Database Systems. [Text Book -2]
**Introduction to Database Design:** Database Design and ER Diagrams, Entities,

Attributes and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model, Extended ER features [Text Book
-1]

**UNIT – II: Relational Model:** Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity Constraints, Querying Relational Data, Logical Database Design: ER to Relational, Introduction to Views, Destroying/Altering Tables and Views [Text Book -1]
**Relational Algebra:** Selection and Projection, Set Operations, Renaming, Joins, Division, More Examples of Algebra Queries, **Relational Calculus:** Tuple Relational Calculus, Domain Relational Calculus [Text Book -1]

**UNIT – III: SQL: Queries, Constraints, Triggers:** The Form of a Basic SQL Query, UNION, INTERSECT and EXCEPT, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers, Exceptions, Procedures, Functions [Text Book -1]**Normal Forms:** Introduction to Schema Refinement, Functional Dependencies, Reasoning about FDs, Normal Forms, Properties of Decompositions, Normalization. [Text Book -1]
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UNIT – IV: Schema Refinement: Multivalued dependencies, Fourth Normal form, Join Dependencies, Fifth Normal Form, Lossless join, dependency preservation.[Text Book -1] **Transaction Management:** ``` Transaction Concepts, Transaction state, Implementation of Atomicity and Durability, Concurrent Execution, Serializability, Recoverability. [Text Book -2] **Concurrency Control**: Lock-based Protocols: Locks, Granting of Locks, Two Phase Locking Protocol, Implementation of locking; Timestamp- Based Protocols: Time Stamps, Time Stamp Ordering protocol, Thomas Write Rule, Validation-Based Protocols [Text Book -2]

UNIT – V: Overview of Storage and Indexing: Data on External Storage, File organization and indexing: Clustered Indexes, Primary and Secondary Indexes; Index Data Structures: Hash and Tree based indexing; Comparison of File organizations. [Text Book -1] **Tree Structured Indexing**: Intuitions for Tree Indexes, Indexed Sequential Access Method (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete, Duplicates, B+ Trees in Practice [Text Book -1]

Text Books:

1. Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, McGraw-Hill
2. Database System Concepts, 6/e, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill
3. DatabaseSystems,9/e, Carlos Coronel, Steven Morris, PeterRob, Cengage

Reference Books:

1. Introduction to Database Systems,8/e, CJ Date, Pearson
2. Database Systems,6/e RamezElmasri, ShamkantB.Navathe, Pearson

WEB REFERENCES:

1. https://nptel.ac.in/courses/106105175
2. https://onlinecourses.swayam2.ac.in/cec22_cs18/preview
3. https://cs186berkeley.net/
4. https://www.youtube.com/playlist?list=PL52484DF04A264E59
5. https://courses.cs.washington.edu/courses/cse414/17au/calendar/lecturelist.ht ml https://www.db-book.com/slides-dir/index.html

I MCA I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA104	3	0	0	40	60	100	3
OPERATING SYSTEMS							

Course Objectives:

This course enables the student to

- Introduce different types of operating systems.
- Learn process management techniques.
- Learn various memory management techniques.
- Introducing the architecture of the Linux operating system.
- Learn multiple operating systems like Unix and Windows.

Course Outcomes

After completion of the course, the students would be able to:

CO1: Classify various operating system functionalities and generations. [K2]

CO2: Interpret process management and Apply various process scheduling algorithms. [K3]

CO3: Interpret process synchronization techniques and apply various deadlock techniques. [K4]

CO4: Distinguish various memory management techniques and disk scheduling algorithms and can interpret the file system implementations. [K4]

CO5: Experiment with the installation and use of different software like Windows 7 and Linux [K3]

UNIT–I:

Introduction to Operating System Concept: Types of Operating Systems, Operating Systems Concepts, Operating System Operations. Operating Systems Structures- Operating System Services, User Operating-System Interface, Introduction to System calls, Types of System Calls.

UNIT–II:

Process Management: Process concept, Process State Diagram, Process control block, Process Scheduling, Inter process Communication, Threads-Threading Scheduling-Basic Concepts, Scheduling Criteria, Scheduling Algorithms. Issues,

UNIT-III:

Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, **Principles of deadlock:** System Model, Deadlock characterization, Deadlock handling, Deadlock Prevention, Detection and Avoidance, Recovery Starvation, Critical Regions form Deadlock

UNIT–IV:

Memory Management: Swapping, Contiguous Memory Allocation, Paging, structure of the Page Table, Segmentation Virtual Memory Management- Demand Paging, Page- Replacement Algorithms, Thrashing.

File-System Interface: File Concept, Access Methods, Directory structure, File-System mounting, Files Sharing, Protection. File- System implementation- File-System Structure, Allocation Methods, Free-Space Management, Disk Structure, Disk Scheduling

UNIT-V:

Case Studies: **Linux System:** Design Principles, kernel Modules, Process Management, File Systems, Input and Output, Interprocess Communication, Network Structure, Security. **Windows 7:** Design ``` Principles, System Components, Terminal Services and Fast User, File System, Networking, Programmer Interface.

Text Books:

1. Operating System concepts, Abraham Siliberschatz, Peter Baer Galvin, Greg Gagne, John Wiley &Sons,Inc., Edition 9,2011
2. Introduction to UNIX Pearson, 2005 and Shell Programming, M.G.VenkateshMurhty,
3. UNIX & Shell Programming, B.M.Harwani, OXFORD University Press,2013

Reference Books:

1. Advanced Programming in the UNIX Environment, W.Richard Stevens, Stephen Rago, Wesley Professional, 2013
2. UNIX Network Programming, W.Richard Stevens,1990
3. Operating Systems, William stallings, PHI/Pearson,6/E,2009
4. Operating Systems, Dietal, Dietal, Pearson,3/e,2007
5. Operating Systems,Dhamdhere,TMH,2/e,2009

Web References:

1. https://onlinecourses.swayam2.ac.in/cec20_cs06/previ ew
2. https://www.cse.iitb.ac.in/~mythili/os/
3. https://onlinecourses.nptel.ac.in/noc21_cs72/preview
4. https://web.stanford.edu/~ouster/cgi-bin/cs140- spring20/lectures.php
5. https://oscourse.org/
6. https://www.cs.jhu.edu/~huang/cs318/fall21/schedule. html

I MCA I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA105	3	1	0	40	60	100	4
Mathematical and Statistical Foundations							

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Course Objectives:

This course is aimed at enabling the students to

- To understand the mathematical fundamentals that are prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems bioinformatics, Machine learning.
- To develop the understanding of the mathematical and logical many basis to modern techniques in computer science technology like learning, machine programming language design, and concurrency.
- To study various sampling and classification problems.

Course Outcomes

After completion of the course, the students would be able to:

CO1: Apply Random variables and continuous probability distributions [K3]
CO2: Infer the statistical inferential methods based on small and large sampling tests [K4].
CO3: Design the components of a classical hypothesis test [K3]
CO4: Apply Number Theory concepts and Algebraic structures to solve problems. [K3]
CO5: Classify the types of graphs to formulate and solve computational problems. [K4].

UNIT- I:

Basic Probability and Random Variables: Random Experiments, Sample Spaces Events, the Concept of Probability the Axioms of Probability, Some Important Theorems on Probability Assignment of Probabilities, Conditional Probability Theorems on Conditional Probability, Independent Events, Bayes Theorem or Rule.

Random Variables, Discrete Probability Distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables, Continuous Random Variables

UNIT -II:

Sampling and Estimation Theory: Population and Sample, Statistical Inference Sampling With and Without Replacement Random Samples, Random Numbers Population Parameters Sample Statistics Sampling Distributions, Frequency Distributions, Relative Frequency Distributions, Computation of Mean, Variance, and Moments for Grouped Data. Unbiased Estimates and Efficient Estimates Point Estimates and Interval Estimates. Reliability Confidence Interval Estimates of Population Parameters, Maximum Likelihood Estimates

UNIT -III:

Tests of Hypothesis and Significance: Statistical Decisions Statistical Hypotheses. Null Hypotheses Tests of Hypotheses and Significance Type I and Type II Errors Level of Significance Tests Involving the Normal Distribution One-Tailed and Two-Tailed Tests P Value Special Tests of Significance for Large Samples Special Tests of Significance for Small Samples Relationship between Estimation Theory and Hypothesis Testing Operating Characteristic Curves. Power of a Test Quality Control Charts Fitting Theoretical Distributions to Sample Frequency Distributions, The Chi- Square Test for Goodness of Fit Contingency Tables Yates' Correction for Continuity Coefficient of Contingency.

UNIT-IV:

Algebraic Structures and Number Theory: Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups Semi Groups and Monoids, Group, Subgroup, ``` Abelian Group, Homomorphism, Isomorphism. Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem)

UNIT-V:

Graph Theory: Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Formula, Graph Coloring and Covering, Chromatic Number, Spanning Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).

Text Books:

1. Foundation Mathematics for Computer Science, 1st Edition, John Springer,2015 Euler's Trees, Vince,
2. Probability & Statistics,3rd Edition, Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, Schaum's Outline Series, Tata McGraw-HillPublishers,2018
3. Probability and Statistics with Reliability,2ndEdition,K.Trivedi,Wiley,2011
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory,7thEdition, H. Rosen, Tata McGraw Hill, 2003

Reference Books:

1. Probability and Computing: Randomized Algorithms and Probabilistic Analysis,1stEdition, M. Mitzenmacher and E. Upfal, 2005
2. Applied Combinatorics,6thEdition, Alan Tucker, Wiley, 2012

WEB REFERENCES:

1. https://archive.nptel.ac.in/courses/106/102/106102064/
2. https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/video_galleries/lecture-videos/
3. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
4. https://visualgo.net/en
5. https://elearn.daffodilvarsity.edu.bd/course/view.php?id=11771

I MCA I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA1L1	0	0	3	40	60	100	1.5
DATABASE MANAGEMENT SYSTEM LAB							

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Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands.
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers

Course Outcomes

After completion of the course, the students would be able to:

CO1: Apply SQL commands like DDL, DML and DCL to perform different Database operations [K3].
CO2: Develop PL/SQL block statements, control statements and cursors. [K3]
CO3: Develop PL/SQL programs using functions and procedures. [K3]
CO4: Develop PL/SQL programs using packages and Triggers. [K3]

1. Execute all DDL, DML and DCL commands on sample tables.
2. Implementation of different types of operators and built-in functions with Suitable examples.
3. Implementation of different types of joins with suitable examples.
4. Create views, partitions, Sequences for a particular DB
5. Implement different types of constraints on relations.
6. Implementation of subqueries and nested queries.
7. Implement Queries on Group By& Having Clauses, ALIAS, Sequence By, Order By
8. Control Structure

a) Write a PL/SQL block for Addition of Two Numbers
b) Write a PL/SQL block for IF, IF and else condition
c) Write a PL/SQL block for implementation of loops
d) Write a PL/SQL block for greatest of three numbers using IF AND ELSEIF

9. Exception Handling- Implement the following with respect to exception handling. Raising Exceptions, User Defined Exceptions, Pre-Defined Exceptions
10. Procedures

a) Write a PL/SQL Procedure using Positional Parameters
b) Write a PL/SQL Procedure using notational parameters
c) Write a PL/SQL Procedure for GCD Numbers
d) Write a PL/SQL Procedures for cursor implementation (explicit and implicit cursors)

11. Functions:

a) Write a PL/SQL block to implement factorial using functions
b) Write a PL/SQL function to search an address from the given database

12. Write a DBMS program to prepare Pl/SQL reports for an application using functions.
13. Triggers:

a) Write a Trigger to pop-up the DML operations
b) Write a Trigger to check the age valid or not Using Message Alert.

c) Create a Trigger on a table so that it will update another table while inserting values
14. Write PL/SQL block for an application using cursors and all types of triggers.
15. Write a PL/SQL block for transaction operations of a typical application using package

```

**Text Books / Suggested Readings:**

1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

**WEB REFERENCES:**

1. https://moodle.sit.ac.in/blog/database-management-system-lab-component- bcs403/#P01
2. https://elearn.daffodilvarsity.edu.bd/course/view.php?id=10250
3. https://cs50.harvard.edu/x/2024/weeks/7/
4. https://courses.cs.washington.edu/courses/cse414/17au/calendar/hwlist.html
5. http://db.lcs.mit.edu/6.5830/2021/assign.php
```

I MCA I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA1L2	0	0	4	40	60	100	2
DATASTRUCTURE USING C LAB							

Course Objectives:

This Course will enable students to

- Design and implement various data structures.
- Implement operations like searching, insertion, and deletion, traversing mechanism
- Develop applications using data structure algorithms.

Course Outcomes

After completion of the course, the students would be able to:

CO1: Analyze the use of conditional and looping statements to solve problems associated with conditions and repetitions. [K4]

CO2: Analyze algorithms, Searching, Sorting and hashing Techniques [K4].

CO3: Make use of elementary data structures such as stacks, Queues and linked list to develop their applications.

CO4: Examine different tree traversal techniques.

Experiment 1:

a) Write a program in C to display the n terms of even natural numbers and their sum.

b) Write a program in C to display the n terms of harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.

c) Write a C program to check whether a given number is an Armstrong number or not

d) Write a C program to calculate the factorial of a given number.

Experiment 2:

a) Write a program in C for multiplication of two square Matrices.

b) Write a program in C to find the transpose of a given matrix.

Experiment 3:

a) Write a program in C to check whether a number is a prime number or not using the function.

b) Write a recursive program which computes the nth Fibonacci number, for appropriate values of n.

c) Write a program in C to add numbers using call by reference.

Experiment 4:

a) Write a program in C to append multiple lines at the end of a text file.

b) Write a program in C to copy a file in another name

Experiment 5:

Write recursive program for the following

a) Write recursive and non recursive C program for calculation of Factorial of an integer.

b) Write recursive and non recursive C program for calculation of GCD (n, m)

c) Write recursive and non recursive C program for Towers of Hanoi: N disks are to be transferred from peg S to peg D with Peg I as the intermediate peg.

Experiment 6:

a) Write a C program that uses both recursive and non recursive functions to perform Linear search for a Key value in a given list.

b) Write a C program that uses both recursive and non recursive functions to perform Binary search for a Key value in a given list.

Experiment 7:

a) Write a C program that implements stack (its operations) using arrays.

b) Write a C program that implements stack (its operations) using Linke list.

Experiment 8:

a) Write a C program that uses Stack operations to convert infix expressions into postfix expressions.

a) Write a C program that implements Queue (its operations) using arrays.

b) Write a C program that implements Queue (its operations) using linked lists.

Experiment 9:

Write a C program that various operations on it.uses functions to create a singly linked list and perform

Experiment 10:

Write a C program to store a polynomial expression in memory using a linked list and perform polynomial addition.

Experiment 11:

a) Write a recursive C program for traversing a binary tree in preorder, in order and post order.

b) Write a non recursive C program for traversing a binary tree in preorder, in order and post order.

Experiment 12:

Implementation of Hash table using double hashing as collision resolution function.

Experiment 13:

Implementation of Binary Search trees- Insertion and deletion..

Experiment 14:

Implementation of AVL Tree – Insertion and Deletion

Experiment 15:

a) Write a C program that implements Bubble sort, to sort a given list of integers in ascending order.

b) Write a C program that implements Quick sort, to sort a given list of integers in ascending order.

c) Write C program that implement Merge sort, to sort a given list of integers in ascending order

WEB REFERENCES:

1. https://ds1-iiith.vlabs.ac.in/
2. https://profile.iiita.ac.in/bibhas.ghoshal/teaching_ds_lab.html
3. https://moodle.sit.ac.in/blog/data-structures-laboratory/
4. https://dsalab.netlify.app/

https://www.vtuloop.com/data-structure-lab-programs-all/

I MCA I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA1L3	0	0	3	40	60	100	1.5
OPERATING SYSTEMS AND LINUX LAB							

Course Objectives:

This Course will enable students to implement CPU scheduling algorithms, Disk scheduling algorithms, Execute different types of Linux commands and Write shell scripts

Course Outcomes

After completion of the course, the students would be able to:

CO1: Apply the fundamental UNIX utilities and Utilize the Unix file system[K3]
CO2: Experiment with shell and UNIX filters. [K3]
CO3: Implement routing algorithms.
CO4: Solve the experiments on scheduling Algorithms and page replacement algorithms.
CO5: Handle the deadlocks, like prevention and detection.

List of Experiments:

UNIX Lab-Introduction to Unix

1. Study of Unix/Linux general purpose utility commands
2. Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system .
3. Study of UNIX/LINUX File System(tree structure).
4. C program to emulate the UNIX ls –l command
5. C program that illustrates how to execute two commands concurrently with a command pipe. Ex: - ls –l | sort
6. Multiprogramming-Memory management-Implementation of fork (), wait (), exec() and exit (), System calls

Operating Systems Lab

1. Simulate the Following CPU Scheduling Algorithms

A) FCFS B)SJF C)Priority D)Round Robin

2. Multiprogramming-Memory Management- Implementation of fork(), wait(), exec() and exit()
3. Simulate The Following

a. Multiprogramming with A Fixed Number Of Tasks (MFT
b. Multiprogramming with A Variable Number Of Tasks (MVT)

4. Write a program to implement first fit, best fit and worst fit algorithm for memory management.
5. Simulate Bankers Algorithm for Deadlock Avoidance
6. Simulate Bankers Algorithm for DeadLock Prevention.
7. Simulate The Following Page Replacement Algorithms.

   a) FIFO b) LRU c) LFU
8. Simulate the Following File Allocation Strategies

   a) Sequenced b) Indexed c) Linked

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Linux Lab

1. Write a Shell program to check whether a given number is prime or not.
2. Write a shell script which will display Fibonacci series up to the given range.
3. Write a shell script to check whether the given number is Armstrong or not.
4. Write a shell script to the calculate the value of
5. Write a shell script to accept student number, name, marks in 5 subjects.
6. Find total, average and grade using the following rules: Avg>=80 then grade A Avg<80 &&Avg>=70 then grade B Avg<70 &&Avg>=60 then grade C Avg<60 &&Avg>=50 then grade D Avg<50 &&Avg>=40 then grade E
7. Write a shell script to find minimum and maximum elements in the given list of elements.
8. Write a shell program to check whether the given string is palindrome or not.
9. Write an awk program to print sum, avg of students marks list
10. Write a shell script to compute no. of characters and words in each line of given file

WEB REFERENCES:

1. https://profile.iiita.ac.in/bibhas.ghoshal/teaching_os_lab.html
2. https://profile.iiita.ac.in/bibhas.ghoshal/OS_2019/teaching_os_lab.html
3. https://dextutor.com/courses/operating-system-programs/
4. https://oscourse.org/labs/
5. https://labex.io/courses/linux-practice-labs
6. https://www.101labs.net/courses/101-labs-linux-lpic1/

I MCA	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDIT
R24MCA201	3	0	0	40	60	100	3
COMPUTER NETWORKS							

Course Objectives:

At the end of the course, the students will be able to:

- To Understand the fundamental concepts of computer networking and OSI Reference model.
- To Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- To learn and understand the advanced networking concepts, preparing the student for entry advanced courses in computer networking.
- To develop and gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Course Outcomes

After completion of the course, the students would be able to:

CO1: Summarize basic concepts of Data Communication and Networking. [K2]
CO2: Compare and Contrast OSI and TCP/IP reference models. [K2]
CO3: Interpret data link layer services and multiple access protocols. [K2]
CO4: Analyse different routing protocols. [K4]
CO5: Illustrate the essential principles of different transport layer and application layer protocols. [K2]

UNIT–I

Introduction: Network Topologies WAN, LAN, MAN. Reference models, The OSI Reference Model, the TCP/ IP Reference Model, A Comparison of the OSI and TCP/IP Reference Models. **Physical Layer:** Introduction to physical layer, Data and Signals, Periodic analog signals, digital signals, transmission impairment, Data rate limits, performance, Introduction to Guided Media, Twisted-pair cable, Coaxial cable and Fiber optic cable and Unguided media: Wireless-Radio waves, microwaves, infrared.

Unit-II

The Data Link Layer: Services Provided to the Network Layer, Framing, Error Control, Flow Control, Error Detection and Correction, Error-Correcting Codes, Error Detecting Codes. **Elementary Data Link Protocols:** Simplex Protocol, A Simplex Stop and Wait Protocol for an Error free channel, A Simplex Stop and Wait Protocol for a Noisy Channel, Sliding Window Protocols, A One Bit Sliding Window Protocol, Go-Back-N, Selective Repeat.

UNIT-III

The Medium Access Control Sublayer: The Channel Allocation Problem, Static Channel Allocation, Assumptions for Dynamic Channel Allocation, Multiple Access Protocols, Aloha, Pure aloha, slotted aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited Contention Protocols. **Wireless LAN Protocols-** Ethernet, Classic Ethernet Physical Layer, Classic Ethernet MAC Sublayer Protocol, Ethernet Performance, Fast Ethernet, Wireless LANs, The 802.11 Architecture and Protocol Stack, 802.11 Physical Layer, 802.11 MAC Sublayer Protocol, 805.11 Frame Structure, Services.

Unit-IV

The Network Layer Design Issues: Store and Forward Packet Switching, Services Provided to Transport layer, Implementation of Connection less Service, Implementation of Connection Oriented Service, Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms, Optimality principle, Shortest path, Flooding, Distance vector, Link state, Hierarchical. **Congestion Control algorithms:** General principles of congestion control, Congestion prevention policies, Approaches to Congestion Control, Traffic Aware Routing, Admission Control, Traffic Throttling, Load Shedding. **Internet Working:** How networks differ, How networks connected, Tunneling, internetwork routing, Fragmentation, network layer an be in the internet, IP protocols, IPV4 protocol, IP addresses, Subnets, IP Version6- The main IPV6 header, Internet control protocols- ICMP, ARP, DHCP.

UNIT-V:

The Transport Layer: Transport layer protocols: Introduction, services, port number, User datagram protocol, User datagram, UDP services, UDP applications, Transmission control protocol: TCP services- TCP features- Segment- A TCP connection, windows in TCP, flow control, Error control. **Application Layer:** World Wide Web: HTTP, FTP, Two connections, control connection, Data connection, security of FTP, Electronic mail, Architecture, web based mail, email security, TELENET, local versus remote Logging. **Domain Name System:** Name Space, DNS in Internet, Resolution, Caching, Resource Records, DNS messages, Registrars, security of DNS Name Servers.

Text Books:

1. Computer Networks: Andrew S Tanenbaum David J. Wetherall, 5/e, Pearson
2. Data communications and networking: BehrouzForouzan, 5/e, McGraw Hill

Reference Books

1. Computer Networks – A System Approach, Peterson, Bruce Davie,2/e , Harcourt Asia
2. Compute communications and networking technologies, Gallo, Hancock, Cengage
3. An Engineering approach to compute networking, Kesha, Pearson

Web References:

1. https://onlinecourses.swayam2.ac.in/cec23_cs07/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs18/preview
3. https://ocw.mit.edu/courses/6-829-computer-networks-fall- 2002/pages/lecture-notes/
4. https://www.sanfoundry.com/computer-network-basics/
5. https://www.cisco.com/c/en_in/solutions/enterprise-networks/what-is- computer-networking.html
6. https://www.cs.vu.nl/~ast/CN5/

I MCA	L	T	P	Internal Marks	External Marks	Total Marks	Credit
R24MCA202	3	0	0	40	60	100	3
NETWORK SECURITY AND CYBER SECURITY							

Course Objectives:

- To learn various cryptographic algorithms including secret key cryptography, hashes and message digests, public key algorithms,
- To Familiar in design issues and working principles of various authentication protocols and various secure communication standards
- To understand the cybercrime fundamentals and preventive steps

Course Outcomes

After completion of the course, the students would be able to:

CO1: Summarize the fundamentals of Cryptography. [K2]

CO2: Analyse how security is achieved, and attacks can be countered by using asymmetric algorithms. [K4]

CO3: Interpret the role of hash functions and Digital Signatures in Information Security.[K2]

CO4: Interpret Cyber Security architecture principles [K2].

CO5: Identifying different classes of attacks [K3].

UNIT I:

Basic Principles: Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography. Symmetric Encryption: Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard.

UNIT II:

Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography-Primes, primality Testing, Factorization, Asymmetric Key Cryptography-RSA Cryptosystem, Rabin Cryptosystem, ElGamal Cryptosystem, Elliptic Curve Cryptosystem **Cryptographic Hash Functions:** Applications of Cryptographic Hash Functions, Two Simple Hash Functions Requirements and Security Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3

UNIT III:

Digital Signatures: Elgamal Digital Signature Scheme, Schnorr Digital Signature, NIST Digital Signature Algorithm

Electronic Mail Security: Internet Mail Architecture, Email Formats, Email Threats and Comprehensive Email Security, S/MIME. IP Security: IP Security Policy, Encapsulating Security Payload, Combining Security Associations Internet Key Exchange

Unit IV:

Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrime, Cyber stalking, Cyber cafe and Cybercrimes, Botnets. Attack Vector, Proliferation of Mobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones

Unit V:

Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer overflow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identify theft, FootPrinting and Social Engineering, Port Scanning, EMailInvestigation, E-Mail Tracking, IP Tracking, EMail Recovery, Password Cracking,

Text Books:

1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill,2015
2. Sunit Belapure Nina Godbole "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", WILEY, 2011.

Reference Books:

1. Network Security and Cryptography, First Edition, Bernard Meneges, Cengage Learning, 2018
2. Cryptography and Network Security, William Stallings, Global Edition, 7e Pearson, 2017

Web References:

1. https://archive.nptel.ac.in/courses/106/105/106105162/
2. https://ebooks.inflibnet.ac.in/csp11/chapter/introduction-to-network- security/
3. https://www.fortinet.com/resources/cyberglossary/what-is- cryptography
4. https://ischoolonline.berkeley.edu/cybersecurity/curriculum/cryptograp hy/
5. https://www.mitel.com/articles/web-communication-cryptography- and-network-security
6. https://www.nist.gov/cybersecurity
7. https://www.codecademy.com/learn/introduction-to-cybersecurity

I MCA	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDIT
R24MCA203	3	0	0	40	60	100	3
OBJECT ORIENTED PROGRAMMING USING JAVA							

Course Objectives:

- To understand the basic concepts of object oriented programming concepts.
- To introduce the principles of inheritance and polymorphism demonstrate how they are related to the design of abstract classes
- To understand the implementation of packages and interfaces
- To introduce the concept of multithreading and exception handling
- To learn and understand the design of Graphical User Interface using swing controls

Course Outcomes

After completion of the course, the students would be able to:

CO1: Interpret the syntax and semantics of java programming language and OOPs concepts [K2]. CO2: Make use of different predefined classes and packages to develop programmes using OOPs concepts [K3]. CO3: Apply exception handling and multithreading on java programs [K3]. CO4: Develop Java Programmes using collection frame work & I/O [K3]. CO5: Make use of Applets, AWT and event-handling to develop GUI [K3]

UNIT–I:

Basics of Object Oriented Programming (OOP): Need for OO paradigm , A way of viewing world- Agents, responsibility, messages, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions, summary of OOP concepts, coping with complexity, abstraction mechanisms. **Java Basics:** Data types, variables, scope and lifetime of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects- concepts of classes, objects, constructors methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter recursion, string handling.

UNIT–II:

Inheritance: Hierarchical abstractions, Base class object, subclass, passing, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism, abstract classes.**Packages and Interfaces:** Defining, Creating and Accessing a package,

Understanding CLASSPATH, Importing packages, differences between classes and interfaces, defining an interface, Implementing interface, applying interfaces variables in interface and extending interfaces.

UNIT–III:

Exception handling and Multithreading: Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throws and finally, built in exceptions, creating own exception subclasses. Differences between multithreading and multitasking, thread lifecycle, creating threads, synchronizing threads, daemon threads, thread groups.

UNIT–IV:

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes. The AWT class hierarchy, user-interface components- labels, button, canvas, scrollbars, text components, check box, checkbox groups, choices, list panes, scroll pane, dialogs, menu bar, graphics, layout manager, layout manager types- boarder, grid, flow, card and grid bag.

UNIT-V:

Swings: Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing-JFrame and JComponent, Icons and Labels, text fields, buttons-The JButton class, Check boxes, Radio Buttons, Combo abbed panes, Scroll panes, Trees and Tables.boxes,

Text Books:

1. Java-The Complete Reference,7/e, Herbert schildt, TMH

Reference Books:

1. JAVA: How to program,8/e, Dietal, Dietal, PHI
2. Introduction of programming with JAVA, S.Dean, TMH
3. Introduction to JAVA programming, 6/e, Y.Daniel Liang, Pearson
4. Core Java2, Vol1(Vol2) Fundamentals (Advanced),7/e, Cay.S.Horstmann, Gary Cornell, Pearson
5. Big Java 2,3/e, Cay.S.Horstmann,Wiley
6. Object Oriented Programming through Java, P.Radha Krishna, University Press

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_cs58/preview
2. https://www.iitk.ac.in/esc101/05Aug/tutorial/information/resources.html
3. https://docs.oracle.com/javase/tutorial/index.html
4. https://www.javacodegeeks.com/best-java-programming-resources

I MCA	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDIT
R24MCA204	3	0	0	40	60	100	3
SOFTWARE ENGINEERING							

Course Objectives:

- To understand the nature of software development and software life cycle models.
- To understand methods of capturing, specifying, visualizing analyzing software equirements.
- To know the basics of testing and understanding the concept of software quality assurance and software configuration management process.
- To learn to provide correctness proofs for algorithms.

Course Outcomes

After completion of the course, the students would be able to:

CO1: Analyze Software Life Cycle models. [K4]
CO2: Analyze the importance of software requirement and project management [K4]
CO3: Analyze various types of software design techniques [K4]
CO4: Analyze Software testing and quality management [K4].
CO5: Analyze various CASE tools and software maintenance process models. [K4]

UNIT–I:

Introduction: Software Engineering and its history, Software crisis, Evolving of a Programming System Product, Characteristics of Software, Brooks' No Silver Bullet,
and Software Myths. **Software Development Life Cycles :** Software Development Process, Code-and-Fix model, Waterfall model, Evolutionary Model, Incremental

Implementation, Prototyping, Spiral Model, Software Reuse, Critical Comparisons of SDLC models. **An Introduction to Non-Traditional Software Development Process:** Rational Unified Process, Rapid Application Development, Agile Development Process- Introduction, Agile- SCRUM(Sprint, Review, Retrospective, Planning) , XP, KANBAN, SAFE agile

UNIT–II:

Requirements: Importance of Requirement Analysis, User needs, Software Features and Software Requirements. **Classes of User Requirements:** Enduring and Volatile, Sub phases of Requirement Analysis, Functional and Non-functional requirements, Barriers to Eliciting User requirements, The software requirements document and SRS standards, Requirements Engineering, Case Study of SRS for a Real Time System.
Tools for Requirements Gathering: Document Flow Chart, Decision Table, Decision Tree, Introduction to non-traditional Requirements.

UNIT-III:

Software Design: Goals of good software design, Design strategies and methodologies, Data oriented software design. **Structured Design:** Structure chart, Coupling, Cohesion, Modular structure, Packaging, Object oriented design, Top-down and bottom-up approach, Design patterns. **Structured Analysis:** DFD, Data Dictionary, Software Measurement and Metrics: Various Size Oriented Measures: Halstead's software science, Function Point (FP) based measures, Cyclomatic Complexity Measures:

Control flow graphs Development: Selecting a language, Coding guidelines, Writing code, Code documentation.

UNIT–IV:

Software Testing : Testing process, Design of test cases, Functional Testing : Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path testing, Data flow and mutation testing, Unit testing, Integration and system testing, Debugging, Alpha & beta testing, testing tools & standards.

UNIT-V:

Software Maintenance: Management of maintenance, Maintenance process, Maintenance models, Regression testing, Reverse engineering, Software reengineering, Configuration management, documentation.

Text Books:

1. Software Engineering: A Practitioner's Approach, R. S. Pressman, McGraw Hill, 9thEdition, Sept 2019

Reference Books:

1. Software Engineering K.K.Aggarwal, Yogesh Singh, New Age international Publishers, Third Edition, 2007
2. Software Engineering, Ian Sommerville, Addison Welsley, 9th 2010.
3. An Integrated Approach to Software Engineering, PankajJalote, Publishing House, 3rdEdition, 2007 Edition, Narosa

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_cs122/preview
2. https://nptelvideos.com/course.php?id=444
3. https://softengbook.org/
4. https://www.coursera.org/learn/introduction-to-software-engineering?msockid=39a584c9c8ac6773281697f5c91e6633

I MCA	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDIT
R24MCA205	3	0	0	40	60	100	3
ARTIFICIAL INTELLIGENCE							

Course Objectives:

- To learn the basic State space representation. Intelligent Systems Categorization of learning Intelligent concepts and techniques of AI and machine
- To explore the various mechanisms of Knowledge and Reasoning used for building an expert system.
- To become familiar with supervised and unsupervised learning models
- To design and develop AI and machine learning solutions using modern tools.

Course Outcomes

After completion of the course, the students would be able to:

CO1: Analyse and Design Intelligent Agents [K4]
CO2: Apply Search Algorithms to Problem Solving [K3]
CO3: Apply techniques for constraint propagation and reasoning under uncertainty [K3]
CO4: Utilize inductive learning, decision trees, and explanation-based learning for learning from observation [K3]
CO5: Analyse and compare typical expert systems such as MYCIN, DART, and XCON [K4]

UNIT–I

Introduction to AI: Definition, Problem, System, Components of AI Program, Foundations of AI, Applications of AI, Current trends in AI, Intelligent Agents: Anatomy, structure, Types.

UNIT–II

Problem solving- Solving problems by Searching: Problem Solving Agent, Formulating Problems. Uninformed Search Methods: Breadth First Search (BFS), Depth First Search (DFS), Depth First Iterative Deepening (DFID), Informed Search Methods-Greedy best first Search, A* Search, Memory bounded heuristic Search. Local Search Algorithms and Optimization Problems- Hill climbing search Simulated annealing and local beam search.

UNIT –III

Knowledge and Reasoning-Knowledge based Agents, The Wumpus World, and Propositional logic**. First Order Logic** –Syntax and Semantic, Inference in FOL, Forward chaining, backward Chaining, Knowledge Engineering in First-Order Logic, Unification and Resolution.

UNIT–IV

Agents: Definition of agents, Agent architectures (e.g., reactive, layered, cognitive), Multi- agent systems-Collaborating agents, Competitive agents, Swarm systems and biologically inspired models. Expert Systems: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

UNIT–V

Expert Systems: Architecture of expert systems, Roles of expert systems, Knowledge Acquisition, Meta knowledge, Heuristics. Expert systems- MYCIN, DART, XOON, Expert systems shells.

Text Books:

1. Artificial Intelligence, Sarojkaushik, Cengage Learning India, 2011
2. Artificial Intelligence and Machine Learning, Vinod Chandra S.S., Anand Hareendran S
3. Stuart J.Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach“ Second Edition, Pearson.

Reference Books:

1. Ivan Bratko "PROLOG Programming for Artificial Intelligence", Pearson Education, Third Edition.
2. Elaine Rich and Kevin Knight "Artificial Intelligence ", Third Edition
3. Han Kamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann Publishers
4. G. Luger, W. A. Stubblefield, "Artificial Intelligence", Third Edition, AddisoWesley Longman, 1998

Web References:

1. https://onlinecourses.nptel.ac.in/noc22_cs56/preview
2. https://openlearning.mit.edu/news/explore-world-artificial-intelligence-online- courses-mit
3. https://cse.iitk.ac.in/users/cs365/2015/resources.html
4. https://microsoft.github.io/AI-For-Beginners/
5. https://artint.info/3e/resources/index.html
6. https://web.dev/explore/ai

MCA	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDIT
R24MCA206	3	0	0	40	60	100	3
DESIGN AND ANALYSIS OF ALGORITHMS (PROGRAM ELECTIVE-1)							

Course Objectives:

- To analyze the asymptotic performance of algorithms.
- To understand and write rigorous correctness proofs for algorithms.
- To familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

Course Outcomes

After completion of the course, the students would be able to:

CO1: Apply asymptotic notations to measure the performance of algorithms [K3]
CO2: Apply divide-and-conquer paradigm when an algorithmic design situation calls for it [K3].
CO3: Apply dynamic-programming approach, to solve real world problems [K3].
CO4: Apply fundamental graph traversal techniques to solve various applications using Backtracking [K3].
CO5: Analyse least cost and FIFO branch and bound paradigms [K4].

UNIT-I:

Introduction: Algorithm, Pseudo code for expressing algorithms, performance Analysis- Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation, probabilistic analysis, Amortized analysis. Disjoint Sets- disjoint set operations, union and find algorithms, spanning trees, connected components and bi- connected components.

UNIT-II:

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Stassen's matrix multiplication. Greedy method: General method, applications-Job sequencing with deadlines, 0/1 knapsack problem, Minimum cost spanning trees, Single source shortest path problem.

UNIT-III:

Dynamic Programming: General method, applications-Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Traveling salesperson problem, Reliability design.

UNIT-IV:

Backtracking: General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

UNIT-V:

Branch and Bound: General method, applications - Travelling salesperson problem, 0/1 knapsack problem-LC Branch and Bound solution, FIFO Branch and Bound solution. NP- Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP Complete classes, Cook's theorem.

Text Books:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, SatrajSahni and Rajasekaran, Universities Press
2. The Algorithm Design Manual, 2nd edition, Steven S. Skiena, Springer
3. Introduction to Algorithms, second edition, T.H. Cormen, Leiserson, R.L. Rivest and C.Stein, PHI Pvt. Ltd

Reference Books:

1. Introduction to the Design and Analysis of Algorithms, AnanyLevitin, PEA
2. Design and Analysis of Algorithms, Pearson Education, ParagHimanshu Dave, HimansuBalachandra Dave
3. Introduction to Design and Analysis of Algorithms A strategic approach, R.C.T. Lee, S.S.Tseng, R.C.Chang and T.Tsai, Mcgraw Hill
4. Design and Analysis of algorithms, Pearson education, Aho, Ullman and Hopcroft

Web References:

1. https://nptel.ac.in/courses/106106131
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?cour se=IntroToAlgorithms
3. https://ocw.mit.edu/courses/6-046j-design-and-analysis-of- algorithms-spring-2015/resources/lecture-notes/
4. https://ocw.mit.edu/courses/6-046j-design-and-analysis-of- algorithms-spring-2015/resources/lecture-notes/
5. https://aofa.cs.princeton.edu/home/

I MCA	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDIT
R24MCA207	3	0	0	40	60	100	3
ADVANCED UNIX PROGRAMMING(PROGRAM ELECTIVE-1)							

Course Objectives:

- To understand the fundamental design of the unix Programming
- To become fluent environment with the systems calls provided in the unix
- To be able to design and build an application/service over the unix operating system

Course Outcomes

After completion of the course, the students would be able to:

CO1: Summarize the internal structure of the UNIX operating system, including the kernel, file systems, processes, and memory management. [K2]

CO2: Interpret complex shell scripts for automating system tasks and processes in UNIX environments. [K2]

CO3: Make use of system calls for low-level programming tasks such as file handling, process control, and communication between programs. [K3]

CO4: Apply IPC techniques, including pipes, message queues, shared memory, and semaphores, to facilitate communication between processes [K4]

CO5: Utilize and manage process scheduling techniques and synchronization Compare various Memory Management Schemes [K3]

UNIT-I:

Review of Unix Utilities and Shell Programming:-File handling utilities, security by file permissions, process utilities, disk utilities, networking commands, backup utilities, text processing utilities. **Shell Programming:** shell, shell responsibilities, pipes and input redirection, output redirection, here documents, the shell as a programming la guage, shell metacharacters, shell variables, shell commands, the environment, control structures, shell script examples.

UNIT-II:

Unix Files: Unix file structure, directories, files and devices, System calls, library functions, low level file access, usage of open, create, read, write, close, lseek, stat, fstat, octl, umask, dup, dup2, Differences between system call and library functions. File and directory maintenance: chmod, chown, unlink, link, symlink, mkdir, rmdir, chdir, getcwd. **Directory handling system calls:** opendir, readdir, closedir, rewinddir, seekdir, telldir

UNIT-III:

Unix Process: Threads and Signals: process, process structure, starting new process, waiting for a process, zombie process, orphan process, process control, process identifiers, system call interface for process management, - fork, vfork, exit, wait, waitpid, exec, system. **Signals**: Signal functions, unreliable signals, interrupted system calls, kill and raise functions, alarm, pause functions, abort, sleep functions.

UNIT-IV:

Inter process Communication: Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different systems, pipes, FIFOs, message queues, semaphores and shared memory. Differences between pipes and FIFOs.Implementing a client server program using pipes and FIFOs.**Message Queues-**:IPC, permission issues, Access permission modes, message structure, working with message queues, client/server example. **Semaphores:** Creating semaphore sets, Unix kernel support for semaphores, Unix APIs for semaphores, file locking using semaphores.

UNIT-V

Shared Memory: Working with shared memory segments, Unix kernel support for shared memory, client/server example. **Sockets:** Berkeley sockets, socket structure, socket system calls for connection oriented protocol and connectionless protocol, implementing client server programs using TCP and UDP sockets.

Text Books:

1. Advanced programming in the unix environment, w- Richard Stevens, 2nd Edition Pearson education
2. Unix Concepts and Applications, 3/e, Sumitabha Das, TMH

Reference Books:

1. Unix and shell Programming, Sumitabha Das, TMH
2. A Beginner's Guide to Unix, N.P.Gopalan, B.SivaSelva, PHI
3. Unix Shell Programming, Stephen G.Kochan, Patrick Wood,
4. Unix Shell Programming, Lowell Jay Arthus& Ted Burns,3/e,GalGotia

Web References:

1. https://archive.nptel.ac.in/courses/117/106/117106113/
2. https://stevens.netmeister.org/631/
3. https://www.cs.fsu.edu/~asriniva/courses/aup02/lectures.html

I MCA	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDIT
R24MCA208	3	0	0	40	60	100	3
DATA WAREHOUSING AND DATA MINING(PROGRAM ELECTIVE-1)							

Course Objectives:

- Be familiar with mathematical foundations of data mining tools..
- Understand and implement classical models and algorithms in data warehouses and data mining Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
- Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes

After completion of the course, the students would be able to:

CO1: Interpret the data mining terminology and types of data to be mined. [K2]

CO2: Compare and contrast different dominant Data Mining Algorithms for Classification and apply them. [K4]

CO3: Analyze the performance of Association Rules. [K4]

CO4: Compare and contrast different dominant Data Mining Algorithms for Clustering and apply them. [K4]

CO5: Interpret web data miming concepts and operations. [K2]

UNIT-1:

Introduction to Data mining, types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, Exploring Data: Data Set, Summary Statistics, Visualization, Data Warehouse, OLAP and multidimensional data analysis.

UNIT-II:

Classification: Basic Concepts, Decision Trees and model evaluation: General approach for solving a classification problem, Decision Tree induction, Model overfitting: due to presence of noise, due to lack of representation samples, Evaluating the performance of classifier. Nearest Neighbor classifier, Bayesian Classifier, Support vector Machines: Linear SVM, Separable and Non Separable case.

UNIT-III:

Association Analysis: Problem Definition, Frequent Item-set generation, rule generation, compact representation of frequent item sets, FP-Growth Algorithms. Handling Categorical, Continuous attributes, Concept hierarchy, Sequential, Subgraph patterns

UNIT-IV:

Clustering: Overview, K-means, Agglomerative Hierarchical clustering, DBSCAN, Cluster evaluation: overview, Unsupervised Cluster Evaluation using cohesion and separation, using proximity matrix, Scalable Clustering algorithm

UNIT-V:

Web data mining: Introduction, Web terminology and characteristics, Web co tent mining,

Web usage mining, web structure mining, Search Engines: Characteristics, Functionality, Architecture, Ranking of Web Pages, Enterprise search

Text Books:

1. Introduction to Data Mining, Tan, Steinbach and Vipin Kumar, Pearson Education, 2016
2. Data Mining: Concepts and Techniques, 2nd Edition, Jiawei Han and MichelineKamber, ELSEVIER
3. Data Mining, VikramPudi and P Radha Krishna, Oxford University Press

Reference Books:

1. DataMining: TheTextbook,Springer,May2015,CharuC.Aggarwal.

Web References:

1. https://nptel.ac.in/courses/106/105/106105174/
2. https://www.saedsayad.com/data_mining.htm
3. https://ocw.mit.edu/courses/15-062-data-mining-spring-2003/pages/lecture- notes/
4. https://www2.cs.uh.edu/~arjun/courses/dm/
5. https://www.rdatamining.com/resources/online-documents-books-and- tutorials
6. https://dataminingbook.info/book_html/

I MCA	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDIT
R24MCA209	3	0	0	40	60	100	3
FRONT END WEB TECHNOLOGIES (PROGRAM ELECTIVE-1)							

COURSE OBJECTIVE:

- This course is designed to introduce students with no programming experience to the programming languages and techniques associated with the World Wide Web. The course will introduce web-based media-rich programming tools for creating interactive web pages.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO1: Interpret a webpage and identify its elements and attributes.[K2].
CO2: Build webpages using HTML5 [K3].
CO3: Make use of Cascading Style Sheets on webpages [K3].
CO4: Make use of Java Script to write nteractive webpages [K3].
CO5: Build dynamic webpages with JQuery [K3].
CO6: Make use of JQuery UI to develop dynamic webpages [K3].

SYLLABUS:

UNIT I:

HTML5: Fundamentals of HTML, working with text, organizing text in HTML, working with Links and URLs, creating tables, working with Images, Colors and Canvas, working with Forms, working with Multimedia.

UNIT II:

Cascading Style Sheets: CSS3-Introduction to Cascading Style Sheets-Features – Inline Style, – Internal or embedded style sheets, External Style Sheet, backgrounds and color gradients in CSS, fonts and text styles, creating boxes and columns using CSS. Displaying, positioning and floating an element, list styles, table layouts, pseudo-classes and pseudo-elements. Effects in CSS.

UNIT - III:

Introduction to JavaScript: General syntactic characteristics, primitives, operations, expressions and Control Statements. Objects in JavaScript: Object creation and modification, Arrays, Functions. Dynamic HTML with JavaScript: Positioning elements, moving elements, element visibility, changing colors and fonts, dynamic content. Regular Expressions in JavaScript: Pattern matching using regular expressions. Working with Events: onload, onclick, onsubmit, onmouseover, onmouseout, onkeydown, onkeyup and onkeypress.

UNIT – IV:

JQuery API: Introduction: What jQuery can Do, Who Develops jQuery? Obtaining jQuery, Installing jQuery, programming conventions, markup and CSS conventions, JavaScript conventions. Selecting and Filtering Elements: Using the selectors API, filtering a selection, working within the context of a selection, working with an element's relatives, slicing a selection, adding to a selection. Events: The various event wrapper methods, attaching other events, attaching persistent event handlers, removing event Handlers,creating custom events.

UNIT – V:

JQuery UI: Drag and Drop: Implementing Drag and Drop, Sortable: Making a List Sortable, Customizing Sortable, Selectable, Accordion: Building an Accordion UI, Changing the Default Pane, Changing the Accordion Event, Setting the Header Elements, Date picker: Implementing a Date picker, Localizing the Date picker, Dialogue: Implementing a Dialog, Styling a Dialog, Making a Modal Dialog, Auto-Opening the Dialog, Controlling Dynamic Interaction, Animating the Dialog, Working with Dialog Events.

TEXT BOOKS:

1. Kogent Learning solutions Inc., "HTML 5 Black book", Dreamtech.,2011, (Unit I,II,III).
2. Uttam K Roy, "Web Technologies",Oxford,2010 (Unit IV).
3. Richard York , Web Development with JQuery, Wiley publications, 2/e ,2015(Unit V)

REFERENCE BOOKS:

1. Robert W Sebesta, "Programming the World Wide Web", 7ed, Pearson, 2012
2. Paul S Wang, Sanda S Katila, "An Introduction to Web Design, Programming", Cengage, 2003.

WEB REFERENCES:

- https://www.w3schools.com/
- nptel.ac.in/courses/106105084/13
- https://www.coursera.org
- https://www.w3schools.com/
- https://jqueryui.com/
- https://api.jquery.com/
- https://www.educba.com/what-is-html5/

I MCA	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDIT
R24MCA2L1	0	0	3	40	60	100	1.5

OBJECT ORIENTED PROGRAMMING USING JAVA LAB

Course Objectives:

- To understand how to design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and control structures, string handling and functions.
- To understand the importance of Classes & objects along with Arrays and Vectors. constructors,
- Discuss the principles of inheritance, interface and packages and demonstrate through problem analysis assignments how they relate to the design of methods, abstract classes and interfaces and packages.
- To understand the importance of Multi-threading & different exception handling mechanisms.
- To learn experience of designing, implementing, testing, and debugging graphical user interfaces in Java using applet and AWT that respond to different user events.
- To understand Java Swings for designing GUI applications based on MVC architecture

Course Outcomes

After completion of the course, the students would be able to:

CO1: Develop java programs by using OOP concepts [K3].

CO2: Make use of interfaces, threads, applets in developinging JAVA programmes [K3].

CO3: Make use of exception handling and collections in Java Programming[K3].

CO4: Develop java components [K3].

List of Experiments: The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 1, 1. Every subsequent value is the sum of the 2 values preceding it. Write a Java Program that uses both recursive and non recursive functions to print the nth value of the Fibonacci sequence.

1. Write a Java Program that prompts the user for an integer and then prints out all the prime numbers up to that Integer.
2. Write a Java Program that checks whether a given string is a palindrome or not. Ex. MALAYALAM is a palindrome
3. Write a Java Program for sorting a given list of names in ascending order.
4. Write a Java Program that illustrates how runtime polymorphism is achieved.Write a Java Program to create and demonstrate packages.
5. Write a Java Program, using StringTokenizer class, which reads a line of integers and then displays each integer and the sum of all integers.
6. Write a Java Program that reads a file name form the user then displays information about whether the file exists, whether the file is readable/ writable, the type of file and the length of the file in bytes and display the contents using File Input Stream class.
7. Write a Java Program that displays the number of characters, lines and words in a text/text file.
8. Write a Java Program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +-*?% operations. Add a text field to display the result.
9. Write a Java Program for handling mouse events.
10. Write a Java Program demonstrating the life cycle of a thread.
11. Write a Java Program that lets users create Pie charts. Design your own user interface (with Swings & AWT).

12. Write a Java Program to implement a Queue, using user defined Exception Handling (also make use of throw, throws).

Web References:

- https://www.iitk.ac.in/esc101/05Aug/tutorial/information/resources.html
- https://labex.io/skilltrees/java
- https://docs.oracle.com/javase/tutorial/index.html
- https://introcs.cs.princeton.edu/java/home/

I MCA	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDIT
R24MCA2L2	0	0	3	40	60	100	1.5
NETWORKS AND SECURITY LAB							

Course Objectives:

- To learn basic understanding of cryptography, how it has evolved, and some key encryption techniques used today..
- To understand and implement encryption and decryption using Caesar Cipher, Substitution Cipher, Hill Cipher.

Course Outcomes

After completion of the course, the students would be able to:

CO1: Analyze security concepts and type of attacks and network security algorithms. [K4]

CO2: Apply symmetric and asymmetric key cryptography technique to encrypt and decrypt text. [K4]

CO3: Apply Cryptography Hash Function for message authentication and to solve other applications. [K3]

List of Experiments:

1. Implement the data link layer farming methods such as character stuffing and bit stuffing.
2. Implement on a data set of characters the three CRC polynomial CRC 16 and CRC CCIP. CRC12,
3. Implement Dijkstra‘s algorithm to compute the Shortest path thru a graph.
4. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm
5. Take an example subnet of hosts. Obtain a broadcast tree for it.
6. Write a C program that contains a string (char pointer) with a value ‘Hello World’. The program should XOR each character in this string with 0 and display the result.
7. Write a C program that contains a string (char pointer) with a value ‘Hello World’. The program should AND or and XOR each character in this string with 127 and display the result
8. Write a Java program to perform encryption and decryption following algorithms:

a) Caesar Cipher
b) Substitution Cipher
c) Hill Cipher

using the

9. Write a Java program to implement the DES algorithm logic
10. Write a C/JAVA program to implement the BlowFish algorithm logic
11. Write a C/JAVA program to implement the Rijndael algorithm logic.
12. Using Java Cryptography, encrypt the text “Hello world” using BlowFish.
13. Create your own key using Java key tool.

a) Write a Java program to implement RSA Algorithm
b) Write a Java program to implement Public key Algorithm like El Gamal
c) Implement the Diffie-Hellman Key Exchange mechanism using HTML

Web References:

1. https://csrc.nist.rip/publications/nistpubs/800-12/800-12-html/chapter19.html
2. http://vlabs.iitkgp.ac.in/ant/
3. https://networklessons.com/labs/network-fundamentals-lab-1
4. https://elearn.daffodilvarsity.edu.bd/course/view.php?id=10230
5. https://www.cybrary.it/practice-lab/cryptography-basics
6. https://www.infosecinstitute.com/resources/cryptography/cryptographic-algorithms- lab/

I MCA	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDIT
R24MCA2MNC	1	0	0	40	60	100	0
EMPLOYABILITY SKILLS-I							

UNIT – I:

1. Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by AzimPremji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

2. Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT – II:

1. Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

2. Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Etiquette Dining

UNIT – III:

3. Standard Operation Methods: Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

4. Verbal Ability: Synonyms, Antonyms, One Word Substitutes-Correction of Sentences-Analogies, Spotting Errors, Sentence Completion, Course of Action - Sentences Assumptions, Sentence Arguments, Reading Comprehension, Practice work

UNIT-IV:

5. Job-Oriented Skills –I: Group Discussion, Mock Group Discussions

UNIT-V:

6. Job-Oriented Skills –II: Resume Preparation, Interview Skills, Mock Interviews

Text books and Reference books:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.
3. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018.
4. Raman, Meenakshi& Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

Web References:

1. www. Indiabix.com
2. www.freshersworld.com

II MCA III SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA301	3	0	0	40	60	100	3
MACHINE LEARNING USING PYTHON							

Course Objectives:

From the course the student will

- Learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
- Design and analyze various machine learning algorithms and techniques with a modern outlook
  focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.
- Explore Deep learning technique and various feature extraction strategies.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Analyze practical issues in machine learning application using Python. [K4]

CO2: Evaluate and compare the performance of different supervised and Un-supervised algorithms for typical learning problems and apply them. [K2]

CO3: Outline the need and importance of Data and Engineering Features. [K2]

CO4: Apply Data Visualization techniques on Text data. [K3]

UNIT-I:

Introduction to Machine Learning with Python: Introduction to Machine Learning, basic terminology, Types of Machine Learning and Applications, Using Python for Machine Learning: Installing Python and packages from the Python Package Index, Introduction to NumPy, SciPy, matplotlib and scikit-learn, Pandas. Tiny application of Machine Learning.

UNIT-II:

Supervised Learning: Types of Supervised Learning, Supervised Machine Learning Algorithms: k-Nearest Neighbors, Linear Models, Naive Bayes Classifiers, Decision Trees, Ensembles of Decision Trees, Kernelized Support Vector Machines, Uncertainty Estimates from Classifiers.

UNIT-III:

Unsupervised Learning: Types of Unsupervised Learning, challenges, Preprocessing and scaling, Dimensionality Reduction, Feature Extraction, Manifold Learning, Clustering: K- Means Clustering, Agglomerative Clustering, DBSCAN, Comparing and Evaluating Clustering Algorithms.

UNIT-IV:

Representing Data and Engineering Features: Categorical Variables, Binning, Discretization, Linear Models, Trees, Interactions and Polynomials, Univariate Nonlinear Transformations, Automatic Feature Selection. Parameter Selection with Preprocessing, Building Pipelines, The General Pipeline Interface

UNIT-V:

Working with Text Data (Data Visualization) : Types of Data Represented as Strings, Example Application: Sentiment Analysis of Movie Reviews, Representing Text Data as a Bag of Words, Stop Words, Rescaling the Data with tf-idf, Investigating Model Coefficients, Approaching a Machine Learning Problem, Testing Production Systems, Ranking, Recommender Systems and Other kinds of Learning.

Text Books:

1. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Muller & Sarah Guido, Orielly Publications, 2019.
2. Python Machine Learning, Sebastian Raschka & Vahid Mirjalili, 3rd Edition, 2019.
3. Building Machine Learning Systems with Python, Luis Pedro Coelho, Willi Richert, 2nd Edition, 2015.

Reference Books:

Machine Learning, Tom M. Mitchell, Mc Graw-Hill Publication, 2017

Web References:

- https://www.freecodecamp.org/learn/machine-learning-with-python
- https://www.coursera.org/learn/machine-learning-with-python
- https://www.nielit.gov.in/calicut/content/machine-learning-using-python-smart-lab-free-course
- https://onlinecourses.swayam2.ac.in/ini25_cs02/preview

II MCA III SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA302	3	0	0	40	60	100	3
FULL STACK DEVELOPMENT							

COURSE OBJECTIVES:
The main objective of the course is to provide understanding on the essential javascript, bootstrap, ReactJS concepts for web development and to store and model data in a no sql database.

COURSE OUTCOMES:
After Completion of this course student will be able to:
CO1: Build webpages using Java Script [K3].
CO2: Outline the need and importance of Document Object Model. [K2]
CO3: Summarize the importance of MERN components. [K2].
CO4: Make use of various formats in React.JS components. [K3]
CO5: Identify and apply the need and importance of MongoDB techniques [K3].

UNIT I:
Basic JavaScript Instructions, Statements, Comments, Variables, Data Types, Arrays, Strings, Functions, Methods & Objects, Decisions & Loops.
Text Book 1: Chapter 2, 3, 4

UNIT II:
Document Object Model: DOM Manipulation, Selecting Elements, Working with DOM Nodes, Updating Element Content & Attributes, Events, Different Types of Events, How to Bind an Event to an Element, Event Delegation, Event Listeners.
Text Book 1: Chapter: 5, 6, 13

UNIT III:
Form enhancement and validation. Introduction to MERN: MERN components, Server less Hello world. React Components: Issue Tracker, React Classes, Composing Components, Passing Data Using Properties, Passing Data Using Children, Dynamic Composition.
Text Book 2: Chapter 1, 2, 3

UNIT IV:
React State: Initial State, Async State Initialization, Updating State, Lifting State Up, Event Handling, Stateless Components, Designing Components, State vs. Props, Component Hierarchy, Communication, Stateless Components. Express, REST API, GraphQL, Field Specification, Graph Based, Single Endpoint, Strongly Typed, Introspection, Libraries, The About API GraphQL Schema File, The List API, List API Integration, Custom Scalar types, The Create API, Create API Integration, Query Variables, Input Validations, Displaying Errors.
Text Book 2: Chapter 4, 5

UNIT V;
MongoDB: Basics, Documents, Collections, Databases, Query Language, Installation, The Mongo Shell, MongoDB CRUD Operations, Create, Read, Projection, Update, Delete, Aggregate, MongoDB Node.js Driver, Schema Initialization, Reading from MongoDB, Writing to MongoDB. Modularization and Webpack ,Back-End Modules Front-End Modules and Webpack Transform and Bundle, Libraries Bundle ,Hot Module Replacement, Debugging Define Plugin: Build Configuration, Production Optimization. Text Book 2: Chapter 6, 7

Text Books:

1. Jon Duckett, "JavaScript & jQuery: Interactive Front-End Web Development", Wiley, 2014.
2. Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node. Apress, 2019.

Web References:

- https://github.com/vasansr/pro-mern-stack
- https://nptel.ac.in/courses/106106156
- https://archive.nptel.ac.in/courses/106/105/106105084/

II MCA III SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA303	3	0	0	40	60	100	3
BIG DATA TECHNOLOGIES							

Course objectives:
The main objective of this course is to implement Map Reduce programs for processing big data, realize storage and processing of big data using MongoDB, Pig, Hive and Spark and analyze big data using machine learning techniques.

Course Outcomes:
After successful completion of this course, the students will be able to:
CO1: Interpret the architectural elements of big data and Hadoop framework. [K2]
CO2: Analyse various big data applications using map reduce programming module. [K4]
CO3: Identify and apply the need and importance of MongoDB techniques [K3].
CO4: Analyze Hadoop data with PIG and Hive. Interpret the applications and architecture of Mobile Computing and multiplexing techniques. [K4]
CO5: Summarize Spark's powerful built-in libraries, including Spark SQL, Spark Streaming. [K2]

UNIT I:
Classification of data, Characteristics, Evolution and definition of Big data, What is Big data, Why Big data, Traditional Business Intelligence Vs Big Data, Typical data warehouse and Hadoop environment. Big Data Analytics: What is Big data Analytics, Classification of Analytics, Importance of Big Data Analytics, Technologies used in Big data Environments, Few Top Analytical Tools , NoSQL, Hadoop.
TB1: Ch 1: 1.1, Ch2: 2.1-2.5,2.7,2.9-2.11, Ch3: 3.2,3.5,3.8,3.12, Ch4: 4.1,4.2

UNIT II:
Introduction to Hadoop: Introducing hadoop, Why hadoop, Why not RDBMS, RDBMS Vs Hadoop, History of Hadoop, Hadoop overview, Use case of Hadoop, HDFS (Hadoop Distributed File System), Processing data with Hadoop, Managing resources and applications with Hadoop YARN(Yet Another Resource Negotiator). Introduction to Map Reduce Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.
TB1: Ch 5: 5.1-,5.8, 5.10-5.12, Ch 8: 8.1 - 8.8

UNIT III:
Introduction to MongoDB: What is MongoDB, Why MongoDB, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.
TB1: Ch 6: 6.1-6.5

UNIT IV:
Introduction to Hive: What is Hive, Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF). Introduction to Pig: What is Pig, Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use case for Pig, Pig Latin Overview, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User Defined Function, Pig Vs Hive.
TB1: Ch 9: 9.1-9.6,9.8, Ch 10: 10.1 - 10.15, 10.22

UNIT V:
Spark and Big Data Analytics: Spark, Introduction to Data Analysis with Spark. Text, Web Content and Link Analytics: Introduction, Text Mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and Analyzing a Web Graph.
TB2: Ch5: 5.2,5.3, Ch 9: 9.1-9.4

Text Books:

1. Seema Acharya, Subhashini Chellappan "Big data and Analytics" Wiley India Publishers, 2nd Edition, 2019.
2. Rajkamal, Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning" , McGraw Hill Publication, 2019

Reference Books:

1. Adam Shook and Donald Mine, "MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems" - O'Reilly 2012
2. Tom White, "Hadoop: The Definitive Guide" 4th Edition, O'reilly Media, 2015.
3. Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016
4. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020, 2nd Edition

Web References:

- https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset
- https://www.youtube.com/watch?v=bAyrObl7TYE&list=PLEiEAq2VkUUJqp1k-g5W1mo37urJQOdCZ
- https://www.youtube.com/watch?v=VmO0QgPCbZY&list=PLEiEAq2VkUUJqp1kg5W 1mo37urJQOdCZ&in dex=4
- https://www.youtube.com/watch?v=GG-VRm6XnNk
- https://www.youtube.com/watch?v=JglO2Nv_92A

II MCA III SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA304	3	0	0	40	60	100	3
CLOUD COMPUTING (PROGRAM ELECTIVE-2)							

Course Objectives:

- To explain the evolving computer model caned cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.
- To motivate students to do programming and experiment with the various cloud computing environments.

COURSE OUTCOMES:

CO1: Ensure System Performance Security, Optimize Energy Efficiency In Distributed Computing.
CO2: Implement Data Center Automation Through Advanced Virtualization Mechanisms.
CO3: Design Compute And Storage Architectures, Evaluate Public Cloud Platforms and Architectures.
CO4: Monitor the Security in cloud.
CO5: Explore cloud platforms, programming paradigms, tools, and emerging environments.

UNIT–I:

Systems modeling, Clustering and virtualization: Scalable Computing over the Internet, Technologies for Network based systems, System models for Distributed and Cloud Computing, Software environments for distributed systems and clouds, Performance, Security And Energy Efficiency.

UNIT–II:

Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structures/ Tools and mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data Centre Automation.

UNIT–III:

Cloud Platform Architecture: Cloud Computing and service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, Inter Cloud Resource Management, Cloud Security and Trust Management. Service Oriented Architecture, Message Oriented Middleware.

UNIT–IV:

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel & Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments. **Storage Systems**: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system., Apache Hadoop, BigTable, Megastore, Amazon Simple Storage Service(S3).

UNIT-V:

Cloud Resource Management and Scheduling : Policies and Mechanisms for Resource Management Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds, Fair Queuing, Start Time Fair Queuing, Borrowed Virtual Time, Cloud Scheduling Subject to Deadlines, Scheduling MapReduce Applications Subject to Deadlines.

Text Books:

1. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
3. Cloud Computing, A Hands on approach, Arshadeep Bahga, Vijay Madisetti, University Press

Reference Books:

1. Cloud Computing: A Practical Approach. Anthony T.Velte. Toby J.VeFte, Robert Elsenpeter. Tata McGraw Hill. rp2Oll.
2. Enterprise Cloud Computing Gautam Shroif, Cambridge University Press. 2010.
3. Cloud Computing: Implementation, Management and Security, John W. Rittinouse, James F Ransome. CRC Press, rp2012.
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud. George
5. Reese, O'Really SPD, rp2Oll,
   Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Ktriaraswamy, Shahed Latif, O'Redç SPD, rp2Oll.

Web References:

- http://nptel.ac.in/courses/106106129/21
- https://freevideolectures.com/course/3649/cloud-computing
- https://www.youtube.com/watch?v=Eg4AAGCE7X4&list=PL2UlrhJ_JwyA5IlOCdEWlNArFke4jgtlg

II MCA III SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA305	3	0	0	40	60	100	3
IMAGE PROCESSING (PROGRAM ELECTIVE-2)							

Course Objectives:

- To comprehend the relation between human visual system and machine perception and processing of digital images.
- To provide a detailed approach towards image processing applications like enhancement, segmentation, and compression.

Course Outcomes:

CO1: Model image formation, camera transformations, 3D space, and perception.
CO2: Perform noise removal, blurring, edge, texture, and corner detection.
CO3: Implement segmentation techniques using color, motion, texture, and shape models.
CO4: Applying machine learning models for classification, sequence learning, and vision
CO5: Develop object tracking, modeling, recognition techniques using geometry and learning.

UNIT – I:

Image Formation and Coordinate Transformations Camera Matrix, Motion, Stereo Pin-hole model, Human eye, cognitive aspects of color, 3D space; illumination; Sampling and Quantization Coordinate transformations and camera parameters

UNIT – II:

Image Processing - Noise Removal, Blurring, Edge Detection: Canny, Gaussian, Gabor, Texture Edges, Curvature, Corner Detection.

UNIT – III:

Segmentation - Concept of Figure vs. Ground, Watershed, Change Detection, Background Subtraction, Texture Segmentation, Gaussian Mixture Models, Applications in Color, Motion based Image Segmentation, Background Modeling and Shape Clustering

UNIT – IV:

Machine Learning techniques in Vision, Bayesian Classification, Maximum Likelihood Methods, Neural Networks; Non-parametric models; Manifold estimation Support Vector Machines ; Temporal sequence learning.

UNIT – V:

Introduction to Object Tracking, Exhaustive vs. Stochastic Search Shapes, Contours, Appearance Models. Mean-shift tracking; Contour-based models, Object Modeling and Recognition Fundamental matrix, Epipolar geometry Adaboost approaches: Face Detection, Recognition Large Datasets; Attention models.

Text Books:

1. David Forsyth and Jean Ponce, Computer Vision: A modern Approach, PHI.
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2008.

Reference Books:

1. E.R. Davies, Machine Vision, Theory Algorithms Practicalities, Elsevier 2005
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, Image Processing, Analysis, and Machine Vision. Brooks, Cole, Thomson 1999

3. Russell, Norvig: AI: A modern Approach, Prentice Hall 2000.
4. Richard Hartley, Andrew Zisserman, Multiple View Geometry in Computer Vision, Cambridge Univ Press 2000
5. Richard O. Duda, Peter E. Hart, David G. Stork, Pattern Classification, 2nd ed., Wiley Asia, 2002

Web References:

- https://onlinecourses.nptel.ac.in/noc25_ee126/preview
- https://en.wikipedia.org/wiki/Digital_image_processing

II MCA III SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA306	3	0	0	40	60	100	3
INTERNET OF THINGS (PROGRAM ELECTIVE-2)							

Course Objectives:

- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
- Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).
- Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

COURSE OUTCOMES:

CO1: Demonstrate knowledge and understanding of the security and ethical issues of the Internet of Things
CO2: Conceptually identify vulnerabilities involving the Internet of Things
CO3: Develop critical thinking skills
CO4: Conceptually identify recent security attacks.

UNIT I:

The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind Io Ts Sources of the Io Ts, M2M Communication, Examples of IoTs, Design Principles For Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

UNIT II:

Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations ,Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High-level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability

UNIT III:

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

UNIT IV:

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services / Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

UNIT V:

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.

Text Books:

1. Internet of Things: Architecture, Design Principles and Applications, 1st ed, Rajkamal, McGraw Hill Higher Education, 2017.
2. Internet of Things, 1st ed, A.Bahgya and V.Madisetti, Univesity Press, 2014

Reference Books:

1. Designing the Internet of Things, 1st ed, Adrian McEwen and Hakim Cassimally, Wiley, 2013.
2. Getting Started with the Internet of Things, 1st ed, CunoPfister, Oreilly, 2011.

Web References:

- https://www.youtube.com/watch?v=G4-CtKkrOmc
- http://www.cse.wustl.edu/~jain/cse570-13/m_18iot.htm
- https://www.youtube.com/watch?v=9ZUFYyXhQm8
- https://www.udemy.com/introduction-to-iot-using-raspberry-pi-2/

II MCA III SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA307	3	0	0	40	60	100	3
DevOps (PROGRAM ELECTIVE-2)							

COURSE OBJECTIVES:

- DevOps improves collaboration and productivity by automating infrastructure and workflows and continuously measuring applications performance.

COURSE OUTCOMES:

At the end of the course, student will be able to

CO1: Demonstrate the phases of software development life cycle. [K2]
CO2: Outline the basic Fundamentals of DevOps. [K2]
CO3: Adopt the DevOps technology into the project. [K6]
CO4: Evaluate the CI/CD concepts and metrics to track CI/CD practices. [K5]
CO5: Summarize the importance of DevOps maturity models. [K2]

SYLLABUS:

UNIT- I

Phases of Software Development life cycle. Values and principles of agile software development.

UNIT- II

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of Applications, DevOps delivery pipeline, DevOps eco system.

UNIT- III

DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

UNIT- IV

CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment, Benefits of CI/CD, Metrics to track CICD practices

UNIT- V

Devops Maturity Model: Key factors of DevOps maturity model, stages of Devops maturity Model, DevOps maturity Assessment

TEXT BOOKS:

1. Gene Kim , John Willis , Patrick Debois, “The DevOPS Handbook: How to Create WorldClass Agility, Reliability, and Security in Technology Organizations” Jez Humb,O’Reilly Publications
2. Mike Loukides, “What is Devops? Infrastructure as code” O’Reilly publications.
3. Jez Humble and David Farley, “Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation”,
4. Dave Harrison, Knox Lively, “Achieving DevOps: A Novel About Delivering the Best of Agile, DevOps, and Microservices.
5. Joakim Verona , Packt, “Practical Devops”

REFERENCE BOOKS:

1. Mandi Walls, “Building a DevOps Culture”, O’Reilly publications
2. Viktor Farcic, “The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline With Containerized Micro services”

WEB REFERENCES:

- https://www.youtube.com/watch?v=hQcFE0RD0cQ
- https://www.youtube.com/watch?v=YSkDtQ2RA_c
- https://www.svrtechnologies.video/courses/devops-training-free/lectures/10955807 4. https://www.youtube.com/watch?v=MOZMw5_fBFA

II MCA III SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA308	3	0	0	40	60	100	3
HUMAN RESOURCE MANAGEMENT							

COURSE OBJECTIVES:

- Contribute to the development, implementation, and evaluation of employee recruitment, selection, and retention plans and processes.
- Administer and contribute to the design and evaluation of the performance management program.
- Develop, implement, and evaluate employee orientation, training, and development programs.
- Facilitate and support effective employee and labour relations in both non-union and union environments.

COURSE OUTCOMES:

The student is able to

CO1: Understand the role of HRM at global perspective. [K2]
CO2: Choose the methods of Recruitment & Selection. [K3]
CO3: Identify the determinants of payment of wages and welfare facilities. [K3]
CO4: Understand the various methods of performance appraisal. [K2]
CO5: Select the Grievance Handling Procedures, Industrial Disputes Resolution Mechanisms. [K3]

UNIT I:

HRM: Significance, Definition and Functions, evolution of HRM, Principles, Ethical Aspects of HRM, HR policies, Strategies to increase firm performance, Role and position of HR department, aligning HR strategy with organizational strategy, HRM at global perspective challenges, cross-cultural problems, emerging trends in HRM.

UNIT II:

Investment perspectives of HRM: HR Planning, Demand and Supply forecasting, Recruitment and Selection, Sources of recruitment, Tests and Interview Techniques, Training and Development, Methods and Techniques, Training evaluation, retention, Job Analysis, job description and specifications, Management development, HRD concepts.

UNIT III:

Wage and Salary Administration: Concept, Wage Structure, Wage and Salary Policies, Legal Framework, Determinants of Payment of Wages, Wage Differentials, Job design and Evaluation, Incentive Payment Systems. Welfare management: Nature and concepts, statutory and non-statutory welfare measures, incentive mechanisms.

UNIT IV:

Performance Evaluation: Importance, Methods, Traditional and Modern methods, Latest trends in performance appraisal, Career Development and Counseling- Compensation, Concepts and Principles, Influencing Factors, Current Trends in Compensation, Methods of Payments, compensation mechanisms at international level.

UNIT V:

Managing Industrial Relations: Trade Unions, Employee Participation Schemes, Collective Bargaining, Grievances and disputes resolution mechanisms, Safety at work, nature and importance, work hazards, safety mechanisms, Managing work place stress.

Text Books:

1. K Aswathappa: "Human Resource and Personnel Management", Tata McGraw Hill, New Delhi, 2013
2. N.Sambasiva Rao and Dr. Nirmal Kumar: "Human Resource Management and Industrial Relations", Himalaya Publishing House, Mumbai
3. Mathis,Jackson,Tripathy:"Human Resource Management: Asouth-Asin Perspective",
   Cengage Learning, New Delhi, 2013
4. Subba Rao P: "Personnel and Human Resource Management-Text and Cases", Himalaya Publications, Mumbai, 2013.
5. Madhurima Lall, Sakina Qasim Zasidi: "Human Resource Management", Excel Books, New Delhi, 2010

Web References:

- https://en.wikipedia.org/wiki/Human_resource_management
- https://www.drnishikantjha.com/booksCollection/hrm-basic-notes.pdf
- https://www.coursera.org/in/articles/human-resource-management

II MCA III SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA3L1	0	0	3	40	60	100	1.5

FULL STACK DEVELOPMENT LAB

Course objectives:

- To understand the essential JavaScript concepts for web development.
- To style Web applications using bootstrap.
- To utilize React JS to build front end User Interface.
- To understand the usage of API's to create web applications using Express JS.
- To store and model data in a no sql database.

COURSE OUTCOMES

After Completion of this course student will be able to:

CO1: Develop static html pages by using HTML5 elements and attributes.[K3].
CO2: Construct a static html pages by using Cascading Style Sheets [K3].
CO3: Build webpages using Java Script [K3].
CO4: Develop a Web pages Using JQuery [K3].

List of Experiments:

1. a. Write a script that Logs "Hello, World!" to the console. Create a script that calculates the sum of two numbers and displays the result in an alert box.
b. Create an array of 5 cities and perform the following operations:
Log the total number of cities. Add a new city at the end. Remove the first city. Find and log the index of a specific city.

2. a. Read a string from the user, Find its length. Extract the word "JavaScript" using substring() or slice(). Replace one word with another word and log the new string. Write a function isPalindrome(str) that checks if a given string is a palindrome (reads the same backward).

3. Create an object student with properties: name (string), grade (number), subjects (array), displayInfo() (method to log the student's details)
Write a script to dynamically add a passed property to the student object, with a value of true or false based on their grade. Create a loop to log all keys and values of the student object.

4. Create a button in your HTML with the text "Click Me". Add an event listener to log "Button clicked!" to the console when the button is clicked. Select an image and add a mouseover event listener to change its border color. Add an event listener to the document that logs the key pressed by the user.

5. Build a React application to track issues. Display a list of issues (use static data). Each issue should have a title, description, and status (e.g., Open/Closed). Render the list using a functional component.
6. Create a component Counter with A state variable count initialized to 0. Create Buttons to increment and decrement the count. Simulate fetching initial data for the Counter component using use Effect (functional component) or component Did Mount (class component). Extend the Counter component to Double the count value when a button is clicked. Reset the count to 0 using another button.

7. Install Express (npm install express).
Set up a basic server that responds with "Hello, Express!" at the root endpoint (GET /). Create a REST API. Implement endpoints for a Product resource: GET : Returns a list of products. POST: Adds a new product. GET /:id: Returns details of a specific product. PUT /:id: Updates an existing product. DELETE /:id: Deletes a product. Add middleware to log requests to the console. Use express.json() to parse incoming JSON payloads.

8. Install the MongoDB driver for Node.js. Create a Node.js script to connect to the shop database. Implement insert, find, update, and delete operations using the Node.js MongoDB driver. Define a product schema using Mongoose. Insert data into the products collection using Mongoose. Create an Express API with a /products endpoint to fetch all products. Use fetch in React to call the /products endpoint and display the list of products. Add a POST /products endpoint in Express to insert a new product. Update the Product List, After adding a product, update the list of products displayed in React.

Web References:

1. **https://www.w3schools.com/html**
2. **https://www.w3schools.com/css**
3. **https://www.w3schools.com/js/**
4. **https://www.w3schools.com/nodejs**

II MCA III SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA3L2	0	0	4	40	60	100	2
MACHINE LEARNING WITH PYTHON LAB							

COURSE OBJECTIVES:

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.
- Design Python programs for various Learning algorithms.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:
CO1: Analyse exploratory data analysis. [K4]
CO2: Analyze the real word datasets presented in different formats using python libraries to Perform exploratory data analysis.[K4]
CO3: Apply the machine learning algorithms on various real time data sets. [K3]
CO4: Analyze the data by using visualization tools or libraries. [K4]

Experiment 1:
Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .csv file

Experiment 2:
For a given set of training data examples stored in a .csv file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples

Experiment 3:
Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Experiment 4:
Write a Python program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.

Experiment 5:
Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

Experiment 6:
Write a program to implement the naive Bayesian classifier for a sample training data set stored as a .csv file. Compute the accuracy of the classifier, considering few test data sets.

Experiment 7:
Write a Python program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.

Experiment 8:
Assuming a set of documents that need to be classified, use the naive Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision and recall for your data set.

Experiment 9:
Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering using Python Programming.

Experiment 10:
Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Web References:

1. https://onlinecourses.nptel.ac.in/noc21_cs22/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs23/preview
3. https://onlinecourses.nptel.ac.in/noc21_cs24/preview
4. https://onlinecourses.nptel.ac.in/noc21_cs51/preview

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II MCA III SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA3L3	0	0	3	40	60	100	1.5
BIG DATA TECHNOLOGIES LAB							

COURSE OBJECTIVES:

1. To implement Map Reduce programs for processing big data.
2. To realize storage and processing of big data using MongoDB, Pig, Hive and Spark.
3. To analyze big data using machine learning techniques.

COURSE OUTCOMES:

After successful completion of the course, student will be able to:

CO1: Experiment with installation of Hadoop and develop applications using MapReduce framework. [K3]
CO2: Experiment with installation of Spark and develop applications. [K3]
CO3: Analyze Hadoop data with PIG. [K4]
CO4: Develop NoSQL structures like Hive for processing and aggregating logs in the database. [K3] L

List of Experiments:

1. Install Hadoop and Implement the following file management tasks in Hadoop: Adding files and directories Retrieving files Deleting files and directories. Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.
2. Develop a Map Reduce program to implement Matrix Multiplication
3. Develop a Map Reduce program that mines weather data and displays appropriate messages indicating the weather conditions of the day.
4. Develop a Map Reduce program to find the tags associated with each movie by analyzing movie lens data.
5. Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB
6. \Write Pig Latin scripts to sort, group, join, project, and filter the data.
7. Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
8. Implement a word count program in Hadoop and Spark.
9. Use CDH (Cloudera Distribution for Hadoop) and HUE (Hadoop User Interface) to analyze data and generate reports for sample datasets

Web References:

1. http://hadoop.apache.org/
2. https://cwiki.apache.org/confluence/display/Hive/Home
3. http://pig.apache.org/docs/r0.7.0/tutorial.html

II MCA III SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA3MNC	1	0	0	40	60	100	0
EMPLOYABILITY SKILLS–2							

COURSE OBJECTIVES:

The main objective of the course is to develop a range of skills and attributes essential for success in the workplace

COURSE OUTCOMES:

CO1: Apply number systems, averages, ratios, and profit-loss concepts to solve numerical problems. [K3]
CO2: Solve problems on ages, work, pipes, time, and distance using arithmetic reasoning. [K3]
CO3: Analyze interest, mixtures, calendars, and probability for practical decision-making. [K4]
CO4: Calculate areas and volumes using mensuration and geometric principles. [K3]
CO5: Interpret and analyze data from tables and graphs for effective decision-making. [K4]

UNIT I :

Numerical ability l: Number system, HCF & LCM, Average, Simplification, Problems on numbers
Numerical ability II: Ratio & Proportion, Partnership, Percentages, Profit & Loss

UNIT II :

Arithmetical ability l: Problems on ages, Time & Work, Pipes & Cistern, Chain Rule.
Arithmetical ability ll: Time & Distance, Problems on boats &Steams, Problems on Trains

UNIT III:

Arithmetical ability lll: Allegation, Simple interest and compound interest, Races & Games of skills, Calendar and Clock,
Logical ability: Permutations and Combination and Probability.

UNIT IV:

Mensuration: Geometry, Areas, Volumes,

UNIT V:

Data interpretation: Tabulation, Bar graphs, Pie charts, line graphs

Text books:

1. R. S. Aggarwal "Quantitative Aptitude", Revised ed., S Chand publication, 2017 ISBN:8121924987

Web References:

- https://blog.feedspot.com/aptitude_youtube_channels/
- https://www.tutorialspoint.com/quantitative_aptitude/
- https://www.careerbless.com/aptitude/qa/home.php

IV SEMESTER

II MCA IV SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA401	3	0	0	40	60	100	3
UNIFIED MODELING LANGUAGE (PROGRAM ELECTIVE-3)							

COURSE OBJECTIVES:

- To understand the Object-based view of Systems
- To develop robust object-based models for Systems
- To explain necessary skills to handle complexity in software design

COURSE OUTCOMES:

Upon the completion of the course, the students will be able to:

CO1: Illustrate the conceptual model of UML in Architecture.

CO2: Outline Common Modeling Techniques of Structural Modeling.

CO3: Analyze, design and document the requirements through use case driven approach.

CO4: Identify, analyze and model the behavioral concepts of a system and Apply Unified Modeling Language (UML) towards analysis and design.

CO5: Apply the concepts of architectural design for deploying the code for software.

UNIT- I:

Introduction to UML: The meaning of Object-Orientation, object identity, encapsulation, information hiding, polymorphism, importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture.

UNIT-II:

Basic structural Modeling: Classes, relationships, common mechanisms, diagrams, **Advanced structural modeling:** advanced relationships, interfaces, types & roles, packages, instances, **Class & object diagrams**: Terms, concepts, examples, modeling techniques, class & Object diagrams.

UNIT-III:

Collaboration diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration diagrams, iterated messages, use of self in messages, **Sequence diagrams:** Terms, concepts, differences between collaboration and sequence diagrams, depicting synchronous messages with/without priority call back mechanism broadcast message.

UNIT- IV:

Behavioral Modeling: Interactions, use cases, use case diagrams, activity diagrams, **Advanced Behavioral Modeling**: Events and signals, state machines, processes & threads, time and space, state chart diagrams.

UNIT–V:

Architectural Modeling: Terms, concepts, examples, modeling techniques for component diagrams and deployment diagrams.

Text Books:

1. The Unified Modeling Language User Guide, 2nd Edition, Grady Booch, Rambaugh, Ivar Jacobson, PEA, 2005
2. Fundamentals of Object Oriented Design in UML, 1st Edition, Meilir Page Jones, Addison Wesley,2000

Reference Books:

1. Head First Object Oriented Analysis & Design, 1st Edition, Mclaughlin, SPD O'Reilly, 2006
2. Object oriented Analysis & Design Using UML, 1st Edition, Mahesh, PHI, 2008
3. The Unified Modeling Language Reference Manual, 2nd Edition, Rambaugh, Grady Booch, etc., PEA, 2004

Web References:

- https://www.udemy.com/uml-fundamentals/
- https://www.youtube.com/watch?v=OkC7HKtiZC0&list=PLGLfVvz_LVvQ5G-LdJ8RLqe-ndo7QITYc
- https://www.youtube.com/watch?v=RRXe1omEGWQ&list=PLD4EF3E3AD055F3C7

II MCA IV SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA402	3	0	0	40	60	100	3
BLOCKCHAIN TECHNOLOGIES (PROGRAM ELECTIVE-3)							

Course Objectives:

The objectives of the course are to

1. Learn the fundamentals of Block Chain and various types of block chain and consensus mechanism.
2. Understand public block chain system, Private block chain system and consortium block chain.
3. Know the security issues of blockchain technology.

Course Outcomes:

Upon the completion of the course, the students will be able to:

CO1: Summarize the fundamentals of Blockchain.[K2]
CO2: Analyze the working of Blockchain.[K4]
CO3: Interpret how business can be easily made with Blockchain.[K4]
CO4: Summarize how Block Chain can be integrated with various current technologies.[K2]
CO5: Get familiarity about the Blockchain case studies in providing solutions.[K3]

UNIT – I:

Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.

Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol.

Cryptocurrency: Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT – II:

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain.

Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

UNIT – III:

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E- commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain.

Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda.

Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT – IV:

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT – V:

Blockchain Case Studies:
Case Study 1 – Retail,
Case Study 2 – Banking and Financial Services, Case Study 3 – Healthcare,
Case Study 4 – Energy and Utilities.
Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.
Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

Text book:

1. "Blockchain Technology", Chandramouli Subramanian, Asha A.George, Abhilasj K A, MeenaKarthikeyan , Universities Press.

Reference Books:

1. Blockchain Blue print for Economy, Melanie Swan, SPDOreilly.
2. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gauar, Pearson Addition Wesley

Web-References:

- https://hackernoon.com/best-resources-for-learning-blockchain-development-in-2019- ffcd5639739a
- https://www.investopedia.com/articles/personal-finance/091316/top-3-books-learn-aboutblockchain.asp
- https://analyticsindiamag.com/top-10-free-resources-to-learn-blockchain/
- https://www.onlinecoursereport.com/online-courses-in-bitcoin-and-blockchaintechnology/

II MCA IV SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA403	3	0	0	40	60	100	3
ADVANCED UNIX PROGRAMMING (PROGRAM ELECTIVE-3)							

Course Objectives:

- To understand the fundamental design of the unix Programming
- To become fluent with the systems calls provided in the unix environment
- To be able to design and build an application/service over the unix operating system

COURSE OUTCOMES

After successful completion of this course, the students will be able to:

CO1: Apply the fundamental UNIX utilities. [K3]
CO2: Utilize the Unix file system.[K3]
CO3: Experiment with shell and UNIX filters. [K3]
CO4: Experiment IPC Mechanism and UNIX API. [K3]
CO5: Design and implement client-server applications using TCP and UDP sockets.[K3]

UNIT-I

Overview of Unix Utilities and Shell Programming: -File handling utilities, security by file permissions, process utilities, disk utilities, networking commands, backup utilities, text processing utilities. **Shell Programming:** shell, shell responsibilities, pipes and input redirection, output redirection, here documents, the shell as a programming language, shell meta characters, shell variables, shell commands, the environment, control structures, shell script examples.

UNIT-II

Unix Files: Unix file structure, directories, files and devices, System calls, library functions, low level file access, usage of open, create, read, write, close, lseek, stat, fstat, octl, umask, dup, dup2, Differences between system call and library functions. File and directory maintenance: chmod, chown, unlink, link, symlink, mkdir, rmdir, chdir, getcwd. **Directory handling system calls:** opendir, readdir, closedir, rewinddir, seekdir,telldir

UNIT-III

Unix Process: Threads and Signals: process, process structure, starting new process, waiting for a process, zombie process, orphan process, process control, process identifiers, system call interface for process management, -fork, vfork, exit, wait, waitpid, exec, system. **Signals**: Signal functions, unreliable signals, interrupted system calls, kill and raise functions, alarm, pause functions, abort, sleep functions.

UNIT-IV

Inter process Communication: Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different systems, pipes, FIFOs, message queues, semaphores and shared memory. Differences between pipes and FIFOs. Implementing client server program using pipes and FIFOs. **Message Queues-**: IPC, permission issues, Access permission modes, message structure, working with message queues, client/server example. **Semaphores:** Creating semaphore sets, Unix kernel support for semaphores, Unix APIs for semaphores, file locking using semaphores.

UNIT-V

Shared Memory: Working with a shared memory segments, Unix kernel support for shared memory, client/server example. **Sockets:** Berkeley sockets, socket structure, socket system calls for connection oriented protocol and connectionless protocol, implementing client server programs using TCP and UDP sockets.

Text Books:

1. Advanced programming in the unix environment, w- Richard Stevens 2nd Edition Pearson education
2. Unix Concepts and Applications, 3/e, Sumitabha Das, TMH

Reference books:

1. Unix and shell Programming, Sumitabha Das,TMH
2. A Beginner's Guide to Unix, N.P.Gopalan, B.Sivaselva,PHI
3. Unix Shell Programming, Stephen G.Kochan, Patrick Wood, 3/e,Pearson
   Unix Shell Programming, Lowell Jay Arthus & Ted Burns,3/e,GalGotia

Web References:

- 1.https://www.youtube.com/watch?v=BsB9Cg6yJc4
- 2.https://www.youtube.com/watch?v=akU1Ji8Vzdk&list=PLbMVogVj5nJRa3VKt_eyZdJ_DitCz1cvQ

II MCA IV SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA404	3	0	0	40	60	100	3
DATA SCIENCE APPLICATIONS (PROGRAM ELECTIVE-3)							

COURSE OBJECTIVE:

This course provides a comprehensive knowledge of data science and analytics techniques using Python. With this students will learn the essential concepts of Python programming and gain deep knowledge in data analytics and data visualization.

COURSE OUTCOMES:

After completion of this course, the students will be able to:

CO1 : Apply principles of NumPy and Pandas to the analysis of data. [K3]
CO2 : Make use of various file formats in loading and storage of data. [K3]
CO3 : Identify and apply the need and importance of pre-processing techniques [K3]
CO4 : Show the results and present them in a pictorial format [K2].
CO5 : Make use of various functions on data for different opeations.[K3]

SYLLABUS

UNIT-I

What is Data science?, The Data science process, A data scientist role in this process, NumPy Basics: The NumPy ndarray: A Multidimensional Array Object(Creating ndarrays ,Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing), Data Processing Using Arrays (Expressing Conditional Logic as Array Operations, Sorting ,Unique).

UNIT-II

Getting Started with pandas: Introduction to pandas, Library Architecture, Features, Applications, Data Structures (Series, Data Frame, Index Objects), Essential Functionality(Reindexing, Dropping entries from an axis, Indexing, selection, and filtering), Sorting and ranking, Summarizing and Computing Descriptive Statistics (Unique Values, Value Counts), Handling Missing Data.

UNIT-III

Data Loading, Storage, and File Formats : Reading and Writing Data in Text Format(Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats, JSON Data), Binary Data Formats (Using HDF5 Format, Reading Microsoft Excel Files),Interacting with HTML and Web APIs.

UNIT-IV

Data Wrangling: Clean, Transform, Merge, Reshape: Combining and Merging Data Sets(Database-style, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap), Reshaping and Pivoting(Reshaping with Hierarchical Indexing), Data Transformation(Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values. Plotting and Visualization: A Brief matplotlib API Primer (Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File), Plotting Functions in pandas (Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots).

UNIT-V

Data Aggregation and Group Operations: Group By Mechanics(Iterating Over Groups, Selecting a Column or Subset of Columns, Grouping with Dicts and Series, Grouping with Functions, Grouping by Index Levels) Data Aggregation(Column-wise and Multiple Function Application, Returning Aggregated Data in "unindexed" Form), Group-wise Operations and Transformations(Apply: General split-apply-combine, Example: Filling Missing Values with Group-specific Values.

TEXT BOOKS: Book title/authors/publisher

1. Wes McKinney, "Python for Data Analysis", O'REILLY, ISBN: 978-1-449- 31979- 3, 1st edition, October 2012.

REFERENCE BOOKS: Book title/authors/publisher

1. Rachel Schutt & O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449- 35865- 5, 1st edition,
2. "Data Science from Scratch", O'REILLY, 1st edition, April 2015

WEB REFERENCES:

1. https://www.w3schools.com/python/numpy/default.asp
2. https://www.w3schools.com/python/pandas/default.asp
3. https://onlinecourses.nptel.ac.in/noc23_cs99/

II MCA IV SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA405	3	0	0	40	60	100	3
MOBILE ADHOC NETWORKS (PROGRAM ELECTIVE-4)							

Course Objectives:

From the course the student will learn

- Architect sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model links cost.
- Understanding of the fundamental concepts of wireless sensor networks and has a basic knowledge of the various protocols at various layers.
- Evaluate the performance of sensor networks and identify bottlenecks.

COURSE OUTCOMES:

CO1: Analyse the MANET

CO2: Analyse the Routing Protocols in MANET and Interpret the TCP over Ad hoc Networks

CO3: basic knowledge of WSNs, including Mica Mote, sensing range, energy use, clustering, protocols, data retrieval, and real-time applications**.**

CO4: Interpret the data transmission and data acquisition in WSN and Design and Develop the various heterogeneous architectures.

CO5: security mechanisms, hardware components, operating systems, programming models, and simulation tools used in Wireless Sensor Networks (WSNs).

UNIT I: Introduction to Ad Hoc Wireless Networks- Cellular and Ad Hoc Wireless Networks, Characteristics of MANETs, Applications of MANETs, Issues and Challenges of MANETs, Ad Hoc Wireless Internet, MAC protocols for Ad hoc Wireless Networks-Issues, Design Goals and Classifications of the MAC Protocols.

UNIT II: Routing Protocols for Ad Hoc Wireless Networks- Issues in Designing a Routing Protocol, Classifications of Routing Protocols, Topology-based versus Position-based Approaches, Issues and design goals of a Transport layer protocol, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks, Solutions for TCP over Ad Hoc Wireless Networks, Other Transport layer protocols.

UNIT III: Security protocols for Ad hoc Wireless Networks- Security in Ad hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad hoc Wireless Networks, Cooperation in MANETs, Intrusion Detection Systems.

UNIT IV: Basics of Wireless Sensors and Applications- The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications, Data Retrieval in Sensor Networks-Classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

UNIT V: Security in WSNs- Security in WSNs, Key Management in WSNs, Secure Data Aggregation in WSNs, Sensor Network Hardware-Components of Sensor Mote, Sensor Network Operating Systems– TinyOS, LA-TinyOS, SOS, RETOS, Imperative Language-nesC, **Dataflow Style Language-**TinyGALS, Node-Level Simulators, NS-2 and its sensor network extension, TOSSIM.

Text Books:

1. Ad Hoc Wireless Networks – Architectures and Protocols, 1st edition, *C. Siva Ram Murthy, B. S. Murthy*, Pearson Education, 2004
2. Wireless Sensor Networks - A Modern approach, *Garimella Rama Murthy*, 1st edition, Universities Publishers, 2025
3. Ad Hoc and Sensor Networks – Theory and Applications, 2nd edition *Carlos Corderio Dharma P.Aggarwal,* World Scientific Publications / Cambridge University Press, 2006

Reference Books:

1. Wireless Sensor Networks: An Information Processing Approach, 1st edition*, Feng Zhao, Leonidas Guibas*, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009
2. Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, 1st edition*,* Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008
3. Ad hoc Networking, 1st edition*,Charles E.Perkins*, Pearson Education, 2001
4. Wireless Ad hoc Networking, 1st edition*, Shih-Lin Wu, Yu-Chee Tseng,* Auerbach Publications, Taylor & Francis Group, 2007

Wireless Sensor Networks – Principles and Practice, 1st edition, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010

Web References:

- 1.https://www.youtube.com/watch?v=RcvHpledeUQ
- 2.https://www.youtube.com/watch?v=ycaz99NogS4
- 3.https://ebooks.inflibnet.ac.in/itp12/chapter/introduction-to-mobile-ad-hoc-networks-manets/

II MCA IV SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA406	3	0	0	40	60	100	3
QUANTUM COMPUTING (PROGRAM ELECTIVE-4)							

Course Objectives:
To introduce the fundamentals of quantum computing, the problem-solving approach using finite dimensional mathematics

COURSE OUTCOMES:
CO1: fundamentals and historical background of Quantum Computing, including key differences between classical and quantum systems.
CO2: Gain foundational knowledge of the mathematical, physical, and biological principles essential for understanding quantum computing.
CO3: Understand the concept of qubits, their physical implementations, quantum gates, circuit design, and the significance of Bell states in quantum computing.
CO4: key quantum algorithms and their relation to classical computation and complexity, including Deutsch's, Shor's, and Grover's algorithms.
CO5: quantum noise, error correction techniques, fault-tolerant computation, and the principles of quantum information and cryptography.

UNIT - I
History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations

UNIT - II
Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements.
Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super- symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

UNIT - III
Qubit: Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

UNIT - IV
Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.

UNIT - V
Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

Text Books:

1. Quantum Computation and Quantum Information, Nielsen M. A., Cambridge
Programming Quantum Computers, Essential Algorithms and Code Samples, Eric R Johnson, NicHarrigan, Mercedes Ginemo, Segovia, Oreilly

Reference Books:

1. Quantum Computing for Computer Scientists, Noson S. Yanofsk, Mirco A. Mannucci
2. Principles of Quantum Computation and Information,Benenti G., Casati G. and Strini G., Vol.I: Basic Concepts, Vol II
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms

Web References:

- https://onlinecourses.nptel.ac.in/noc25_cs95/
- https://quantum.cloud.ibm.com/learning

II MCA IV SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA407	3	0	0	40	60	100	3
AGILE METHODOLOGIES (PROGRAM ELECTIVE-4)							

Course Objectives:

The main objectives of this course are to

- Introduce the important concepts of Agile software development Process
- Emphasize the role of stand-up meetings in software collaboration
- Impart the knowledge on values and principles in understanding agility

Course outcomes:

CO1: Understand Agile basics & values for adoption.[K2]
CO2: Analyze & apply 12 Agile principles for delivery & teamwork. [K4]
CO3: Explain Scrum roles/practices; demonstrate self-organizing teams. [K3]
CO4: Evaluate XP practices to embrace change & incremental design. [K5]
CO5: Apply Lean/Kanban to eliminate waste & improve flow; understand coaching. [K3]

UNIT I:

Learning Agile: Agile, Getting Agile into your brain, Understanding Agile values, No Silver Bullet, Agile to the Rescue. A fractured perspective, The Agile Manifesto, Understanding the Elephant, Where to Start with a New Methodology.

UNIT II:

The Agile Principles: The 12 Principles of Agile Software, The Customer Is Always Right, Delivering the Project, Better Project Delivery for the Ebook Reader Project. Communicating and Working Together, Project Execution—Moving the Project Along, Constantly Improving the Project and the Team. The Agile Project: Bringing All the Principles Together

UNIT III:

SCRUM and Self-Organizing Teams: The Rules of Scrum, Act I: I Can Haz Scrum, Everyone on a Scrum Team owns the Project, Status Updates Are for Social Networks!, The Whole Team Uses the Daily Scrum, Feedback and the Visibility-Inspection-Adaptation Cycle, The Last Responsible Moment, Sprinting into a Wall, Sprints, Planning, and Retrospectives.

Scrum Planning And Collective Commitment: Not Quite Expecting the Unexpected, User Stories, Velocity, and Generally Accepted Scrum Practices, Victory Lap, Scrum Values Revisited.

UNIT IV:

XP And Embracing Change: Going into Overtime, The Primary Practices of XP, The Game Plan Changed, but We're Still Losing, The XP Values Help the Team Change Their Mindset, An Effective Mindset Starts with the XP Values, The Momentum Shifts, Understanding the XP Principles Helps You Embrace Change.

XP, Simplicity, and Incremental Design: Code and Design, Make Code and Design Decisions at the Last Responsible Moment, Final Score.

UNIT V:

Lean, Eliminating Waste, and Seeing the whole: Lean Thinking, Creating Heroes and Magical Thinking. Eliminate Waste, Gain a Deeper Understanding of the Product, Deliver As Fast As Possible.

Kanban, Flow, and Constantly Improving: The Principles of Kanban, Improving Your Process

with Kanban, Measure and Manage Flow, Emergent Behavior with Kanban.
The Agile Coach: Coaches Understand Why People Don't Always Want to Change. The Principles of Coaching.

Text Books:
1. Andrew Stellman, Jill Alison Hart, Learning Agile, O'Reilly, 2015.

Reference Books:
1. Andrew Stellman, Jennifer Green, Head first Agile, O'Reilly, 2017.
2. Rubin K , Essential Scrum : A Practical Guide To The Most Popular Agile Process, Addison-Wesley, 2013

Web References:
- https://www.coursera.org/in/articles/what-is-agile-a-beginners-guide
- https://en.wikipedia.org/wiki/Agile_software_development
- https://www.youtube.com/watch?v=8eVXTyIZ1Hs

II MCA IV SMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
R24MCA408	3	0	0	40	60	100	3
E-COMMERCE (PROGRAM ELECTIVE-4)							

COURSE OBJECTIVES:

This course will enable students

1. Explain to students why information systems are so important today for business and management.
2. Evaluate the role of the major types of information systems in a business environment and their relationship to each other.
3. Identify the major management challenges to building and using information systems and learn how to find appropriate solutions to those challenges.

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1: Demonstrate an understanding of the foundations and importance of E-commerce.
CO2: Demonstrate an understanding of retailing in E-commerce.
CO3: Analyse the impact of E-commerce on business models and strategy.
CO4: Describe Internet trading relationships including Business to Consumer, Business to-Business & Intra-organizational.

UNIT I

Electronic Commerce, Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

UNIT II

Consumer Oriented Electronic commerce, Mercantile Process models. Electronic payment systems , Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

UNIT III

Intra Organizational Commerce: Work Flow, Automation Customization and internal Commerce, Supply chain Management.

UNIT IV

Corporate Digital Library: Document Library, Digital Document types, Corporate Data Warehouses. Advertising and Marketing, Information based marketing, Advertising on Internet, on-line marketing process, market research.

UNIT V

Consumer Search and Resource Discovery, Information search and Retrieval, Commerce Catalogues, Information Filtering. Multimedia - key multimedia concepts, Digital Video and electronic Commerce, Desktop video processing‘s, Desktop video conferencing.

TEXT BOOK

1. Frontiers of Electronic Commerce, Kolkata, Whinstone, PEA, 2006.

REFERENCE BOOKS

1. E-Commerce Fundamentals and Applications Hendry Chan, Raymond Lee, Dillon, Chang, John Wiley.
2. E-Commerce, A Managerial Perspective, Turban E, Lee J , King, Chung H.M.,PEA,2001.
3. E-Commerce An Indian Perspective , 3/e, P.T. Joseph, PHI,2009.
4. E-Commerce, S.Jaiswal. , Golgothia.
5. Electronic Commerce , Gary Schneider, Thomson.

WEB REFERENCES

1. http://www.udemy.com/topic/e-commerce.
2. http://www.nptel.ac.in/topic/e-commerce.