Faculty of Commerce and Management Science

REGULATIONS SPECIFIC TO

M.C.A. PROGRAM

Outcome Based Education Pattern Aligned with National Education Policy (NEP) 2020

(Applicable for University Department)

Dr. Babasaheb Ambedkar Marathwada University,
Chhatrapati Sambhajinagar
(With Effect from 2024-25)

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar

MCA PROGRAM (2 Years Degree)

(Choice Based Credit & Grade System)

M.C.A program prepares students to take up positions as systems analysts, system designers, programmers and managers in any field related to information technology. The program, therefore, aims at imparting comprehensive knowledge with equal emphasis on theory and practice. The M.C.A. students are encouraged to spend a full semester working in the industry in the institute giving them insight into the workings of the IT world.

Vision

Fostering an environment of Excellence in Business Education through Innovative Learning & Social Commitment, by involvement of all.

Mission

- Create an environment of excellence in Management Education.
- Encourage innovations in Management and Technology Education.
- Undertake qualitative research studies, consultancy and training programs.
- Collaborate with stakeholders in creating atmosphere for value-driven Education.

The underlying principle that forms the soul of our existence as a Business and Technical School is –

- Creation of an environment - i.e. creating amenities, resources, infrastructure etc. most importantly able-human resource that shall support students to excel holistically- as a learner & as a professional too.
- Innovative Learning - here at the Department, we envision to educate students in a way that aims at interesting learning experience, illustrate the concept & retention-centric. For achieving these goals, we intend to make a blend of educational styles-right from Management Games to case-study education to 'learning through doing' projects.
- Social Commitment - While we render education, we are aware that the product that we are going to deliver shall thrive as an input to the society & industry. Hence, besides the core-education part, we impart education that shall make a wholesome being & an ideal.
- Involvement - forms the cornerstone of this Vision; as all the stakeholders of this institution are committed to deliver excellence.

Outcome Based Education System

1. Program Educational Objectives:

The program educational objectives (PEO) are the statement that describes the career and professional achievement after the program of studies (graduation/ post-graduation). The PEO s are driven form question no. (ii) of the Mission statement (What is the purpose of organization). The PEOs can be a minimum three and maximum five.

PEO1: The advance knowledge of Management Science/Computer application in the management and administration of the organization.
PEO2: To work as a private and public sector professional through respective competitive examination/interviews.
PEO3: To establish own professional activity in the domain of Management science such as Human Resources Development, Marketing, etc.
PEO4: To be a researcher and a life-long learner.
PEO5: To be a values-based and ethical leader in the professional and social life.

2. Program Outcomes:

The program outcomes (PO) are the statement of competencies/ abilities. POs are the statement that describes the knowledge and the abilities the graduate/ post-graduate will have by the end of program studies.

1. Computational Knowledge:
Apply knowledge of computing fundamentals, computing specialisation, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

2. Problem Analysis:
Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

3. Design /Development of Solutions:
Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

4. Conduct Investigations of Complex computing Problems:
Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of t h e information to provide valid conclusions.

5. Modern Tool Usage:
Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

6. Professional Ethics:
Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.

7. Life-long Learning:
Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

8. Project Management and finance:
Demonstrate knowledge and understanding of the computing and management principles and

apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

9. Communication Efficacy:

Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

10. Societal and Environmental Concern:

Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.

11. Individual and Team Work:

Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

12. Innovation and Entrepreneurship

Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

1.Rules and Regulations

1. Eligibility and Selection Criteria –

(A) First Year Admission.-

(1) For Maharashtra State Candidature Candidates, All India Candidature Candidates, Union Territory of Jammu and Kashmir and Union Territory of Ladakh Migrant Candidature Candidates. –

The candidate,-

(i) should be a citizen of India;

(ii) should have passed any graduation degree (e.g.: B.E. or B.Tech. or B.Sc or B.Com. or B.A. or B. Voc. or BCA etc.,) preferably with Mathematics at 10+2 level or at Graduation level and obtained at least fifty per cent marks (at least forty five per cent. in case of candidates of Reserved Categories, Economically Weaker Section and Persons with Disability category belonging to the Maharashtra State) in the qualifying examination;

iii) should have obtained non zero score in MAH-MCA CET conducted by the Competent Authority.

(2) Non Resident Indian (NRI) or Overseas Citizen of India (OCI) or Person of Indian Origin (PIO), Children of Indian workers in the Gulf countries, Foreign National Candidature Candidates.-

(i) The candidate should have passed any graduation degree (e.g.: B.E. or B.Tech. or B.Sc or B.Com. or B.A. or B. Voc. or BCA etc.,) preferably with Mathematics at 10+2 level or at Graduation level and obtained at least fifty per cent. marks in the qualifying examination;

(ii) Any other eligibility criteria and requirement declared from time to time by the appropriate authority as defined under the Act;

(B) Second Year (Lateral Entry) Admission. –

Maharashtra State Candidature Candidates and All India Candidature Candidates.-

(i) The candidate should be a citizen of India;

(ii) The candidate should have passed B.Tech.(Computer Technology (IT)) or B.E. (Computer Science and Engineering (CSE) or Information Technology (IT)) or Bachelor of Computer Applications (BCA) (4 years);

(iii) Any other eligibility criteria and requirement declared from time to time by the appropriate authority as defined under the Act

Duration

- Duration of the MCA PROGRAM shall be 2 years/ 4 semesters.
- Duration of the MCA PROGRAM shall be 1 year/ 2 semesters if Admitted for Second Year (Lateral Entry)

2. Admission/Promotion Criteria

If candidate gets selected for MCA course through DTE admission process, he/she have to apply on the application form of the University provided with the prospectus. Once the candidate is admitted to the MCA course, he/she will be promoted to next semester with full carryon; subject to the registration of candidate in every consecutive semester. Dropout candidate will be allowed to register for respective semester in which he/she has failed, subject to the condition that his/her tenure should not exceed more than twice the duration of MCA course from the date of

first registration at institute. The admission of concern candidate will automatically get cancelled if he/she fails to complete the course in maximum period.(Four years)

3. Credits and Degrees

- A candidate who has successfully completed all the Foundation, Core, Elective courses and Project Work as prescribed for the MCA Course and Service courses as approved by the University with prescribed CGPA shall be eligible to receive the degree.
- One Credit shall mean one teaching period of one hour per week for one semester (of 15 weeks) for theory courses and two hours/week of practical for one semester.

Courses

The MCA programme comprises of

I. Foundation Course: It may be of two kinds Compulsory Foundation Course for Knowledge Enhancement and Elective Foundation Course for value based education.

II. Core Course: A core course is course that a candidate admitted to particular P.G. programme must successfully complete to receive the degree.

III. Elective Course: Elective courses identified by the Departmental Committee of the department offering the programme. Means these courses given to the candidate as optional from which he/she has to opt for specialization. Whereas no elective course shall be offered unless a minimum of 10 students are registered.

IV. Each course shall include lectures/tutorials/laboratory of field work/ seminar/practical training/assignments /mid-term and term end examinations/paper/report writing or review of literature and any other innovative practice etc., to meet effective teaching and learning needs.

V. Each course shall have a unique alphanumerical code.

For eg.

MANC401	Advance Operating system
Here, MAN	means Management Science
C	means MCA course
401	means Subject Code

VI. The University committee shall design the course structure including the detailed syllabus for this MCA programme. The committee shall have the freedom to introduce new courses and / or to modify / redesign existing courses and replace any existing course with a new course to facilitate better exposure and training for the candidates.

VII. Attendance: A student must have 75% of mandatory attendance in each Course for appearing in the examination. In the event of Non-Compliance of Attendance criteria(75%), students will have to seek admission next year so as to complete the course. However Student having 65% attendances with medical certificate can apply to the H.O.D. for condonation of attendance.

2. Grievance Redressal Scheme

University will provide the separate guidelines for Grievance Redressal Scheme.

3. Grade Awards

i. The Degree of MCA will be of **96 Credits**. And PG Diploma(if exit option taken) of **54 Credits.**

ii. In order to pass the examination following choice based credit and grading system (CBC&GS) will be followed. Ten point rating scale shall be used for evaluation of performance of the student to provide Letter Grade for each course and overall grade for this course. Grade points are based on the total number of marks obtained by him / her in all the heads of the examination of the course. These grade points and their equivalent range of the marks are shown separately in following:

Table – I: Ten Point grades and grade description

Sr.No.	Equivalent Percentage	Grade points for SGPA and CGPA	Grade	Grade Description
1.	90 – 100	9.00 – 10	O	Outstanding
2.	80 – 89.99	8.00 – 8.99	A++	Excellent
3.	70 – 79.99	7.00 – 7.99	A+	Exceptional
4.	60 – 69.99	6.00 – 6.99	A	Very Good
5.	55 – 59.99	5.50 – 5.99	B+	Good
6.	50 – 54.99	5.00 – 5.49	B	Fair
7.	45 – 49.99	4.50 – 4.99	C+	Average
8.	**40.01 – 44.99**	**4.01 – 4.49**	C	Below Average
9.	40	4.00	D	Pass
10.	Below 40	0.00	F	Fail

iii. **Table – II: Classification for the degree is given as follows**

Classification	**Overall letter grade**
First Class with distinction	*A+ and above*
First Class	*A*
Higher Second Class	*B+*
Second Class	*B*
Pass	*C+ to D*
Fail	*F*

iv. In the event of student registered for the examination (i.e. Internal Tests/End Semester Examination/Practical/Seminar/Project Viva-voce), non-appearance shall be treated as the student deemed to be absent in the respective course.

v. Minimum D grade shall be the limit to clear /pass the course/subject. A student with F grade will be considered as 'failed' in the concerned course and he/she has to clear the course by reappearing in the next successive semester examinations.

vi. Using table – I, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and Cumulative Grade Card with CGPA will be given on completion of the course.

4. Computation of SGPA (Semester Grade Point Average) &CGPA (Cumulative Grade Point Average)

The computation of SGPA and CGPA will be as below:

i. Semester Grade Point Average (**SGPA**) is the weighted average of points obtained by a student in a semester and will be computed as follows:

$$SGPA = \frac{\textbf{\textit{Sum(Course Credit * Number of Points in concern course gained by the student)}}}{\textbf{\textit{Sum (Course Credit)}}}$$

The SGPA for all four semesters will be mentioned at the end of every semester.

ii. The Cumulative Grade Point Average (**CGPA**) will be used to describe the overall performance of a student in all semesters of the course and will be computed as follows:

$$CGPA = \frac{Sum(All\ Four\ semester\ SGPA)}{Total\ number\ of\ semesters}$$

The SGPA and CGPA shall be rounded off to the second place of decimal.

5. Evaluation Scheme

- **Appearance for both Internal and External Evaluations (Examinations) is mandatory.**
- **Separate Passing for both Internal and External Evaluations (Examinations) of course is compulsory.**
- **Minimum and Separate Passing Percentage for both Internal and External Evaluations (Examinations) is 40%.**
- Theory course of 100 Marks will be divided in to Internal Examination (Sessional) of 40 Marks and Semester End Examination of 60 Marks (40+60=100) **except Papers with Full Internal Assessment**.
- Theory course of 75 marks will be divided in to internal Examination of 25 marks and semester end examination of 50 marks (25+50=75).
- Theory course of 50 marks will be divided in to internal Examination of 20 marks and semester end examination of 30 marks. (20+30=50).
- Each Practical Course will be of 25 Marks.

a) For Theory Course

i. Internal Evaluation Scheme

There shall be weekly assessment in the form of Test/Assignment/Tutorials/seminars/Presentations/laboratory work /Field work/Project Work throughout the semester. Aggregation of these marks will be considered for the internal evaluation of 40/25/20 marks.

ii. Semester End Examination Evaluation Scheme

- English shall be the medium of instruction and examination.
- Examination shall be conducted at the end of each semester as per the academic calendar notified by University.
- The Semester End Examination theory question paper of 60 marks will have two parts **(10 + 50 = 60)** Marks

  Q1 will carry short question (fill in the blanks/multiple choice

questions/match the columns/state true or false/answer in one sentence) as compulsory questions and it should cover entire syllabus (10 Marks).

Q2 to Q8 will carry 7 questions out of which there shall be at least one question from each unit, student will have to answer any 5 questions out of 7.

- The Semester End Examination theory question paper of 50 marks will have two parts **(10 + 40 = 50)** Marks

  Q1 will carry short question (fill in the blanks/multiple choice questions/match the columns/state true or false/answer in one sentence) as compulsory questions and it should cover entire syllabus (10 Marks).

  Q2 to Q6 will carry 5 questions, students will have to answer any 4 questions out of 5.

- The Semester End Examination theory question paper of 30 marks will have two parts **(06 + 24 = 30)** Marks

  Q1 will carry short question (fill in the blanks/multiple choice questions/match the columns/state true or false/answer in one sentence) as compulsory questions and it should cover entire syllabus (06 Marks).

  Q2 to Q5 will carry 4 questions, students will have to answer any 3 questions out of 4.

b) For Practical Course

i. Evaluation Scheme

- A student should complete lab assignments practically given by course teacher. However, in addition teacher can allot a mini project to students for better evaluation but assignments are compulsory. Internal evaluation for the practical will be considered for 50 Marks.

- Under this roof, a student has to face practical examinations in which he/she has to complete the task on computer system (It may computer program or testing) given by External Examiner. Also student has to present seminar or viva-voce in front of External Examiner.

c) For Mini Project –

i. Internal Evaluation –

- All the students are divided among different teams & work under the guidance of the Faculty/guide. Internal Evaluation for the project will be of 40% marks that will be evaluated by the respective faculty/ guide depending upon presentation/review/performance during project/ report writing/field work/seminars etc.

- Student has to present seminar/viva-voce/ demonstration of project in front of External Examiner. External evaluation for the project will be considered for 60% Marks.

d) Fourth Semester Project Evaluation Scheme

The Major project work should be carried out over the entire period of the final semester in an Industry. If the project is carried out in an Industry organization outside the campus, then a co-guide shall be there from Industry. Every student should do the Major Project individually. However students can opt for project in groups based on merits/requirements of the project and in consultation with the project guide. A guide will review the project periodically. At the end of the semester the candidate shall submit the Project report (two bound copies) duly approved by the guide and /Director H.O.D. of the Institute. The University will appoint external examiner for assessment of the project. The project will be assessed by the external examiner and the guide separately on the basis of the following criteria tentatively.

- Innovative Idea 15%
- Content 15%
- Preparation of Project Report 30%
- Presentation/Viva- voce 40%

If student failed to complete the project within scheduled time then he/she has to reappear and register freshly with new project topic after paying required fees for that semester.

6. Grade Card

The university under its seal shall issue to the students a grade card on completion of each semester.

Grade card shall contain the following:

a. Title of the courses along with code taken by the student.
b. The credits associated with and grades awarded for each course.
c. The number of grade and grade point secured by the student.
d. The total credits earned by the student in that semester.
e. The SGPA of the student.
f. The total credits earned by the student till that semester.
g. The CGPA of the student (At the end of the IVth semester).

7. Cumulative Grade Card

The grade card issued on completion of the programme shall contain the name of the programme, the department /school offered the programme, the titles of the courses taken, the credits associated with each course, grades awarded, the total creditsearned by the student, the CGPA and the class in which the student is placed.

8. Exit Option

- Students who have joined as two -year's Master's Degree program (MCA) may opt for exit at the end of first year and earn a PG Diploma.
- PG Diploma may be awarded to a student provided they have earned the requisite Credits (**50 +4 = 54 Credits**) in one year including on-the-job training of 04 Credits (**MANC462**) during summer break, after completion of the second semester of the First year.

9. Re-Entry

Re-entry to complete the PG Degree, after taking the exit option, will be permissible up to 05 years from the date of admission to the PG program(MCA).

10. General Clause

It may be noted that beside the above specified rules and regulations all the otherrules and regulations in force and applicable to semester system in Post-Graduatecourses in Dr. Babasaheb Ambedkar Marathwada University will be applicable as amended from time to time by the University. The students shall abide by all suchRules and Regulations.

MCA Program Structure

SEMESTER -I

Sem	Ref. No	SubjectTitle	Teaching Scheme			Credit	Marks		
			L	T	P		Int	Ext	Total
I	MANC401	Advance Operating System	3	1	-	4	40	60	100
	MANC402	Mathematics and Probability	3	1	-	4	40	60	100
	MANC403	Programming Using Python	3	-	-	3	25	50	75
	MANC404	Advance Web Technology	3	-	-	3	25	50	75
	MANC405	Java	3	-	-	3	25	50	75
	MANC41X	***Open Elective - I***	3	1	-	4	100	--	100
	MANC451	Python Lab	-	-	2	1	25	--	25
	MANC452	Advance Web Technology Lab	-	-	2	1	25	--	25
	MANC453	Java Lab	-	-	2	1	25	--	25
			Total			**24**	**330**	**270**	**600**

Open Elective – I *(Select any One from Following)*

Sr.No	Ref. No	Subject Title	Teaching Scheme			Credit	Marks		
			L	T	P		Int	Ext	Total
1.	MANC411	MIS & DSS	3	1	-	4	100	-	100
2.	MANC412	Creativity & Innovation							
3.	MANC413	Basics of Programming Language							
4.	MANC414	Software Engineering							

SEMESTER -II

Sem	Ref. No	Subject Title	Teaching Scheme			Credit	Marks		
			L	T	P		Int	Ext	Total
II	MANC415	Object Oriented Analysis &Design	2	-	-	2	50	--	50
	MANC416	Advances in Data structure	3	-	-	3	25	50	75
	MANC417	Advance DBMS	3	-	-	3	25	50	75
	MANC418	Software Testing	3	-	-	3	25	50	75
	MANC419	Research Methodology	3	1	-	4	100	--	100
	MANC42X	***Open Elective – II***	3	-	-	3	25	50	75
	MANC42X	***Open Elective - III***	2	-	-	2	20	30	50
	MANC454	Advances in Data Structure & Algorithms Lab	-	-	2	1	25	--	25
	MANC455	Advance DBMS Lab	-	-	2	1	25	--	25
	MANC456	Software Testing Lab	-	-	2	1	25	--	25
	MANC45X	***Open Elective – II Lab***	-	-	2	1	25	--	25
	MANC457	Mini Project	-	-	4	2	50	--	50
			Total			**26**	**420**	**230**	**650**

Open Elective –II *(Select any One from Following)*

Sr.No	Ref. No	Subject Title	Teaching Scheme			Credit	Marks		
			L	T	P		Int	Ext	Total
1.	MANC421	Advance JAVA	3	-	-	3	25	50	75
	MANC458	Advance JAVA Lab	-	-	2	1	25	--	25
2.	MANC422	Data Science using Python	3	-	-	3	25	50	75
	MANC459	Data Science using Python Lab	-	-	2	1	25	--	25
3.	MANC423	ASP.NET	3	-	-	3	25	50	75
	MANC460	ASP.NET LAB	-	-	2	1	25	--	25
4.	MANC424	Data Visualization using Power BI and Tableau	3	-	-	3	25	50	75
	MANC461	Power Bi & Tableau Lab	-	-	2	1	25	--	25

Open Elective – III *(Select any One from Following)*

Sr.No	Ref. No	Subject Title	Teaching Scheme			Credit	Marks		
			L	T	P		Int	Ext	Total
1.	MANC425	Blockchain Technology	2	-	-	2	20	30	50
2.	MANC426	Internet of Things (IOT)							
3.	MANC427	Fundamentals of Digital Marketing							
4.	MANC428	Introduction of NLP							

*** The On The Job Training (MANC462) is only applicable to students who wish for PG Diploma by taking Exit after First Year.**

Sr.No	*Ref. No*	*Subject Title*	*Teaching Scheme*			*Credit*	*Marks*		
			L	*T*	*P*		*Int*	*Ext*	*Total*
1.	*MANC462*	*on-the-job training*	*-*	*-*	*4*	*4*	*40*	*60*	*100*

SEMESTER -III

Sem	Ref. No	Subject Title	Teaching Scheme			Credit	Marks		
			L	T	P		Int	Ext	Total
III	MANC501	Advances In Algorithm	3	-	-	3	25	50	75
	MANC502	Web Development using PHP	3	-	-	3	25	50	75
	MANC503	Optimization Techniques	3	1	-	4	40	60	100
	MANC504	Advance Networking	3	1	-	4	40	60	100
	MANC52X	***Open Elective - IV***	3	-	-	3	25	50	75
	MANC551	Advances in Algorithm Lab	-	-	2	1	25	--	25
	MANC552	PHP Lab	-	-	2	1	25	--	25
	MANC553	Research Project	-	-	4	4	100	--	100
	MANC554	Research Project -Seminar	-	-	2	2	50	--	50
	MANC55X	***Open Elective – III Lab***	-	-	2	1	25	--	25
		Total				**26**	**380**	**270**	**650**

Open Elective – IV *(Select any One from Following)*

Sr.No	Ref. No	Subject Title	Teaching Scheme			Credit	Marks		
			L	T	P		Int	Ext	Total
1.	MANC521	Data Mining using SQL	3	-	-	3	25	50	75
	MANC555	Data Mining using SQL Lab	-	-	2	1	25	--	25
2.	MANC522	Linux Admin & Server Config.	3	-	-	3	25	50	75
	MANC556	Linux Admin & Server Config. Lab	-	-	2	1	25	--	25
3.	MANC523	Mobile Application Development Using Android	3	-	-	3	25	50	75
	MANC557	Android Lab	-	-	2	1	25	--	25
4.	MANC524	Cloud Computing	3	-	-	3	25	50	75
	MANC558	Cloud Computing Lab	-	-	2	1	25	--	25

SEMESTER -IV

Sem	Ref. No	Subject Title	Teaching Scheme			Credit	Marks		
			L	T	P		Int	Ext	Total
IV	*MANC506	Software Project Management	2	-	-	2	50	-	50
	*MANC507	Entrepreneurship Development	2	-	-	2	50	-	50
	*MANC508	Report Writing	2	-	-	2	50	-	50
	*MANC509	Quantitative Aptitude	2	-	-	2	50	-	50
	MANC559	Seminar	-	2	-	2	50	-	50
	MANC560	Project	-	-		10	100	150	250
		Total				**20**	**350**	**150**	**500**

*The teaching, learning process for subject MANC506 – Software Project Management and MANC507 – Entrepreneurship Development, MANC508 – Report Writing , MANC509 – Quantitative Aptitude of MCA- IV sem will be conducted in ONLINE mode only.

MCA Degree (Two Years Programme)			Marks		
	Credits		Int	Ext	Total
Course Total	96	--	1480	920	2400

PG Diploma (One Year Programme)			Marks		
	Credits		Int	Ext	Total
Course Total	54	--	790	560	1350

Semester-I

Subject Title	**:**	**Advanced Operating System**			
Subject Ref. No.	**:**	**MANC401**	**No. of Credits**	**:**	4
			Assignments / Sessional		40
			Semester Examination		60

Course Outcomes (COs)

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

CO-1	Demonstrate understanding of design issues of advanced operating systems and compare different types of operating systems
CO-2	Analyze design aspects and data structures used for file subsystem, memory subsystem and process subsystem of Linux OS
CO-3	Differentiate between threads and processes and compare different processor scheduling algorithms
CO-4	Master concepts of memory management including virtual memory & Master system resources sharing among the users

Pre Requisite	**:**	Working knowledge of C programming, Basic Computer Architecture-Concepts., Basic algorithms and data structure concepts.
Unit – I	**:**	**Introduction**: Functions of operating systems, Design approaches: layered, kernel based and virtual machine approach, types of advanced operating systems (NOS, Multiprocessor OS, Mobile OS, RTOS, Cloud OS)
Unit – II	**:**	**Process Management:** Process Concept, Process Control Block, Process Schedule **CPU Scheduling:** Scheduling Concept, Scheduling Criteria, Scheduling algorithm **Process Synchronization** & **Deadlock:** Synchronization concept, Synchronization Requirement, Critical Section Problem, Monitors, Deadlock concepts, Deadlock prevention & avoidance, Deadlock Detection, Deadlock Recovery
Unit – III	**:**	**Memory Management:** Memory Management Techniques, Contiguous & Non Contiguous allocation, Logical & Physical Memory, Conversion of Logical to Physical address, Paging, Segmentation, Segment with paging Virtual Memory Concept, Demand paging, Page Replacement algorithm, Allocation of Frames, Page fault.
Unit – IV	**:**	**Distributed Operating system concepts:** Goals, Distributed Computing Models, Hardware Concepts, Software Concepts, Architecture of DOS. Design Issues: Transparency, Flexibility, Scalability, Reliability, Performance, fault tolerance
Unit – V	**:**	**Mobile OS:** Architecture, Android OS, iOS, Virtual OS, Cloud OS and their design issues
Text Books	**:**	**1.** The Design of the UNIX Operating System, PHI, by Maurice J. Bach. **2.** Distributed Computing 2nd Edition, Mahajan and Seema Shah, OXford. **3.** Advanced Concepts in Operating Systems, Mukesh Singhal, Niranjan G Shivaratri. **4.** Mobile Computing by Rajkamal, 1st edition, Oxford.

	:	1. Silberschatz , Galvin, and Gagne "Operating System Concepts", John Wiley, 8th Ed., 2016. 2. D. M. Dhamdhere Operating Systems--A Concept Based Apparoach, McGraw-Hill, 2018
Additional Reference Books		1. William Stallings, "Operating Systems Internals & Design Principles", Pearson Education, 6th Ed., 2016.

Subject Title		**Mathematics and Probability**			
Subject Ref. No.		**MANC402**			
			No. of Credits	:	4
			Assignments / Sessional	:	40
			Semester Examination	:	60

Course Outcomes (COs)

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

CO-1	To extend student's logical and mathematical maturity & ability to deal with abstraction and to introduce most of the basic terminologies used in computerscience courses and application of ideas to solve practical problems.
CO-2	To understand the basic concepts of combinatorics, graph theory and to familiarizethe applications of algebraic structures.
CO-3	To understand the concepts and significance of lattices and boolean algebra whichare widely used in computer science and engineering.
CO-4	To provide a foundation in probability theory in order to solve applied problemsand to prepare for more advanced courses in probability.
CO-5	To learn various distributions, Sampling Distributions that helps to enhance the quality of research approach.

Course Objective	In this subject student will learn Logic, Relations and Functions, Algebraic Functions, Graph Theory and Trees will be introduced in this course. Students will be able to calculate permutations and combinations to then find the probability of a compound event or to solve a problem.
Prerequisites	Prerequisites for this course is student should have basic knowledge of abstract algebra and permutation and combination

Unit I	**LOGIC AND PROOFS**: Propositional logic – Propositional equivalences – Predicates and quantifiers – Nested quantifiers – Rules of inference – Introduction to proofs – Proof methods and strategy. **COMBINATORICS**: Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.
Unit II	**GRAPHS AND GRAPH MODELS** – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths. **ALGEBRAIC SYSTEMS** – Semi groups and monoids – Groups – Subgroups – Homomorphism‘s – Normal subgroup and cosets – Lagrange‘s theorem – Definitionsand examples of Rings and Fields.
Unit III	**LATTICES AND BOOLEAN ALGEBRA**: Partial ordering – Posets – Lattices as posets – Properties of lattices – Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.
Unit IV	**Probability** : Sample Space , Events, Counting Sample Points, Probability of an Event, Additive Rules, Conditional Probability, Independence and Product Rules, Bayes' Rule. **Random Variables and Probability Distributions** : Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Joint Probability Distributions. **Mathematical Expectation**: Mean of a Random Variable, Variance and Covariance of Random Variables, Means and Variances ofLinear Combinations of Random Variables 127, Chebyshev's Theorem.
Unit V	**Discrete Probability Distributions**: Binomial, Multinomial, Hypergeometric Distributions, Negative Binomial and Geometric Distributions, Poisson Distribution and the Poisson Process. **Continuous Probability Distributions** : Continuous Uniform Distribution, Normal Distribution, areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial, Gamma and Exponential Distributions, Chi-Squared Distribution. **Sampling Distributions and More Graphical Tools** : Random Sampling and Sampling Distributions, Sampling Distribution of Means and the Central Limit Theorem, Sampling Distribution of S2, t-Distribution , F-Distribution.
Text Book	1. Swapan Kumar Sarkar, "A text book of Discrete Mathematics", S. Chand Publication 2. Discrete Mathematical Structures for Computer S Science by Kolman B and Bushy R , Prentice – Hall of India 1998 3. A Basic Course in Probability Theory by Rabi Bhattacharya & Edward C.Waymire 4. Probability and Random Variables: A Beginner's Guide by David Stirzaker
Reference Books	1. Discrete Mathematics by C L Liu- Tata McGraw Hill Publishing house 2000 2. Discrete Mathematical Structures with applications to Computer Science by Tremblay and Manohar, Prentice – Hall of India 1997

Subject Title	**:**	**Programming using Python**			
Subject Ref. No.	**:**	**MANC403**	**No. of Credits**	**:**	3
			Assignments / Sessional	**:**	25
			Semester Examination	**:**	50

Course Outcomes (COs)

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

CO-1	Apply the principles python programming.
CO-2	Write clear and effective python code.
CO-3	Create applications using python programming.
CO-4	Access database using python programming.
CO-5	Develop web applications using python programming.
CO-6	Develop and use Web Services using python.

Pre Requisite	**:**	Working knowledge of C/C++ programming, Basic algorithms and data structure concepts.
Unit – I	**:**	**Introduction to Python Programming Language :** Strengths and Weaknesses, IDLE, Dynamic Types, Naming Conventions, String Values, String Operations, String Slices, String Operators, Numeric Data Types, Conversions, Built In Functions
Unit – II	**:**	**Data Collections and Language Component:** Introduction, Control Flow and Syntax, Indenting, The if s tatement, Relational Operators, Logical, Operators, True or False, Bit Wise Operators, The while Loop, breakand continue, The for Loop, Lists, Tuples, Sets, Dictionaries, Sorting Dictionaries, Copying Collections.
Unit – III	**:**	**Object and Classes :** Classes in Python, Principles of Object Orientation, Creating Classes, Instance Methods, File Organization Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes
Unit – IV	**:**	**Functions and Modules :** Introduction, Defining Your Own Functions, Parameters, Function Documentation, Keyword and Optional Parameters, Passing Collections to a Function, Variable Number of Arguments, Scope ,Functions - "First Class Citizens", Passing Functions to a Function, Mapping Functions in a Dictionary, Lambda, Modules
Unit – V	**:**	**I/O and Error Handling In Python :** Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, ,Reading Data From a File, Additional File Methods, Using Pipes as Data Streams, Handling IO Exceptions, Working with Directories, Metadata, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions
Text Books	**:**	Learning Python, 4th Edition by Mark Lutz Programming Python, 4th Edition by Mark Lutz

Subject Title		**Advance Web Technology**			
Subject Ref. No.		**MANC404**	**No. of Credits**		3
			Assignments/Sessional		25
			Semester Examination		50

Course Outcomes (COs)

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

CO-1	Design WebPages using basic HTML tags & forms.
CO-2	Apply different CSS to WebPages.
CO-3	Write basic script in JavaScript to perform different functionalities.
CO-4	Validate the forms input depending upon different events.
CO-5	Write simple programs using jQuery & AJAX.
CO-6	Design website using Dream Viewer tool.

Prerequisites	Student should know the basic programming concepts.
Unit I	**HTML & Forms** Introduction To HTML, WWW, W3C, web publishing, Common HTML, Tags Physical & Logical, Some basic tags like <body> , changing background color of page, text color etc., Text formatting tags, <p> , <hr> tags, Ordered & Unordered Lists Tags, Inserting image, Links: text, image links, image mapping , Tables , Frames, Form Introduction with text box, text area, buttons, List box, radio, checkbox etc. **HTML 5** Introduction , form elements – date, dateTime, email, number, range, tel, color, URL, datetimelocal, month , week, time, placeholder attribute, autofocus attribute,required attributes , HTML audio , video
Unit II	**CSS** Introduction To Style sheet, types of style sheets- Inline, External, Embedded CSS, text formatting properties, CSS Border, margin properties, Positioning Use of classes in CSS, color properties, use of &
Unit III	**JavaScript**
	Intro to script, types, intro of JavaScript, JavaScript identifiers, operators, control& Looping structure, Intro of Array, Array with methods, Math, String, Date Objects with methods User defined & Predefined functions, DOM objects, Window Navigator, History, Location. **Event handling & Validations on Forms – JavaScript** Handling Events on Button, Textbox, radio button, checkbox, drop down box, text area etc. Form Validation – numeric, alphanumeric, alphabets and any combination of these. Disabling the keys on the keyboard, regular expression

Unit IV	**jQuery** Introduction to jQuery, Syntax Overview Anatomy of a jQuery Script, Creating first jQuery script Traversing the DOM, Selecting Elements with jQuery, Refining & Filtering Selections, Selecting Form Elements Working with Selections - Chaining, Getters & Setters CSS, Styling, & Dimensions
Unit V	Manipulating Elements - Getting and Setting Information about Elements, Moving, Copying, and Removing Elements, Creating New Elements Manipulating Attributes, Utility Methods Events - Connecting Event to Elements, Namespacing Events, Event handling, Triggering Event handlers, Event Delegation JQuery Effects –hide/show, fade, slide, animate, callback, stop Interactions – Draggable, Droppable, Resizable, Selectable, SortableWidgets - Accordian, DatePicker, Menu, Tabs Plugins – Using readymade plugins, Create a basic plugin, Writing Plugins
Text Books	• HTML, DHTML, JavaScript, Perl & CGI Ivan Bayross • HTML & CSS : The Complete reference, Fifth Edition By Thomas Powell
Reference books	• Html, Xhtml, And Css Bible (English) 5th Edition (paperback) by Schafer, Steven • HEAD FIRST HTML AND CSS, 2/ED (UPDATED FOR HTML) by ROBSON • Beginning HTML and CSS (English) (Paperback) by Rob Larsen • Learn to Code HTML and CSS (English) (Paperback) by Howe • Javascript Bible (English) 7th Edition by Danny Goodman MichaelMorrison Paul Novitski Tia GustaffRayl • Javascript Programming: Pushing the Limits (English) 1st Edition By (2013)Jon Raasch • Head First JavaScript (2007) By michael Morrison • JavaScript: The Definitive Guide (2011) by Flanagan, David • Introducing HTML5 - Bruce Lawson, Remy Sharp • AngularJS - Brad Green, Shyam Seshadri • Learning jQuery - Jonathan Chaffer, Karl Swedberg • Professional Ajax, 2nd Edition Wrox Press • Internet Technology at work Hofstetter fred, TMH.
Web references	1. www.w3school.com 2. www.tutorialpoint.com

Subject Title		**JAVA**			
Subject Ref. No.		**MANC405**			
			No. of Credits	:	3
			Assignments / Sessional	:	25
			Semester Examination	:	50

Course Outcomes (COs)

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

CO-1	Write, compile, and execute Java programs that may include basic data types and control flow constructs using J2SE or other Integrated Development Environments (IDEs) such as Eclipse, NetBeans, and JDeveloper
CO-2	demonstrate the use of good object-oriented design principles including encapsulation ,information hiding, Inheritance , Full Abstraction and Partial Abstraction
CO-3	Create GUI Application using Applet & HTML
CO-4	Implement the Multithreading Concept with real time application
CO-5	Control & Maintain Run-Time Exception occurred during web based software development
CO-6	Maintain the file using File handling concepts and provide the ability to inspect & modify the runtime behavior of application using Reflection

Course Objective	This subject helps to clarify the programming concepts in JAVA language. This
	language covers all the techniques of developing the JAVA programs. The course structure of JAVA programming Languages is help to develop web based applications and APPs for Android Mobiles
Prerequisites	Fundamentals of Computer System , operating system , C and C++ Language
Unit I	Java Fundamentals , J2SE, J2EE, J2ME, Features of Java , OOPs concepts, benefits of JAVA, Hardware / Software requirement, Support system and Environment of JAVA, System Variable, Environment Variable, Path and Class Path. JAVA API. Application of More JAVA, application with two classes , program structure , tokens, statements installing and configuration JAVA , implementing JAVA program, JAVA virtual M/C Architecture and different alias with functionality, command line arguments, program style, keywords , data types, Operators, Decision Making and Branching , looping Statement . Predefined classes (Scanner, Date, Random …….)
Unit II	Class objects and methods: class definition,class types-Bean Class, POJO class, Factory Class, Singleton Class, Runtime class, Inner Class. methods, fields declaration.Object, ways to create an object and operations on it. Garbage Collector. constructor , overloading , static members , nesting methods , Inheritance, overloading , Final class and Methods , array string and vector, Interfaces : definition , implementation , accessing Interface Variables , Packages : introduction, uses , creating , accessing adding a class to package hiding class

Unit III	Multithreaded Programming : Introduction , creating threads stopping and blocking a threads , Life cycle of a thread, its exceptions priority, synchronization, Managing Errors and Exception : types of error , exception , syntax of exception Handling , multiple catch statement, throwing our own exception Applet Programming : Introduction , preparing to write Applets building Applets code, creating an executable Applet , designing a web page , applet tag, adding Applet Tag, running applet more HTML tags , event handling
Unit IV	AWT programming : introduction , create JAVA application using AWT, creating JAVA Applet using AWT , execute applet, execute applet in browse, message in the status bar, get HTML and AREA size , window and event, Graphic Programming : introduction, Graphic class, lines and rectangles, circle, ellipse, arcs poly, line graphs, using control loops in Applets , Bar charts , Text Field, Label , button , check box layouts , text area, scroll list , selection control, scrollbar, menu, dialog.
Unit V	Managing Input / Output Files in JAVA : streams, streams classes, Byte streams classes , reading and writing characters , bytes, Random Access Files , Interactive I/pand o/p,Reflection API- class identification, interface identification, parent class informationand methods information.
Text Book	Programming with Java A Primer, E.Balaguruswamy Tata McGraw Hill Companies, Core Java, Dietel and Dietel
Reference Books	The complete reference JAVA2, Herbert schildt. TMH, Java Programming John P. Flynt Thomson 2nd, Java Programming Language Ken Arnold Pearson , Big Java, Cay Horstmann 2nd edition, Wiley India Edition

Open Elective –I

Subject Title	:	**MIS and DSS**		
Subject ref. No.	:	**MANC411**		
		No. of credits	**:**	**4**
		Internal	**:**	**100**
		Semester Exam	**:**	**-**
Course Objectives	:	**1.** Understand the fundamental concepts, definitions, characteristics, and objectives of Management Information Systems (MIS) and their role in enhancing organizational effectiveness. **2.** Analyze the decision-making process within organizations and the impact of MIS in supporting managerial decision-making and control systems. **3.** Examine IT infrastructure, data collection methods, and the classification of information, with a focus on contemporary platforms and their organizational impact. 4. Explore the concepts, components, and limitations of Decision Support Systems (DSS), Group Decision Support Systems (GDSS), AI, KMS and their integration with MIS for improved business processes.		
Pre Requisite	:	NA		
Unit-I **MIS, Decision Making: An overview**	:	Concept, definition , characteristics, objectives , Role and impact of MIS, Management as a control system, MIS: A support to the management, application of MIS to e- business, organization effectiveness, Decision making concept, decision making process, organizational decision making, MIS and decision making.		
Unit-II **Information, Knowledge, Business Intelligence**	:	Information: A quality product, Classification of information, methods of data and information collection, value of information, IT infrastructure, components, Planning, contemporary platforms, IT Capabilities and their organizational impact – Telecommunication, Networks & internet, current trends in technologies & tools –- IT enabled services, e business, wireless technologies etc. information systems levels , information system in business , Computer based information system, limitation and disadvantages of IS, Human as an information processor, knowledge and knowledge management system, business intelligence.		
Unit-III **System Engineering: Analysis and design, BPR**	:	System: concept and control, types of system, general model of MIS, need of system Analysis, SDM, SSAD, OOA, OOSAD Development Life cycle, development process of MIS, Strategic design of MIS, Business process, Process model of an organization, MIS and BPR		
Unit-IV **DSS, ESS, OAS**	:	SS: concept and philosophy, objectives and characteristics of DSS, major functions of DSS, Components of DSS, DSS generators and tools, limitations of DSS, GDSS, components of GDSS, MIS and benefits of DSS, ESS and components of ESS, OAS, EMS, teleconferencing, telecommuting, automated office, off- line and online data processing.		

Unit-V **Knowledge system , artificial intelligence and ERP**	:	Knowledge system, types of knowledge system, Expert system, application of ES, benefits and Limitations of ES, knowledge base, inference engine, AI, neural network in business, SIS, EMS, ERP, ERP models and modules, benefits of ERP, ERP implementation, SCM, CRM.
Text Books	:	1. Decision Support & Expert System, Efraim Turban 2. W.S.Jawadekar, Management Information System 3. Dr. A.K.Gupta, Management Information System, S.Chand 4. C.S.V. Murthy, Management Information System, Himalaya publishing house, millennium edition
Additional Reference Books	:	1. Spargue, Ralph H. *Decision Support for Management*, Englewood Cliffs, New Jersey, Prentice Hall Inc., 1995. 2. Turban, E. *Decision Support & Expert Systems*, 2nd ed., New York, MacMillan, 1990. 3. Ken Laudon, jane Laudon, Rajanish Dass, Management Information System, Pearson, Eleventh edition

Subject Title		**Creativity & Innovation**			
Subject Ref. No.		**MANC412**	**No. of Credits**		4
			No. of Periods / Week		3
			Internal Evaluation		100
			External		-

Course Outcomes (COs)

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

CO-1	To foster creative thinking and problem-solving skills in the context of computer applications.
CO-2	To explore various innovation methodologies and tools relevant to the IT industry.
CO-3	To enable students to apply creativity and innovation principles to software development and other computer-based projects.

Prerequisites	
Unit I	**Overview of Creativity** Meaning and concept of creativity - Creativity Process- Nature and characteristics of creativity - Factors affecting creativity - understanding creativity from studying the profiles of most creative personalities.
Unit II	**The Creative Process** Stages of the creative process (Preparation, Incubation, Illumination, Verification), Techniques for enhancing creativity (Brainstorming, Mind Mapping, SCAMPER), **Innovation Fundamentals** Innovation Concepts Definition of innovation and its types (Product, Process, Business Model) Difference between creativity and innovation The role of innovation in competitive advantage **Innovation Strategies** Innovation strategies in IT companies Open Innovation and Crowdsourcing Disruptive Innovation and its impact on the industry
Unit III	**Tools and Techniques for Creativity and Innovation** Week 5: Design Thinking Introduction to Design Thinking The five stages of Design Thinking (Empathize, Define, Ideate, Prototype, Test) Application of Design Thinking in software development
Unit IV	**Creativity and Innovation in Software Development** Week 8: Creative Coding Introduction to creative coding and generative art Tools and platforms for creative coding Examples of creative coding in real-world applications
Unit V	**Intellectual Property and Innovation** Understanding patents, trademarks, and copyrights in the IT industry Protecting software innovations Ethical considerations in innovation
Text Books	"Creativity, Inc." by Ed Catmull "The Innovator's Dilemma" by Clayton M. Christensen "Design Thinking: Understanding How Designers Think and Work" by Nigel Cross "The Lean Startup" by Eric Ries "TRIZ for Engineers: Enabling Inventive Problem Solving" by Yuri Salamatov
Reference books	Online tutorials and courses on Design Thinking and Agile methodologies Industry case studies and guest lectures from innovation leaders in IT This curriculum is designed to provide MCA students with the skills and knowledge to be creative and innovative in their approach to software development and other technology-related projects.

Subject Title	:	**Basics of Programming Languages**			
Subject Ref. No.	:	**MANC413**	**No. of Credits**	:	4
			Assignments / Sessional	:	100
			Semester Examination	:	--

Course Objectives:

The primary goals of programming languages are to provide a means for people to transmit instructions to computers, to make code easy for humans to write, read, and understand, and to allow the machine to execute the instructions efficiently.

Course Outcomes (COs)

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

CO-1	To learn how to enhance the thinking capacity to develop the logic of any programming language
CO-2	To develop the programs in C & C++
CO-3	To understand the applications of Kotlin Programming Language
CO-4	To create a basic awareness of C# programming languages

Pre Requisite	:	Computer Fundamentals & Operating System
Unit – I	:	**Basic of Programming Languages** : Programming Languages concepts, Types, Translators, System Software & Application Software , Program definition, steps to write a program in any programming languages, Formulation of Problem, Algorithms, Flowchart, Symbols using in Flowcharts, examples of algorithms using flowcharts.
Unit – II	:	**Introduction to C programming language** : C Language Structure, Data Types, Identifiers, tokens , Statements : Conditional & Loop , Array Function, Structure , Union, pointer & File handling
Unit – III	:	***Introduction to C++ Programming Language*** *: Difference between C & C++,* Characteristics of OOPs, Class & Object, Inheritance, Abstraction , Encapsulation, virtual class, file handling
Unit – IV	:	**Introduction to Kotlin programming Language :** Basic difference between C++ & Kotlin, Features of Kotlin , Environment Setup, IDE, Control Flow, Function, Array, String, Exception , Null Safety, Collections & OOPs concepts in Kotlin
Unit – V	:	***Introduction to C#*** **programming Language :** Basic Structure of C#, Control Statements, Function , Array, Object Class, Properties, Inheritance, Polymorphism, Collections, Delegates, Reflection, String, Exception, Multi-threading
Text Books	:	1. Concepts of Programming Languages by Pearson – Robert W. Sebesta 2. C Programming – Balguruswami 3. Let Us C & C++ - Yashwant Kanetkar 4. Kotlin at A Glance by bpb publication , Swati Saxena
Reference Book		1. Head First Kotlin: A Brain - Friendly Guide Paperback – 26 February 2019, by Dawn Griffiths (Author), David Griffiths (Author) 2. Object Oriented Programming with C++ | 8th Edition, E.Balagurusamy Paperback – 24 September 202

<table>
<tr><td colspan="5">Subject Title : SOFTWARE ENGINEERING</td></tr>
<tr><td>Subject Ref. No.</td><td>MANC414</td><td>No. of Credits</td><td>:</td><td>04</td></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td>No. of Periods/Week</td><td>:</td><td>04</td></tr>
<tr><td>Assignments/Sessional</td><td>:</td><td>100</td></tr>
<tr><td>External Assessment</td><td>:</td><td>--</td></tr>
<tr><td>Course Objective</td><td colspan="4">The purpose of this course is to understand the Software Engineering process, DFD, ERD, Software Inspection process, different design methods, maintenance, CASE TOOLS.</td></tr>
<tr><td></td><td colspan="4">CO-1 Understand basics concepts related with software engineering
CO-2 Understand object oriented methodologies.
CO-3 Understand different models of software development.
CO-4 Design the SRS for software.</td></tr>
<tr><td>Prerequisite :</td><td colspan="4">Emergence of Software Engineering, Different software life cycle models.</td></tr>
<tr><td>Unit –I :</td><td colspan="4">Current trends in Software Engineering
1.1 Software Engineering for projects & products.
1.2 Introduction to Web Engineering and Agile process
Models:
Waterfall, Prototyping, Spiral (including WIN-WIN Spiral), RAD ,Group Based Approach: JAD, Object Oriented methodology</td></tr>
<tr><td>Unit –II :</td><td colspan="4">Activities in Requirements Determination
a) Requirements Anticipation
b) Requirements Investigation
c) Requirements Specifications
Software requirement Specification (SRS)
1] Structure and contents of the requirements specification analysis modeling, types of requirements - functional and non-functional , Quality criteria, requirements definition, SRS format, Fundamental problems in defining requirements
2] Structure and standards followed for SRS
3] characteristics of good SRS –
Unambiguous , complete , verifiable , consistent , modifiable , traceable, usable during maintenance
Feasibility Study : economical, operational, social, technical</td></tr>
<tr><td>Unit –III:</td><td colspan="4">Maintenance
3.1 Types of Maintenance
3.2 Maintenance Cost
3.3 Reverse Engineering
3.4 Introduction to legacy systems
Documentation
3.5 Types
3.6 Role of documentation in maintenance</td></tr>
</table>

Unit – IV:	**Object Oriented Methodologies** SSAD VS OOAD.Why Object –Orientation? Object Oriented Design -Booch Object Modeling Techniques - Rumbaugh Object – Oriented Analysis - Cood Yourdon Object – Oriented Software engineering – Ivar Jacobson Unified Approach
Unit – V :	**Object-Oriented Systems Development Process** Rational Unified Process - Four Major phases:- Inception ,Elaboration, Construction, TransitionRequirements Engineering Problem analysis. Understanding Stockholders need Type of requirements. Use-case Model: Writing Requirements
Text Books:	1. Software Engineering by Pressman 2. Design Object- Oriented Software - Rebecea Wrifs - Brock. Brian Wilkerson, LaurenWiener 3. Object Oriented Analysis and Design - Bennett , Simon McGraw Hill.
Reference Books :	1. System Analysis and Design by Jalote 2. Software Engineering by Sommerville 3. Software Engineering - W S Jawadekar 4. System Analysis & Design methods – Whiten, Bentley 5. System Analysis & Design – Elias Awad 6. Object Oriented Modeling& Design – James Rumbaugh 7. Analysis & Design of Information System – James Senn 8. Analysis & Design of Information System – V. Rajaraman 9. Software Engineering Concepts-Richard Fairley

Subject Title	:	**Python Lab**			
Subject Ref. No.	:	**MANC451**	No. of Credits	:	1
			Internal	:	25
			External	:	-
Content	:	Assignment containing on basis of python programming .			

Subject Title	:	**Advance Web Technology LAB**			
Subject Ref. No.	:	**MANC452**	**No. of Credits**	:	1
			Internal	:	25
				:	-

Course Outcomes (COs)

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

CO-1	Design WebPages using basic HTML tags & forms.
CO-2	Apply different CSS to WebPages.
CO-3	Write basic script in JavaScript to perform different functionalities.
CO-4	Validate the forms input depending upon different events.
CO-5	Write simple programs using jQuery & AJAX.
CO-6	Design website using Dream Viewer tool.

Content	:	Assignment based on the HTML,JAVASCRIPT, JQuery, AJAXwill be covered.

Subject Title		**JAVA LAB**			
Subject Ref. No.		**MANC453**	**No. of Credits**	:	1
			Assignments / Sessional		**Internal**
			Semester Examination		

Course Outcomes (COs)

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

CO-1	Design the fundamentals of object oriented application, and have the ability to apply them
CO-2	Identify, formulate and solve problems by using object oriented programming
CO-3	Use APIs (Application Programmer Interfaces) and design/program APIs
CO-4	Implement Inheritance , Association and Abstraction using OOPs concepts
CO-5	Maintain the Exceptions in Software Development & Design GUI using AWTcontrols
CO-6	Develop Webpage using Applet & Implement multithreading concept in real application

Course Objective	This subject helps to clarify the programming concepts in JAVA language. This language covers all the techniques of developing the JAVA programs. The course structure of JAVA programming Languages is help to develop web based applicationsand APPs for Android Mobiles	
Prerequisites	Fundamentals of Computer System , operating system , C and C++ Language	
Unit I	**Java Fundamentals**	
	1.	Practical demo on JDK installation, Path setting , Classpath Setting , Run programon Console, MyEclipse
	2.	WAP a to demonstrate the primitive data types with their default values.
	3.	WAP a to demonstrate the Looping and decision statements in Java.
	4.	WAP a to demonstrate the function of Predefined class ***Scanner***.
	5.	WAP a to demonstrate the function of Predefined class ***Date***.
	6.	WAP a to demonstrate the function of Predefined class ***Random***.
Unit II	**Class objects and methods**	

	7.	WAP a program to demonstrate the use of Static member and static method
	8.	WAP a program to demonstrate the use of Static member, static block and static method
	9.	WAP a program to demonstrate the use of this, Instance Initializer block
	10.	WAP a program to demonstrate the application of Inheritance using IS-Arelation & Has-A relation.
	11.	WAP a program to demonstrate the application of constructors in Inheritance concept using IS-A relation & Has-A relation.
	12.	WAP to implement static binding in JAVA.
	13.	WAP to implement dynamic binding in JAVA.
	14.	WAP to demonstrate the use of super keyword in inheritance.
	15.	WAP to demonstrate the use of final keyword with instance variable , with method and with class name.
	16.	WAP to demonstrate the implementation of an Array & Vector in Java and its access methods using enhance for a& Enumeration
	17.	WAP to demonstrate all Access Modifiers in JAVA. Default, public, private & protected.
	18.	WAP that demonstrate the applications of abstract class and interface in JAVA
	19.	WAP that demonstrate the applications of package in JAVA
	20.	WAP that demonstrate how to import package, class and how to access the static members and methods of class in JAVA
Unit III	**Multithreaded Programming**	
	21.	WAP to demonstrate the implementation of Multi Threading using Thread Class.
	22.	WAP to demonstrate the implementation of Multi Threading using Runnable Interface.
	23.	WAP to demonstrate the implementation of sleep() & join() methods with Multi-Threading.
	24.	WAP to demonstrate the application of Daemon thread in java.
	25.	WAP to demonstrate the application of Synchronized thread for Mutual Exclusion in java.
	26.	WAP to manage the ArithmeticException in Java.
	27.	WAP to manage the NullPointerException in Java.
	28.	WAP to manage the NumberFormatException in Java.
	29.	WAP to manage the ArrayIndexOutOfBoundsException in Java.
	30.	WAP to management nested Exceptions

	31.	WAP to demonstrate a Simple Applet Functionality in JAVA.
	32.	WAP to demonstrate various shapes avaiLabel in Graphics class which can be implements in JAVA Applet.
	33.	WAP to demonstrate the Applet with FontSize, Font, Color.
	34.	WAP to implement Mutli threading in Applet.
	35.	WAP to configure the components in HTML file and fetch it in Applet & manipulate.
	36.	WAP to configure the number in HTML file and print its table in Applet.
	37.	WAP to create Random Circles in Applet using Random Class and Multi Threading.
	38.	WAP to create Random Circles in different colors in Applet using Random Classand Multi Threading.
Unit IV	**AWT programming**	
	39.	WAP a program to Create a Frame by using Inheritance and Association
	40.	WAP to demonstrate the BorderLayout Layout Manager
	41.	WAP to demonstrate the GridLayout Layout Manager
	42.	WAP to demonstrate the FlowLayout Layout Manager
	43.	WAP to demonstrate the BoxLayout Layout Manager
	44.	WAP to demonstrate the CardLayout Layout Manager
	45.	WAP a program to validate Login Page using TextField & Button
	46.	WAP to create a Calculator in awt
	47.	WAP to enter two numbers and print its addition using Label, Button &TextField
	48.	WAP to perform All Arithmetic Operations on two numbers and print itsaddition using Label, TextField & Button ActionListener Interface
	49.	WAP to add Checkbox & Label. And apply ItemListener Interface application onit.
	50.	WAP to add CheckboxGroup & Label. And apply ItemListener Interfaceapplication on it.
	51.	WAP to add Choice & Label. And apply ActionListener on it
	52.	WAP to add List & Label. And apply ActionListener on it
	53.	WAP a create four Buttons and Two Lists and write code of each Button click to perform different operations
	54.	WAP to demonstrate Canvas Implementation.
	55.	WAP to create Scrollbar application using Label.

	56.	WAP to create MenuBar using Menu and MenuItem application using Label.
	57.	WAP to create MenuBar using Menu and MenuItem application using Label andapply ActionListener Interface
	58.	WAP to demonstrate the Use of Dialog Box.
	59.	WAP to enter two numbers in Dialog Box and perform Addition on it
	60.	WAP to demonstrate the Use of ActionListener on Different Components.
	61.	WAP to demonstrate the Use of MouseListener.
	62.	WAP to demonstrate the Use of ItemListener on Difference Components.
	63.	WAP to demonstrate the Use of KeyListeners .
	64.	WAP to demonstrate the Use of WindowsListeners.
	65.	WAP to demonstrate the Use of Adapter Classes .
	66.	WAP to implement WindowCloseEvent .
	67.	WAP to implement Awt control in Applet
	68.	WAP to implement Awt control & Multi Threading concept in Applet
	69.	WAP program to implement Awt control , Multi Threading & Exception conceptin Applet
Unit V	**Managing Input / Output Files in JAVA**	
	70.	WAP to write & read a character to File.
	71.	WAP to write & read a string to File.
	72.	WAP to write & read the data from&to File using BufferedOutputStream & BufferedInputStream
	73.	WAP to read the data from two files and writes into another file using FileStreams and SequenceStreams.
	74.	WAP to demonstrate the use of Write & Reader classes.
	75.	WAP to demonstrate the use of FileWrite & FileReader classes.
	76.	WAP to demonstrate the use of CharArrayReader & CharArrayWritr classes.
		Reflection in JAVA
	77.	WAP to demonstrate the use of newInstance() method
	78.	WAP to demonstrate the use of javap tool.
	79.	Few program of Refection Concepts

Semester-II

<table>
<tr><td>Subject Title :</td><td colspan="4">Object Oriented Analysis And Design</td></tr>
<tr><td>Subject Ref. No.</td><td>MANC415</td><td colspan="2">No. of Credits:</td><td>02</td></tr>
<tr><td colspan="3"></td><td>Assignments/Sessional:</td><td>50</td></tr>
<tr><td colspan="3"></td><td>Semester Exam.:</td><td>--</td></tr>
<tr><td colspan="5">Course Outcomes (COs)
At the end of the course, students will be able to:
<table><tr><td>CO-1</td><td>Design UML diagrams as Class, sequence, use case, activity, component, deployment, state.</td></tr><tr><td>CO-2</td><td>Generate the documentation associated with SDLC using UML.</td></tr></table></td></tr>
<tr><td>Prerequisite :</td><td colspan="4">Students must have knowledge of Software development life cycle.</td></tr>
<tr><td>Unit –I :</td><td colspan="4">Analysis
Behavioral Analysis
Domain Analysis or Business ObjectAnalysis
Use-case Driven Object Oriented analysis
The UML approach
Use Case Diagram
Use-case Description
Activity Diagram
Class Diagram, Object Diagram
Identify the classes.
Introduction to different approaches for identifying classes
“Noun Phrase” approach OR
“Conman Class Pattern” approach Or“CRC” approach Or
Use case Driven Approach.
Containment and Composition
Aggregation
Inheritance, Subtypes and IS-A Hierarchies.
Association and Link Relationships.</td></tr>
<tr><td>Unit –II :</td><td colspan="4">Design Phases
Translating Analysis Concept into Design.
Optimizing classes and Objects: The Multi-tiered Architecture View
Mapping System functions to objects.
Objects-to-Object Visibility.
Collaboration Diagram
Sequential Diagram
Specification Class Diagram
State Transition Diagram</td></tr>
<tr><td>Unit –III :</td><td colspan="4">Implementation
3.1 Component diagram
3.2 Deployment diagram</td></tr>
</table>

Text Books :	1. Object Oriented Analysis and Design with Applications - Grady Booch., Benjamin / Cummings , 1994. 2. Object – Oriented Modeling and Design - J Rumbaugh, M Blaha, W .Premerlani
Reference Books :	1. Principles of Object- Oriented Software Development - Anton Eliens , Addison Wesley. 2. Object Oriented System Development - Ali Bahrami McGRAW-HILL International Edition. 3. Object-Oriented Software Engineering - Ivar Jacobson Pearson Education INC 4. Applying UML And Pattern - Craig Larman Pearson Education INC 5. UML Distilled - Martin Flowler Pearson Education INC 6. The Unified Modeling Language User Guide - Grady Booch, James Rumbaugh, Ivar Jacobson-Pearson Education INC 7. The Unified Modeling Language Reference Guide - Grady Booch, James Rumbaugh, Ivar Jacobson-Pearson Education INC 8. Instant UML – Muller – Apress LP 9. UML Instant – Thomas A Pendar – Wiley Publication 10. UML in Nutshell

Subject Title	**:**	**Advances in Data Structure**			
Subject Ref. No.	**:**	**MANC409**	**No. of Credits**	**:**	3
			Assignments / Sessional	**:**	25
			Semester Examination	**:**	50

The main objective of the course :

To provide the knowledge of basic data structures and their implementations, to understand importance of data structures in context of writing efficient programs and to develop skills to apply appropriate data structures in problem solving.

Course Outcomes (COs)

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

CO-1	To introduce the concepts of Abstract data Type implement linear data structures
CO-2	To learn real time applications using Stack and Queue
CO-3	To implement various search data structures such as hashing, binary search trees, AVL trees, B+ trees and B*-trees using programming languages
CO-4	To implement graph theory concept (Minimum Spanning Tree) in Civil Network Planning, Computer Network Routing Protocol and summarize searching and sorting techniques

Pre Requisite	**:**	C & C++ Programming Languages

Unit – I	**:**	**Introduction To Data Structure** : Introduction, Data Definition, Data Object, Data Types, Built-in Data Type, Derived Data Type, Data Structure, Implementation of Data Structure Array : Array as Data Structure, Storage Representation of Arrays, Applications of Arrays, Polynomial Representation Using Arrays, Addition of Two Polynomial, Multiplication of Two Polynomial, Sparse Matrices, Addition of Sparse Matrices, Transpose of a Sparse Matrix
Unit – II	**:**	Stack : Introduction, Definition, Operation on Stack, Static & Dynamic Implementation of a Stack, Application of Stack, Recursion, Infix, Prefix & Postfix expression, Matching Parentheses in an expression Queue: Introduction, Definition of a Queue, Operation on a Queue, Static & Dynamic Implementation of Queue, Types of Queue, Circular Queue, Priority Queue, DEQueue, Application of Queue, Job Scheduling, Reversing Stack using Queue
Unit – III	**:**	***Linked List :*** Introduction, Drawback of Sequential Storage, Concept of Linked List, Implementation of Linked List, Operation of Linked List, Creating a List, Displaying a List, Inserting an element in the List, Deleting an element, Other Operation & Applications, Reversing a Linked List, Concatenation of Two Lists, Representation of Polynomial, Circular Linked List & Operation, Doubly Linked List & Operation, Doubly Circular Linked List & Operation, Difference between an array and Linked list, Generalized Linked List,
Unit – IV	**:**	**Tree :** Tree Terminology, Binary Tree, Binary Tree Representation, Binary Search Tree (BST), Creating a BST, Binary Search Tree Traversal, Preorder Traversal, Inorder Traversal, Postorder Traversal **Binary Threaded Tree :** AVL tree, B tree, introduction to B tree, insertion in B tree, deletion from B tree, introduction to B+, B* tree, Expression Tree, Threaded Binary Tree
Unit – V	**:**	***Graph*** **:** Introduction, Graph Representation, Adjacency Matrix, Adjacency List, Graph Traversals, Depth First Search, Breadth First Search. minimumspanning trees -- Prims and Kruskals ***Searching and Sorting*** : Insertion Sorting , Selection Sorting , Bubble Sorting , Shell Sorting , Merge Sorting, Quick Sorting , Divide and Conquer Sorting, Radix sorting , Heap Sorting , Binary Tree Sort. Binary Search, Hashing and Rehashing, Extendible Hashing, Storage
Text Books	**:**	1. C & Data Structure Balagurusamy, 2. Data Structure through C in depth Shrivastava&Shrivastava , 3. Data Structure through C Y.P. Kanetkar 4. Introduction to Algorithms, 3Ed. (International Edition) (MIT Press) by T Cormen (Author), C Leiserson (Author), R Rivest (Author), C Stein (Author). 5. Computer Algorithms, by Horowitz, Sahni, and Rajasekaran, Silicon Press
Reference Book		1. Data Structure Seymour Liptsuz, Data Structure Tannebaum , 6. Data structure and program design in c R.L.Kruse

Subject Title :	**Advanced DBMS**			
Subject Ref. No.	**MANC417**	No. of Credits	:	03
		No. of Periods/Week	:	03
		Assignments/Sessional	:	25
		Semester Exam.	:	50
Course Objective	Keen stress on the Advanced concepts of distributed and object oriented databases is focused on for effective understanding of the subject			
Prerequisite :	NA			
Unit –I :	**Introduction** Database and Need for DBMS, Characteristics of DBMS, Database Users, 3-tier architecture of DBMS (its advantages over 2-tier), Data Models, Views of data-schemas and instances.			
Unit –II :	**Transaction and Concurrency Control** Concept of transaction, ACID properties' Serializibility, States of transaction, Concurrency control, Locking techniques, Time stamp based protocols, Granularity of data items, Deadlock.			
Unit –III :	**Relational Model and Relational Database design** Relational data model & relational algebra, Relational model concept, Relational model constraints, Relational Algebra, Relational database language Data definition in SQL, Views and Queries in SQL, Specifying constraints and Indexes in SQL, Specifying constraints management systems, Normalization.			
Unit – IV :	**Data warehousing** Data Marts, Getting data into the warehouse, Extraction, Transformation, Cleansing, Loading, Summarization, Meta data, Data warehousing & ERP, Data warehousing & KM, Data warehousing & CRM			
Unit – V :	**Object Databases Systems** Introduction, User-defined ADTs, Structured types, Object, object identity and references, Inheritance, Database design for ORDBMS, New Challenges in implementing ORDBMS,Storage & access methods,Query processing & Optimization			
Text Books :	Database system concept, Korth Fundamentals of Database Sysems, Elmasri Navathe Database Management Systems, Bipin Desai			
Reference Books :	1. Raghu Ramakrishnan, Johannes Gerhke, "Database Management Systems" McGraw Hill. 2. Decision support & database system –Efrem G. Mallach. 3. Datawarehousing fundamental – Paulraj Ponniah Wiley. 4. Introduction to data mining with case studies – G.K. Gupta. 5. Data Warehousing (OLAP) S. Nagabhushana New Age.			

<table>
<tr><td>Subject Title</td><td></td><td colspan="4">Software Testing</td></tr>
<tr><td>Subject Ref. No.</td><td></td><td>MANC418</td><td>No. of Credits</td><td>:</td><td>3</td></tr>
<tr><td></td><td></td><td></td><td>Assignments / Sessional</td><td>:</td><td>25</td></tr>
<tr><td></td><td></td><td></td><td>Semester Examination</td><td>:</td><td>50</td></tr>
<tr><td></td><td></td><td colspan="4">Course Objective
Understand the different types of testing , testing life cycle , manual & automated test casewriting etc.

Course Outcome (CO)
At the end of the course, students will be able to:
<table><tr><td>CO 1</td><td>Understand the basic concepts of software testing, levels of testing.</td></tr><tr><td>CO 2</td><td>Learn the White box and Blackbox testing techniques.</td></tr><tr><td>CO 3</td><td>Design Manual test cases</td></tr><tr><td>CO 4</td><td>Write automated test cases using any tool.</td></tr></table></td></tr>
<tr><td>Pre Requisite</td><td></td><td colspan="4">Students must have knowledge of Software development life cycle.</td></tr>
<tr><td>UNIT - I</td><td></td><td colspan="4">Introduction
Fundamentals of Testing
1.1 What is Testing?
1.1.1 Typical Objectives of Testing
1.1.2 Testing and DebuggingWhy
is Testing Necessary?
Testing’s Contributions to Success
1.2.2 Quality Assurance and Testing
1.2.3 Errors, Defects, and Failures
1.2.4 Defects, Root Causes and Effects
1.3 Seven Testing Principles
1.4 Test Process
1.4.1 Test Process in Context
1.4.2 Test Activities and Tasks
1.4.3 Test Work Products
1.4.4 Traceability between the Test Basis and Test Work Products
1.5 The Psychology of Testing
1.5.1 Human Psychology and Testing
Tester’s and Developer’s Mind-set</td></tr>
<tr><td>UNIT - II</td><td></td><td colspan="4">Testing Throughout the Software Development Lifecycle
2.1 Software Development Lifecycle Models
2.1.1 Software Development and Software Testing
2.1.2 Software Development Lifecycle Models in Context
2.2 Test Levels
2.2.1 Component Testing
2.2.2 Integration Testing
2.2.3 System Testing
2.2.4 Acceptance Testing
2.3 Test Types
2.3.1 Functional Testing
2.3.2 Non-functional Testing
2.3.3 White-box Testing</td></tr>
</table>

		2.3.4 Change-related Testing 2.3.5 Test Types and Test Levels 2.4 Maintenance Testing 2.4.1 Triggers for Maintenance 2.4.2.Impact Analysis for Maintenance
UNIT - III		3 Static Testing 3.1 Static Testing Basics 3.1.1 Work Products that Can Be Examined by Static Testing 3.1.2 Benefits of Static Testing 3.1.3 Differences between Static and Dynamic Testing 3.2 Review Process 3.2.1 Work Product Review Process 3.2.2 Roles and responsibilities in a formal review 3.2.3 Review Types 3.2.4 Applying Review Techniques 3.2.5 Success Factors for Reviews
UNIT - IV		4 Test Techniques 4.1 Categories of Test Techniques 4.1.1 Choosing Test Techniques 4.1.2 Categories of Test Techniques and Their Characteristics 4.2 Black-box Test Techniques 4.2.1 Equivalence Partitioning 4.2.2 Boundary Value Analysis 4.2.3 Decision Table Testing 4.2.4 State Transition Testing 4.2.5 Use Case Testing 4.3 White-box Test Techniques 4.3.1 Statement Testing and Coverage 4.3.2 Decision Testing and Coverage 4.3.3 The Value of Statement and Decision Testing 4.4 Experience-based Test Techniques 4.4.1 Error Guessing 4.4.2 Exploratory Testing 4.4.3. Checklist-based Testing
UNIT - V		**Tool Support for Testing** Test Tool Considerations 5.1 Test Tool Classification 5.1.1 Benefits and Risks of Test Automation 5.1.2 Special Considerations for Test Execution and Test ManagementTools 5.2 Effective Use of Tools 5.2.1 Main Principles for Tool Selection 5.2.2 Pilot Projects for Introducing a Tool into an Organization 5.2.3 Success Factors for Tools One Automated Testing Tool Demonstration will be covered.
Text Books		A. Introducing Software Testing by Louise Tamres B. Effective Methods for software Testing by William Perry C. Software Testing in Real World by Edward Kit D. Software Testing Techniques by Boris Beizer

Subject Title	**:**	**Research Methodology**			
Subject Ref. No.	**:**	**MANC419**	**No. of Credits**	**:**	4
			Assignments / Sessional		100
			Semester Examination		

Course Outcomes (COs)

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

CO-1	To provide students with a comprehensive understanding of research methodology in the context of computer applications.
CO-2	To equip students with the skills needed to design, conduct, analyze, and report research in the field of computer science.
CO-3	To introduce students to various research methods, tools, and techniques relevant to computer applications.

Pre Requisite	**:**	
Unit – I	**:**	**Introduction to Research in Computer Applications** Definition and objectives of research Types of research: Basic, applied, exploratory, descriptive, analytical Importance of research in computer science and applications
Unit – II	**:**	**Research Process and Research Design** Overview of the research process Steps in conducting research: Problem identification, literature review, hypothesis formulation, research design Types of research design: Experimental, correlational, survey, case study
Unit – III	**:**	**Importance of literature review in research** Sources of literature: Journals, conferences, books, online databases Techniques for effective literature search and review **Research Problem and Hypothesis** Identifying and defining a research problem Formulating research questions and hypotheses Importance of clarity and specificity in problem formulation
Unit – IV	**:**	**Quantitative Research Methods** Overview of quantitative research methods in computer applications Data collection techniques: Surveys, experiments, simulations Data analysis techniques: Statistical analysis, regression, correlation Qualitative Research Methods Overview of qualitative research methods Data collection techniques: Interviews, focus groups, case studies Data analysis techniques: Thematic analysis, content analysis, coding
Unit – V	**:**	**Data Collection and Analysis** Sampling Techniques Concepts of population and sample Probability and non-probability sampling techniques Determining sample size and sampling error **Ethical Issues in Research** Ethical considerations in research: Privacy, consent, plagiarism Intellectual property rights and copyright issues

		Best practices for ethical research in computer science
Text Books	**:**	(i) "Research Methodology: Methods and Techniques" by C.R. Kothari and Gaurav Garg (ii) "Research Methods for Computer Science" by Michael O. Rabin and Panagiotis K. Chrysanthis (iii) "The Craft of Research" by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams (iv) "Design and Analysis of Experiments" by Douglas C. Montgomery
	:	

Open Elective –II

Subject Title		**Advance JAVA**			
Subject Ref. No.		**MANC421**	**No. of Credits**		3
			Assignments / Sessional		25
			Semester Examination		50

Course Outcomes (COs)

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

CO-1	Develop Swing-based GUI application & understand the real application of Collections in Software Development
CO-2	Develop the server side programming using Servlet
CO-3	Connect the server side database and its implementation in client server terminology using JDBC
CO-4	Develop client/server application and TCP/IP socket programming using Networking Technology
CO-5	Develop component-based Java software using JavaBeans
CO-6	Develop distributed applications using Remote Method Invocation

Course Objective	This subject is essential for providing knowledge and hands on experience over the issues of managing data on web, developing powerful GUI based friendly user interface, server side programming and developing applications for communication over network using object oriented fundamentals.
Prerequisites	Concepts of OOPs and Core JAVA

Unit I	SWINGS : introduction , JApplet , JFrame, Jcomponent , Labels, TextFields, Buttons, Check Boxes, Radio Buttons, Combo Boxes, Tabbed Panes, Scroll Panes, Tree, Tables, GenericProgramming : class, methods bounds for type variable , generic code and the virtual machine, translating generic expressions and methods, calling legacy code, restrictions and limitations , Inheritance rules for Generic type, wildcard types , reflection and generic
Unit II	COLLECTION: collection interfaces , concrete collections : Linked List, Array List, Hash Sets, Tree Sets. NETWORKING : introduction, Socket Overview, Client/Server, InetAddress class, TOP-UP socket : Socket, Server Socket, Datagrams, Address indetifiers , URL connection
Unit III	JDBC: Overview, who and why JDBC, JDBC architecture JDBC API, Types of JDBC Drivers, JDBC basic –java Database connectivity steps, Test JDBC driver Installation, Test JDBC connection, JDBC driver name and version, JDBC create table JDBC insert Data into SQL Tables, JDBC select data, JDBC update Data.
Unit IV	SERVLETS: What is servlets, advantages servlets over traditional CGI , Basic structure of servlets, A simple servlets generating plain text, computing, and installing the servlet, running servlet interface and life cycle. Request and response Objects, Request onto, , A servlet that Generates HTML, Simple HTML building utilities, cookies , The servlet cookies API, generating cookies , reading cookies from client , some minor cookies utilities, session tracking , the session tracking API, associating the information with a session
Unit V	JAVA RMI :overview, The RMI architecture , Operation on an RMI distributed system summary, Note on code mobility, writing RMI services , writing a RMI client , developing of RMI.
Text Book	1. Core Java Vol 2 Advanced Features by Cay Horstmann, Gary Cornell 2. Head First Java by Kathy Sierra & Bert Bates 3. The Complete Reference –J2EE Jim Keogh
Reference Books	1. Swing a Beginner's Guide by Herbert Schildt 2. An Introduction to object-oriented programming with JAVA by C. Thomas WU 3. Graphic JAVA Mastering the JFC-David Geary

Subject Title		Advance JAVA Lab			
Subject Ref. No.		MANC458	No. of Credits		1
			Internal		25

Course Outcomes (COs)

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

CO-1	Develop Swing-based GUI application & understand the real application of Collections in Software Development	
CO-2	Develop the server side programming using Servlet	
CO-3	Connect the server side database and its implementation in client server terminology using JDBC	
CO-4	Develop client/server application and TCP/IP socket programming using Networking Technology	
CO-5	Develop component-based Java software using JavaBeans	
CO-6	Develop Distributed Applications using Remote Method Invocation	

Course Objective		
Unit I	1.	WAP to create Login Validation form using JButton , JLabel, JTextField ,JPasswordField and ActionOperformed & KeyPressedListeners
	2.	WAP to create Arithmetic operation GUI form using JButton , JLabel & ActionOperformed Listener
	3.	WAP to demonstrate the use of JTextArea control with its methods.
	4.	WAP to create JCheckBox and implement ItemListener interface
	5.	WAP to create a application of multiple JCheckBox with ItemListener
	6.	WAP to demonstrate the use of JRadioButton control with JOptioPane & ActionListener Interface
	7.	WAP programto create JOptionPane with showMessageDialog, showInputDialog, showConfirmationDialog.
	8.	WAP to create a JScrollBar with AdjustmentListener
	9.	WAP to create a note application using JMenubar, JMenu, JMenuItem & ActionListener

	10.	WAP to create JPopupMenu withMouseListener & ActionListener
	11.	WAP to create JCheckBoxMenuItem & JSeparator using ActionListener
	12.	WAP to create JProgressBar & JScrollBar with all methods.
	13.	WAP to create JTable, JTree & JSlider with all methods.
	14.	WAP to create JColorChooser with ActionListener.
	15.	WAP to demonstrate use of JFileChooser control in Swing
	16.	WAP to demonstrate all LayoutManagers in swing
	17.	Demonstration of other controls available in swing
	18.	WAP to create JDBC Connection Type-1 (JDBC-ODBC bridge driver)
	19.	WAP to create JDBC Connection Type-2 (Native-API driver (partially java drive
	20.	WAP to create JDBC Connection Type-3 (Network Protocol driver (fully java driver)
	21.	WAP to create JDBC Connection Type-4 (Thin driver (fully java driver)
	22.	WAP to implement Statement Interface in JDBC. (Insert, Delete, update and Display the records from oracle table)
	23.	WAP to implement PreparedStatement Interface in JDBC. (Insert, Delete, update and Display the records from oracle table)
	24.	WAP JDBC program to write & read a BLOB and CLOB to Table
	25.	WAP to demonstrate the CollableStatment Interface to retrieve the procedure for IN parameter
	26.	WAP to demonstrate the CollableStatment Interface to retrieve the procedure for OUT parameter
	27.	WAP to demonstrate the CollableStatment Interface to retrieve the procedure for INOUT parameter
	28.	WAP to demonstrate the CollableStatment Interface to retrieve the function from SQL.
	29.	WAP to demonstrate how to get primary key value(Auto generated keys) from inserted queries using JDBC
	30.	WAP for CallableStatement statement with batch execution.
	31.	WAP to execute SQL cursor using CallableStatement Interface.
	32.	WAP to demonstrate the batch update using Statement Interface.
	33.	WAP to demonstrate the batch update using PreparedStatement Interface.
	34.	Write an example for scrollable result set with read only mode.
	35.	WAP to get JDBC Connection object using properties file.

Unit II	36.	WAP to print a Welcome Message in servlet using Serlvet Interface
	37.	WAP to print a Welcome Message in servlet using GenericServlet class
	38.	WAP to print a Welcome Message in servlet using HttpSerlvet Class
	39.	WAP to retrieve the Client Input Data in Servlet using getParameter()
	40.	WAP to retrieve the Client Input Data in Servlet using getParameterValues()
	41.	WAP to retrieve the Client Input Data in Servlet using getParameterNames()
	42.	WAP to demonstrate the application of ServletConfig Interface.
	43.	WAP to demonstrate the application of ServletContext Interface.
	44.	WAP to connect servlet to database.
	45.	WAP to create login Application using JDBC concept.
	46.	WAP that demonstrate the implementation of RequestDispatcher Interface..
	47.	WAP to demonstrate the difference between forward() & sendRedirect() method
	48.	WAP to demonstrate the difference types of attributes in Servlet i.e. request scope, session scope & application scope.
	49.	WAP to demonstrate how session tracking can be achieve by Cookies
	50.	WAP to create a Login & Logout application using Cookies.
	51.	WAP to demonstrate how session tracking can be achieve by Cookies
	52.	WAP to create a Login & Logout application using Cookies.
	53.	WAP to demonstrate how session tracking can be achieve by Hidden Form Field
	54.	WAP to create a Login & Logout application using Hidden Form Field.
	55.	WAP to demonstrate how session tracking can be achieve by URL rewriting
	56.	WAP to demonstrate how session tracking can be achieve by HttpSession.
	57.	WAP to create a Login & Logout application using **HttpSession**.
	58.	WAP to demonstrate CRUD implementation in Servlet.
Unit III	59.	WAP to add the elements in collection object.
	60.	WAP to demonstrate all methods of Collections class.
	61.	WAP to demonstrate the use of Enumeration Cursor in Collection.
	62.	WAP to demonstrate the use of Inte WAP to perform all operations of ArrayList & iterate it.rator Cursor in Collection.
	63.	WAP to demonstrate the use of ListInterator Cursor in Collection.
	64.	WAP to perform all operations of ArrayList & iterate it.
	65.	WAP to perform all operations of LinkedList & iterate it.
	66.	WAP to perform all operations of Stack & iterate it.
	67.	WAP to perform all operations of Vector & iterate it.

	68.	WAP to perform all operations of LinkedHashSet & iterate it.
	69.	WAP to perform all operations of TreeSet & iterate it.
	70.	WAP to perform all operations of Queue & PriorityQueue and iterate it.
	71.	WAP to perform all operations of Deque & ArrayDeque and iterate it.
	72.	WAP to perform all operations of Map Interface & iterate it.
	73.	WAP to perform all operations of HashMap Interface & iterate it.
	74.	WAP to perform all operations of LinkedHashMap Interface & iterate it.
	75.	WAP to perform all operations of TreeMap Interface & iterate it.
	76.	WAP to perform all operations of HashTable Interface & iterate it.
	77.	WAP to perform natural sorting using Comparable Interface.
	78.	WAP to perform customize sorting using Comparator Interface.
Unit IV	79.	WAP to create a URL.
	80.	WAP to create a File URL.
	81.	WAP to create a URL object with all propertirs.
	82.	WAP to get URL Properties.
	83.	WAP to get URL object with relative path .
	84.	WAP to read URL content, encode & decode URL content.
	85.	WAP to get machine IP address, IP address of host, host name by IP address, machine host name .
	86.	WAP to get all IP address of a Host
	87.	WAP to create Connection Oriented client server application using ServerSocket & Socket
	88.	WAP to create Connection Oriented client server chatting application using ServerSocket & Socket
	89.	WAP to create Connection less client server application using DatagramSocket & DatagramPocket
Unit V	90.	WAP to create RMI application using Remote
Text Book		

Subject Title	:	**Data Science Using Python**			
Subject Ref. No.	:	**MANC422**	**No. of Credits**	:	3
			Assignments / Sessional		25
			Semester Examination		50

Course Outcomes (COs)

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

CO-1	Use Python for Data Science and Machine Learning
CO-2	Learn to use NumPy for Numerical Data, Pandas for Data Analysis, Matplotlib for Python Plotting
CO-3	K-Means Clustering Logistic Regression

Pre Requisite	:	Basics of Python, Probability, and Statistics
Unit – I	:	Introduction: Basics of Python Revision, Basics of Probability, Statistics
Unit – II	:	**Introduction to Numpy:** Numpy Arrays, Quick Note on Array Indexing, Numpy Array Indexing, Numpy Operations, Numpy Exercises Overview Numpy Exercises Solutions **Introduction to Pandas:** Series, DataFrames - Part 1, DataFrames - Part 2, DataFrames - Part 3, Missing Data, Groupby, Merging Joining and Concatenating, Operations, Data Input and Output
Unit – III	:	**Python for Data Visualization -** **Matplotlib**: Matplotlib Part 1, Matplotlib Part 2, Matplotlib Part 3, Matplotlib Exercises Overview, Matplotlib Exercises - Solutions **Introduction to Seaborn**, Categorical Plots, Matrix Plots, Grids, Regression Plots, Style and Color, Seaborn Exercise Overview, Seaborn Exercise Solutions
Unit – IV		**Introduction of Machine Learning:** Supervised Learning Overview, Evaluating Performance - Classification Error Metrics, Evaluating Performance - Regression Error Metrics, Machine Learning with Python Linear Regression Theory model_selection Updates for SciKit Learn, Linear Regression with Python Logistic Regression Theory, Logistic Regression with Python, KNN Theory KNN with Python
Unit – V		**Introduction to Tree Methods:** Decision Trees and Random Forest with Python, SVM Theory Support Vector Machines with Python, K Means Algorithm Theory K Means with Python, Principal Component Analysis PCA with Python
Text Books	: :	Python for Data Science, Ben Chan Published by Notion Press available on Flipkart Python for Data Science For Dummies John Paul Mueller Luca Massaron
E BOOKS		Python Data Science Handbook: Essential Tools for Working with Data by Jake VanderPlas O'Reilly Publications
MOOC		https://www.udemy.com/course/python-for-data-science-and-machine-learning-bootcamp/

Subject Title	**:**	**Data Science Using Python Lab**			
Subject Ref. No.	**:**	**MANC459**	**No. of Credits**	**:**	1
			Internal		25

Course Outcomes (COs)

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

CO-1	Use Python for Data Science and Machine Learning
CO-2	Learn to use NumPy for Numerical Data, Pandas for Data Analysis, Matplotlib for Python Plotting
CO-3	K-Means Clustering Logistic Regression

As per necessity of Data Science using Python Theory

Subject Title		**ASP.NET - I**			
Subject Ref. No.		**MANC 423**	**No. of Credits**		3
			Assignments / Sessional		25
			Semester Examination		50

Course Outcomes (COs)

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

CO-1	Describe basic concepts of ASP.NET and identify components of a form.
CO-2	Use various validation controls on respective objects on the form.
CO-3	Establish connectivity with back end using ADO.Net.
CO-4	Implement stored procedures in ASP.NET.
CO-5	Describe use of Authentication services in ASP.NET.
CO-6	Create a mini-project using controls learnt.

Prerequisites	Before attending this course, students must have:

	The ability to create HTML or DHTML, including: • Tables • Images • Forms Programming experience using Visual Basic .NET, including: • Declaring variables • Using loops Using conditional statements
Unit I	Overview of the Microsoft .NET Framework, Using Microsoft Visual Studio .NET, Introduction to the .NET Framework, Overview of ASP.NET, Creating a Microsoft ASP.NET Web Form, Adding Code to a Microsoft ASP.NET Web Form Using Code-Behind Pages, Adding Event Procedures to Web Server Controls
Unit II	Validating User Input Overview of User Input Validation, Using Validation Controls, Page Validation Creating User Controls Adding User Controls to an ASP.NET Web Form, Creating User Controls
Unit III	Accessing Relational Data Using Microsoft Visual, Studio .NET Overview of ADO.NET, Creating a Connection to the Database, Displaying a DataSet in a List-Bound Control Accessing Data with MicrosoftADO.NET Introduction to Using ADO.NET, Connecting to a Database, Accessing Data with DataSets, Using MultipleTables, AccessingDatawithDataReaders
Unit IV	Calling Stored Procedures with Microsoft ADO.NET, Overview of Stored Procedures, Calling Stored Procedures, Reading and Writing XML Data Overview of XML Architecture in ASP.NET, XML and the DataSet Object, Working with XML Data, Using the XML Web Server Control, Securing a Microsoft ASP.NETWebApplication
Unit V	Web Application Security Overview Working with Windows-Based Authentication Working with Forms-Based Authentication Overview of Microsoft Passport Authentication
Text Books	1. Programming ASP.NET By Jesse Liberty, Dan Hurwitz, Publisher: O'Reilly Media
Reference books	1. ASP. NET: abeginner's guide By DaveMercer, PublisherMcGraw-HillCompanies

Subject Title		**ASP.NET – I Lab**			
Subject Ref. No.		**MANC460**	**No. of Credits**		1
			Internal		25

Course Outcomes (COs)

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

CO-1	Write Simple programs using C#.
CO-2	Use calendar control and Treeview control in forms.
CO-3	Using various validation controls on objects on the forms.
CO-4	ImplementDatagridcontrol,databindingandconnectivityusingC#.Net.
CO-5	Learn to use hyperlink control on Forms.
CO-6	Create a minor project using ASP.NET and SQL Server.

Prerequisites	HTML and VB.net
Unit I	Simple application using web controls A Finding factorial Value B Money Conversion C Quadratic Equation D Temperature Conversion E Login control
Unit II	States of ASP.NET Pages, Adrotator Control, Calendar Control A Display messages in a calendar control BDisplay vacationinacalendarcontrol CSelected dayin a calendar controlusing style DDifference betweentwocalendardates Treeview control A Treeview control and datalist B Treeview operations
Unit III	Validation controls Query textbox and Displaying records Display records by using database Datalist link control Databinding using dropdownlist control Inserting record into a database
Unit IV	Deleting record into a database Databinding using datalist control Datalist control templates Databinding using datagrid Datagrid control template
Unit V	Datagrid hyperlink Datagrid button column Datalist event Datagrid paging Creating own table format using datagrid
Text Books	ProgrammingASP.NET ByJesseLiberty, Dan Hurwitz, Publisher: O'ReillyMedia Visual Basic .NET Programming Black Book By Steven Holzner Publisher: Dreamtech Press ASP. NET: abeginner's guide By DaveMercer, Publisher McGraw-HillCompanies

Subject Title	:	**Data Visualization using Power BI and Tableau**			
Subject Ref. No.	:	**MANC424**	**No. of Credits**	:	3
			Assignments / Sessional		25
			Semester Examination		50

Course Objective:

The course aims to equip students with the skills to use Power BI and Tableau for data visualization, including data preparation, creating visualizations, and designing interactive dashboards. Students will also learn to publish, share, and optimize visualizations for effective data-driven decision-making in real-world scenarios.

Course Outcomes (COs)

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

CO-1	Understand core concepts of data visualization and Business Intelligence tools.
CO-2	Perform data handling, cleaning, and transformation in Power BI and Tableau.
CO-3	Create basic and advanced visualizations for various data insights.
CO-4	Design interactive dashboards and data stories for effective decision-making.
CO-5	Publish, share, and optimize dashboards and visualizations using cloud platforms.

Pre Requisite	:	
Unit – I	:	**Introduction to Data Visualization & BI Tools** Definition & Importance of Data Visualization Concepts of Data Visualization History and Evolution of Visualization Role of Visualization in Data-Driven Decision Making Understanding Business Intelligence (BI) What is BI? Data Analytics vs. Business Intelligence Introduction to BI Tools Overview of Power BI Overview of Tableau Comparative Analysis of Power BI and Tableau
Unit – II	:	**Data Handling and Preparation** Data Sources & Connections Connecting to different types of data sources (databases, files, cloud storage) Data Importing & Exporting in Power BI and Tableau Data Transformation & Cleaning Data cleaning techniques in Power BI (Power Query Editor) Data transformation in Tableau (Data Interpreter, Joins, Blends) Managing Missing and Outlier Data Data Modeling Data Model in Power BI (relationships, hierarchies) Data Model in Tableau (dimensions, measures)

Unit – III	**:**	**Creating Basic Visualizations** Basic Charts & Visualizations Bar, Line, Pie Charts Tables and Matrix Visualizations Scatter Plots, Heat Maps, and Tree Maps Advanced Charts Waterfall Charts, Gauge Charts, and Funnel Charts in Power BI Bullet Graphs, Gantt Charts, and Sparklines in Tableau Customizing Visualizations Formatting and Labeling (Colors, Fonts, and Borders) Tooltips, Legends, and Filters
Unit – IV		**Advanced Features & Dashboards** Advanced Visualizations Time Series Visualizations (Date and Time Analysis) Geospatial Visualizations (Maps) Advanced Filters and Calculations (Slicers, Drillthrough in Power BI, LOD in Tableau) Creating Dashboards Principles of Dashboard Design Creating Interactive Dashboards Combining Multiple Visualizations in Power BI and Tableau Data Storytelling & Interactive Features Adding Interactivity (buttons, actions) Telling Stories with Data
Unit – V		**Publishing, Sharing & Collaboration** Publishing & Sharing Dashboards Power BI Service (publishing and sharing options) Tableau Server/Tableau Public for sharing dashboards Managing Access and Permissions Collaboration Features Collaborating on Reports and Dashboards Using Power BI and Tableau in Teams and Workspaces Performance Optimization Best Practices for Performance Optimization in Power BI and Tableau Reducing Load Times and Handling Large Datasets
Text Books	**:** **:**	
Reference Book		

Subject Title		**Power BI and Tableau Lab**			
Subject Ref. No.		**MANC461**	**No. of Credits**		1
			Internal		25

Course Outcomes (COs)

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

CO-1	Demonstrate proficiency in installing, setting up, and navigating Power BI and Tableau interfaces.
CO-2	Apply data cleaning and transformation techniques using Power Query in Power BI and Data Interpreter in Tableau.
CO-3	Develop basic and advanced visualizations, including time series and geospatial visualizations, in both Power BI and Tableau.
CO-4	Design and implement interactive dashboards with filters, drill-downs, and storytelling elements.
CO-5	Publish, share, and manage permissions for visualizations on Power BI Service and Tableau Public, ensuring effective collaboration.

Prerequisites	
Unit I	**Chapter 1: Introduction to Data Visualization & BI Tools** **Lab Work 1.1: Power BI Installation & Setup** • Install Power BI Desktop. • Explore the Power BI interface (Home, Data, Model, and Report views). • Import a sample dataset (e.g., Excel or CSV file). **Lab Work 1.2: Tableau Installation & Setup** • Install Tableau Public or Tableau Desktop. • Navigate through the Tableau interface (Data, Analytics, and Worksheet panes). • Import a sample dataset (e.g., Excel or CSV file).
Unit II	**Chapter 2: Data Handling and Preparation** **Lab Work 2.1: Connecting to Data Sources in Power BI** • Connect Power BI to different data sources (Excel, SQL Server, Web Data). • Perform basic data loading and examine the data in Power BI. **Lab Work 2.2: Data Cleaning in Power BI (Power Query)** • Use Power Query Editor to clean and transform data (remove duplicates, filter data, fill missing values). • Perform data transformations like pivot/unpivot, merge, and split columns. **Lab Work 2.3: Data Import and Transformation in Tableau** • Import data from multiple sources (Excel, Google Sheets, and SQL Server). • Clean and transform data using Data Interpreter, joins, and blends in Tableau. **Lab Work 2.4: Building Data Models** • Create a data model in Power BI, establishing relationships between multiple tables. • In Tableau, work with dimensions and measures to create a basic data model.

Unit III	**Chapter 3: Creating Basic Visualizations** **Lab Work 3.1: Creating Basic Charts in Power BI** • Create bar charts, line charts, and pie charts using sample datasets. • Add filters and slicers for data interaction. **Lab Work 3.2: Creating Basic Charts in Tableau** • Use Tableau to build bar charts, line charts, and scatter plots. • Use the "Show Me" feature to experiment with different visualization types. **Lab Work 3.3: Advanced Visualizations in Power BI** • Build advanced visualizations like funnel charts, waterfall charts, and gauge charts. • Customize the appearance and interactivity of these charts. **Lab Work 3.4: Advanced Visualizations in Tableau** • Create Gantt charts, bullet graphs, and tree maps in Tableau. • Customize formatting and apply conditional color schemes.
Unit IV	**Chapter 4: Advanced Features & Dashboards** **Lab Work 4.1: Time Series and Geospatial Visualization in Power BI** • Build time series visualizations to analyze trends over time (line chart with date axis). • Create maps and apply geospatial visualizations using latitude and longitude data. **Lab Work 4.2: Time Series and Geospatial Visualization in Tableau** • Use Tableau to create time series graphs and maps to analyze trends and geographic data. • Experiment with different map types and layers. **Lab Work 4.3: Creating Dashboards in Power BI** • Build an interactive dashboard that combines multiple charts and filters. • Use slicers, drillthrough, and drill-down options to enhance interactivity. **Lab Work 4.4: Creating Dashboards in Tableau** • Design a Tableau dashboard with multiple views (charts, graphs, and maps). • Add filters and interactivity (actions between sheets). **Lab Work 4.5: Data Storytelling with Power BI** • Create a report that walks through a business story using multiple pages. • Use buttons and navigation to make the report interactive. **Lab Work 4.6: Data Storytelling with Tableau** • Build a Tableau story that walks through key insights with a step-by-step narrative. • Use actions and dashboard navigation.
Unit V	**Chapter 5: Publishing, Sharing & Collaboration** **Lab Work 5.1: Publishing Dashboards to Power BI Service** • Publish your Power BI report to Power BI Service. • Set up user permissions and explore different sharing options. **Lab Work 5.2: Publishing Dashboards to Tableau Public** • Publish a Tableau dashboard to Tableau Public or Tableau Server. • Adjust sharing and access control settings. **Lab Work 5.3: Collaboration and Team Workspaces in Power BI** • Create a workspace in Power BI for collaboration. • Add team members and manage permissions. **Lab Work 5.4: Tableau Collaboration and Permissions** • Set up permissions for Tableau dashboards. • Collaborate with team members by adding comments and sharing links. **Lab Work 5.5: Performance Optimization in Power BI** • Analyze and improve the performance of large datasets in Power BI (reduce data load times).

	Lab Work 5.6: Performance Optimization in Tableau • Explore best practices for performance tuning in Tableau (optimize extracts, reduce chart complexity). **Final Lab Project** • Build an end-to-end data visualization project using either Power BI or Tableau. • **Requirements:** o Import and clean a real-world dataset. o Create multiple visualizations to provide insights. o Design a dashboard or story. o Publish and share the dashboard, ensuring proper user permissions.

Open Elective –III

Subject Title		**BLOCKCHAIN TECHNOLOGY**			
Subject Ref. No.		**MANC425**	**No. of Credits**	**:**	2
			Assignments / Sessional	**:**	20
			Semester Examination	**:**	30
		Course Objective This course cover both the conceptual as well as application aspects of Blockchain. This includes the fundamental design and architectural primitives of Blockchain, the system and the security aspects, along with various use cases from different application domains.			
		Course Outcomes (CO) – At the end of the course, students will be able to: **CO1:** Understand the fundamental concepts of blockchain technology, including cryptography, hash functions, and decentralized public ledgers. **CO2:** Analyze the differences between centralized, decentralized, and distributed systems, and explain the value proposition of Bitcoin and other cryptocurrencies. **CO3:** Demonstrate knowledge of blockchain architecture, including block structure, transactions, distributed consensus, and the economics behind blockchain networks. **CO4:** Apply blockchain technology concepts in real-world applications, including permissioned and permission-less models, smart contracts, and enterprise-level solutions like Hyperledger Fabric.		
Pre Requisite					

Unit – I		Introduction to Blockchain Problems with centralized systems Centralized Vs Decentralized Vs Distributed Blockchains and Public Ledgers Historical Perspectives- Cryptography , hash functions , time stamp, hash tree
Unit – III		Bitcoin and Blockchain What is Bitcoin? Bitcoin Value proposition Technology behind bitcoin Bitcoin Transaction Lifecycle Bitcoin 2.0 Smart contracts Contracts in centralised platforms- crowd funding
Unit – IV		The Architectural Principals – The Block in Blockchain Structure of Block Transactions in a Block The Blockchain replicas The notion of distributed consensus The Economics behind blockchain consensus
Unit – V		Conceptualization and Applications- The permission-less model Privacy and security Cryptocurrency applications using blockchains The permissioned Blockchain Hyperledger Fabric Blockchain for Enterprise Applications
BOOKS		• Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos • Blockchain by Melanie Swa, O'Reilly • Hyperledger Fabric - https://www.hyperledger.org/projects/fabric • Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

Subject Title		**Internet of Things (IoT)**			
Subject Ref. No.		**MANC426**			
			No. of Credits	:	2
			Assignments / Sessional	:	20
			Semester Examination	:	30

Course Outcomes (COs)

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

CO-1	Understand general concepts of Internet of Things
CO-2	To understand the sensors & boards to implement IoT in real world
CO-3	Recognize various devices, sensors and applications
CO-4	Apply design concept to IoT solutions
CO-5	To study IoT architectures & different models
CO-6	Design issues in IoT applications

Course Objective	In this course, student will explore various components of Internet of things such as Sensors, internetworking and cloud. In the end they will also be able to design and implement IoT circuits and solutions.
Prerequisites	Before learning IoT Tutorial, you must have the basic knowledge of Internet,
	programming language, and electronics
Unit I	Introduction to IoT : Concept , applications, advantages , disadvantage, EmbeddedDevices & System, IoT Ecosystem, IoT Framework, IoT Architecture & Domains .
Unit II	IoT cloud Platforms : Definition, important , types of Platform with its applications, key features. Examples of platforms- AWS, Google Cloud, IBM Waston , SAP Cloud, Oracle Integrated , Bosch, MS Azur, ThingWorx, Cisco Jasper etc
Unit III	IoT Technology & Communication protocols : concepts of protocols , properties , advantages & disadvantage of Data Link, Network Layer & Session Layer, types & applications of WiFi, Bluetooth, Zigbee, Z-wave, Cellular, NFC, LoRaWAN
Unit IV	IoT Devices : Microcontroller, Microprocessor, sensors : Accelerometers, temperature sensors , magnetometers, gyroscopes ,acoustic sensors, pressure sensors, humidity sensors, proximity sensors, image sensors, light sensors, gas RFID sensors, micro flow sensors, fog detector sensors, Wearable devices - Helmets, glasses , Jewelry, Watches, WristBand, rings, clothing, backpacks
Unit V	Developing IoT solutions: Introduction to different IoT tools, Introduction to Arduinoand Raspberry Pi Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT.
Text Book	1. Internet of Things (IoT) , Kamal Kant Hiran Dr. Kamlesh Lakhwani, Dr.Hemant Kumar Gianey, Joseph Kofi Wireko 2. Internet of Things: A Hands-On Approach, by Arsheep Bahga and VijayMadisetti. 3. IoT Fundamentals | Networking Technologies, Protocols, and Use Cases forthe Internet of Things by Hanes David , Salgueiro Gonzalo. 4. IoT - Internet Of Things Basics: For Beginners: Fast And Easy Way To LearnIot Basics And Introduction To Data Science Kindle Edition

Subject Title	**:**	**Introduction to Digital Marketing**		
Subject ref. No.	**:**	**MANC427**		
		No. of credits	**:**	**2**
		No. of periods per week	**:**	**2**
		Assignment/Sessionals	**:**	**20**
		Semester Exam	**:**	**30**
Course Objectives	:	1. Gain a comprehensive understanding of digital marketing principles, channels, and strategies to effectively reach and engage customers in the digital environment. 2. Develop the ability to apply advanced digital marketing techniques, including SEO, social media, and data analytics, to drive measurable business outcomes and adapt to emerging trends.		
Pre Requisite	:	NA		
Unit-I Fundamentals of Digital Marketing	:	1. Overview of Digital Marketing 2. Evolution and Importance of Digital Marketing 3. Key Digital Marketing Channels and Strategies 4. Customer Behavior in the Digital Age 5. Role of Data Analytics in Digital Marketing 6. Legal and Ethical Considerations in Digital Marketing		
Unit-II Core Components of Digital Marketing	:	1. Search Engine Optimization (SEO) 2. Social Media Marketing (SMM) 3. Pay-Per-Click Advertising (PPC) 4. Content Marketing and Blogging 5. Email Marketing Strategies 6. Mobile Marketing and Optimization		
Unit-III **Advanced Techniques and Trends in Digital Marketing**	:	1. Affiliate and Influencer Marketing 2. E-Commerce Marketing Strategies 3. Marketing Automation Tools and Techniques 4. Understanding Digital Metrics and KPIs 5. Artificial Intelligence in Digital Marketing 6. Emerging Trends: Voice Search, Chatbots, and AR/VR Marketing		
Text Books	:	1. Chaffey, D., & Ellis-Chadwick, F. (2019). *Digital Marketing: Strategy, Implementation, and Practice* (7th ed.). Pearson. 2. Kotler, P., Kartajaya, H., & Setiawan, I. (2021). *Marketing 5.0: Technology for Humanity*. Wiley.		
Additional Reference Books	:	1. Ryan, D. (2017). *Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation* (4th ed.). Kogan Page. 2. Kingsnorth, S. (2019). *Digital Marketing Strategy: An Integrated Approach to Online Marketing* (2nd ed.). Kogan Page. 3. Charlesworth, A. (2020). *Digital Marketing: A Practical Approach* (4th ed.). Routledge.		

Subject Title		**Introduction of NLP**			
Subject Ref. No.		**MANC428**	**No. of Credits**		2
			No. of Periods / Week		2
			Assignments / Sessional		20
			Semester Examination		30

Course Outcomes (COs)

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

CO-1	To introduce the fundamental concepts and techniques in Natural Language Processing (NLP).
CO-2	To provide practical knowledge on how to implement basic NLP tasks using Python and relevant libraries.
CO-3	To explore real-world applications of NLP in areas such as text processing, sentiment analysis, and information extraction.

Unit I	**Introduction to NLP** Definition and scope of NLP Applications of NLP in various domains Challenges in NLP (ambiguity, context, etc.) NLP Pipeline: Basic steps in NLP (Text pre-processing, parsing, etc.) Introduction to common NLP tasks (tokenization, POS tagging, etc.)
Unit II	**Text Pre-processing** Text Normalization: Tokenization: Words, sentences, and their importance Lowercasing, stemming, and lemmatization Removing stop words and special characters Feature Extraction: Bag of Words (BoW) model Term Frequency-Inverse Document Frequency (TF-IDF) Introduction to word embeddings (Word2Vec, GloVe)
Unit III	**Syntax and Semantics in NLP** Part-of-Speech Tagging: Understanding POS tags and their significance Techniques for POS tagging (Rule-based, stochastic) Introduction to POS tagging libraries (NLTK, spaCy) Named Entity Recognition (NER): Concept of entities and entity types Techniques for NER Using Python libraries for NER tasks **NLP Models and Techniques** Introduction to Language Models (LM) n-gram models Introduction to pre-trained language models (BER T, GPT) Text Classification: Overview of text classification Sentiment analysis as a case study Implementing a simple text classifier using Python
Text Books	"Speech and Language Processing" by Daniel Jurafsky and James H. Martin "Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper "Hands-On Natural Language Processing with Python" by Rajesh Arumugam, Rajalingappaa Shanmugamani

Subject Title		**Advances in Data Structure Lab**			
Subject Ref. No.		**MANC454**	**No. of Credits**		1
			Internal		25
					-

Course Outcomes (COs)

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

CO-1	To implement the concepts of Abstract data Type using Programming Languages
CO-2	To learn the practical approaches of Stack & Queue in real time applications
CO-3	To implement various search data structures such as hashing, binary search trees, AVL trees, B+ trees and B*-trees using programming languages
CO-4	To implement graph theory concept (Minimum Spanning Tree) in Civil Network Planning, Computer Network Routing Protocol and summarize searching and sorting techniques

Practical Lab

1.	WAP a program to implement the addition of two Polynomial using an Array .
2.	WAP a program to implement the multiplication of two Polynomial using anArray .
3.	WAP a program to convert Array into Sparse Array using an Array .
4.	WAP a program to implement the stack operations such as push, pop, display &search element using an Array .
5.	WAP a program to implement the queue operation such as front , rear, display& search using an Array .
6.	WAP a program to implement the Circular Queue using an Array .
7.	WAP a program to implement the Priority Queue using an Array
8.	WAP a program to implement the DeQueue Queue using an Array
9.	WAP a program to implement the Reverse Stack using Queue implementation.
10.	WAP a program to demonstrate the application of malloc, calloc and freefunction.
11.	WAP a program to implement the addition of two Polynomial using Linked List.
12.	WAP a program to implement the multiplication of two Polynomial using usingLinked List.
13.	WAP a program to Create the Linked List and Print it.
14.	Write a menu driven program in to perform all operations such as create , delete (first,last & between), insert(first,last & between), display, search elementin ***Linked List***.
15.	Write a menu driven program in to perform all operations of ***stack*** such ascreate , delete, insert, display, search element by using Linked List.
16.	Write a menu driven program in to perform all operations of ***queue*** such ascreate , delete, insert, display, search element by using Linked List.
17.	Write a menu driven program in to perform all operations such as create , delete (first,last & between), insert(first,last & between), display, search elementin ***Circular Linked List***.
18.	Write a menu driven program in to perform all operations such as create , delete (first,last & between), insert(first,last & between), display, search elementin ***Doubly Linked List***.
19.	Write a menu driven program in to perform all operations such as create , delete (first,last & between), insert(first,last & between), display, search elementin ***Doubly Circular Linked List***.
20.	Write a program to convert normal linked List into ***Reverse Linked List.***

21.	Write a program to construct Tree by using three arrays.
22.	Write a program to construct Tree by using one array.
23.	Write a program to construct Tree by using Linked List
24.	Write a program to construct BST by using array.
25.	Write a program to construct BST by using Linked List.
26.	Write a program to construct Tree by using three arrays and perform inorder,preorder and post order on it.
27.	Write a program to construct Graph using Adjacency Matrix.
28.	Write a program to construct Graph using Adjacency List.
29.	Write a program to construct Graph using Incidence Matrix.
30.	Write a program to perform Bubble Sorting.
31.	Write a program to perform Insertion Sorting.
32.	Write a program to perform Selection Sorting.
33.	Write a program to perform Merge Sorting.
34.	Write a program to perform Shell Sorting.
35.	Write a program to perform Quick Sorting.

Subject Title		**Advanced DBMS Lab**		
Subject Ref. No.	**MANC 455**	**No. of Credits**		1
		Internal		25

Course Outcomes (COs)

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

CO-1	Execute and create Triggers and write Advanced Triggers
CO-2	Implement Cursors Management in PL/SQL
CO-3	Write Subprograms and implement them.
CO-4	Write Functions and use them in PL/SQL.
CO-5	Write programs to perform Error Handling using PL/SQL.

Practical based on SQL and Introduction to PL/SQL

Subject Title	:	**Software Testing Lab**			
Subject Ref. No.	:	**MANC456**	No. of Credits	:	1
			Internal	:	25
Content	:	Assignment containing Automated Testing will be covered.			

Subject Title		**Mini Project**			
Subject Ref. No.		**MANC457**	No. of Credits	:	2
			Internal	:	50
Content	:	Mini Project based on Programming & Database concepts.			

Subject Title	:	***on-the-job training***			
Subject Ref. No.	:	***MANC462***	*No. of Credits*	:	*4*
			Internal	:	*40*
			External	:	*60*
Content	:	*Students needs to complete the on the job training.*			

Semester-III

Subject Title	**:**	**Advances in Algorithms**			
Subject Ref. No.	**:**	**MANC501**	**No. of Credits**	**:**	3
			Assignments / Sessional		25
			Semester Examination		50

Course Outcomes (COs)

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

CO-1	To introduce students to the fundamental concepts of algorithm design and analysis.
CO-2	To develop the ability to analyze the efficiency of algorithms.
CO-3	To explore various algorithm design paradigms such as Divide and Conquer, Greedy methods, Dynamic Programming, and others.

Pre Requisite	**:**	Working knowledge of C programming, Basic Computer Architecture-Concepts., Basic algorithms and data structure concepts.
Unit – I	**:**	**Introduction to Algorithms and Analysis Techniques** Definition and importance of algorithms Characteristics of algorithms Algorithm specification and pseudocode conventions Growth of functions: Asymptotic notation (Big O, Theta, Omega) Recurrences: Solving recurrences using the substitution method, recursion tree, and master theorem Basic complexity analysis: Time and space complexity
Unit – II	**:**	**Divide and Conquer** Introduction and general approach Examples: Binary Search, Merge Sort, Quick Sort Analyzing time complexity of divide and conquer algorithms Strassen's algorithm for matrix multiplication Closest pair of points problem Analysis and optimization strategies
Unit – III	**:**	**Greedy Algorithms** Greedy strategy and its application Case studies: Activity Selection, Fractional Knapsack, Huffman Coding Proof of correctness and optimality Minimum Spanning Trees: Prim's and Kruskal's algorithms Shortest Path Algorithms: Dijkstra's algorithm Analysis of greedy algorithms in graph theory
Unit – IV	**:**	**Dynamic Programming** Principles of optimality and overlapping subproblems Comparison with divide and conquer Case studies: Fibonacci sequence, Longest Common Subsequence (LCS) 0/1
Unit - V		Knapsack problem Matrix Chain Multiplication Bellman-Ford algorithm for shortest paths Techniques for identifying and solving dynamic programming problems
Text Books	**:**	ıtroduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein (CLRS) lgorithm Design" by Jon Kleinberg and Éva Tardos

		he Design and Analysis of Computer Algorithms" by Alfred V. Aho, John E. Hopcroft, and Jeffrey D. Ullman lgorithms" by Robert Sedgewick and Kevin Wayne

Subject Title :	**Web Development Using PHP**			
Subject Ref. No.	**MANC502**	No. of Credits	:	03
Assignments/Sessional	:			25
Semester Exam.	:			50

Course Outcomes (COs)

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

CO-1	Write code for implementing basic concept of PHP as loops, conditions, arrays, strings.
CO-2	Connect the My Sql database with PHP for performing operations such as insert, update, delete, retrieve.
CO-3	Implement the concepts of COOKIES and SESSION handling using PHP.
CO-4	Write the programs using concepts of HTML + JAVASCRIPT + PHP + MYSQL.
CO-5	Design the Web portals to fulfill the requirements.

Prerequisite :	Students must have knowledge of HTML, JavaScript.
Unit –I :	**Introduction to PHP** PHP Basics Conditions and Branches Loops Variables and Arrays Strings
Unit –II :	**Form Handling** Dealing with functions Forms Super global variables Super global array A script to acquire user input Importing user input Accessing user input Combine HTML and PHP code Using hidden fields Redirecting the user File upload and scripts Delete a File

Unit –III :	**Cookies , Sessions and Authentication** Using Cookies in PHP Setting a cookie Accessing cookie Destroying Cookie HTTP Authentication Storing Username and Passwords Using Sessions Starting a session Ending a session Session Security
Unit – IV :	**Database Operations with PHP** Built-in Database Functions, Connecting to a MySQL, Selecting a Database, Building and Sending the Query to Database Engine, Retrieving , Updating and Inserting Data in database
Unit – V :	**Classes And Objects** Object oriented concepts Define a class Class attributes An Object Creating an object Object properties Object methods Object constructors and destructors Class constants Static method Class inheritance Abstract classes Final keyword Implementing Interface Object serialization Understanding Advance and New Checking for class and method existence Iterators
Reference Books :	1. *PHP and MySQL Web Development* by Luke Welling, and Laura Thomson 2. *PHP, MySQL, and JavaScript* by Robin Nixon 3. *PHP 6 and MySQL 5 for Dynamic Web Sites: Visual QuickPro Guide* by Larry Ullman 4. *PHP Cookbook* by Adam Trachtenberg, and David Sklar 5. PHP Object – Oriented Solution by David Powers 6. *Head First PHP & MySQL* by Lynn Beighley, and Michael Morrison 7. *Beginning PHP and MySQL* From Novice to Professional, Third Edition by W.J. Gilmore

Subject Title		**Optimization Techniques**			
Subject Ref. No.		**MANC503**	**No. of Credits**		4
			Assignments / Sessional		40
			Semester Examination		60

Course Outcomes (COs)

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

CO-1	apply the techniques used in operations research to solve real life problem in industry
CO-2	Develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language understandable to the decision-making processes in Management Engineering(Transportation /Assignment / replacement Models).
CO-3	Formulate Nonlinear and Linear Programming Model
CO-4	Formulation and solution of network problems using graph optimization algorithms
CO-5	Construct linear integer programming models and discuss the solution techniques to solve the integer programming models using branch-and-bound method.
CO-6	Study and develop game theory, practical use of game theory in real life, types of game theory.

Course Objective	The main objective of this course to learn research methodologies, defining hypothesis and its analytical methods. The content also help to solve many real-time problems of operation research such as assignment, transportation, queuing, Linear programming and network problems also.
Prerequisites	Statistical Basic, discrete Mathematics and Data Structure
Unit I	Linear Programming Application areas of Linear Programming Linear Programming – The Graphical method – Graphical Solution methods of Linear Programming problem, Maximization Linear Programming problem, Maximization Problem.
Unit II	Linear Programming – Simplex Method – Phase I and Phase II of the Simplex Method, The Revised Simplex method, Primal and Dual Simplex Method, Simplex Algorithm for maximization case, Simplex Algorithm for minimization case – Two phase method and the Big –M method. Transportation Problem and its solution, Assignment Problem and its solutions by Hungarian Method.
Unit III	PERT & CPM Basic differences between PERT and CPM. , Arrow Networks, time estimates, earliest, expected time, latest – allowable, occurrences time, Forward Pass Computation, Backward Pass Computation, Representation in Tabular Form Critical Path,

	Probability of meeting scheduled date of completion, Calculation on CPM network. Various floats for activities, Critical path updating projects. Operation time cost tradeoff Curve project, Time cost – tradeoff Curve- Selection of schedule based on Cost Analysis, Crashing the network
Unit IV	Integer Programming, Gomory Cutting Plan Methods – Branch and Bound , Queuing Theory. Game theory.
Unit V	Replacement of items that deteriorates. Replacement of items that fails suddenly, Individuals and Group Replacement- Policy, INVENTORY THEORY: Inventory Model Building, Single item deterministic Model, Inventory Control Models without strategies and Inventory, Control Models with shortages.
Text Book	Research Methodology methods and Techniques by C.R. Kothari Operation Research J.K. Sharma Operations Research Kanti Swarup, Gupta P.K. and ManMohan. Operation Research - By Hira Gupta S.Chand publication
Reference Books	Comprehensive Statistical Methods, P.N. Arora, SummetArora, S. Arora Operation Research , A.M. Nataranjan , P. BalaSubramani, A. Tamilaraji

Subject Title	:	**Advance Networking**		
Subject ref. No.	:	**MANC504**		
		No. of credits	:	4
		Assignment/Sessionals	:	40%
		Semester Exam	:	60%
Course Objectives	:	CO1: Build an understanding of the fundamental concepts of computer networking. CO2: Understand and explain the concept of Data Communication and networks, layered architecture and their applications. CO3: Enumerate the layers of the OSI model and TCP/IP. CO4: Familiarize the student with the taxonomy and terminology of advance concepts of computer networking. CO5: Familiarity with the basic of internet and various important terms associated with it.		
Pre Requisite	:	NA		
Unit-I **Introduction to Networking:**	:	Hardware Architecture:- Topologies, Media, Devices Transmission Techniques:-Twisted Pair, Coaxial Cable, Fiber Optics, Wireless Transmission Switching: - Circuit Switching, Message Switching, Packet Switching		
Unit-II **Common Network Architecture:**	:	Connection oriented N/Ws, Connectionless N/Ws **Local Area Networks:** Components & Technology , Access Technique Transmission Protocol & Media		
Unit-III **Reference Models:**	:	**The OSI Reference Model:** Protocol Layering, TCP/IP Model, OSI vs TCP/IP		
Unit-IV **Broad Band Networks**	:	Integrated Service Digital Networks (ISDN), Broad Band ISDN, ATM, ATM Traffic Management, Introduction to very small Aperture Terminal(VSAT)		
Unit-V **Network Applications :**	:	**Hyper Text Transfer Protocol (HTTP)** **HTTP communications**: - HTTP request, Request Headers, Responses, Status Code, Error Status Code Email : Sending & Receiving Emails, Email Addressing, Message Structure MIME – Multipurpose Internet Mail Extensions SMTP – Simple Mail Transfer Protocol with Examples Mail Exchangers – Delivering a message, Mail Boxes POP – Post Office Protocol IMAP – Internet Message Access Protocol FTP – File Transfer Protocol Telnet – Remote Communication Protocol Proxy Server, Proxy Web Servers		
Text Books	:	1. Tanenbaum, Andrew, Computer Networks, PHI 2. Forouzan Behrouz A., Tata Mcgraw Hill		
Additional Reference Books	:	1. Norton Peter, Complete Guide To Networking		

OPEN ELECTIVE - IV

Subject Title :		**Data Mining using SQL**		
Subject Ref. No.	**MANC521**	No. of Credits	:	03
		No. of Periods/Week	:	03
		Assignments/Sessional	:	25
		Semester Exam.	:	50
Course Objective	This course is an introductory course on data mining. It introduces the basic concepts, principles, methods, implementation techniques, and applications of data mining, with a focus on two major data mining functions: (1) pattern discovery and (2) cluster analysis.			
Prerequisite :	Basics of SQL and DBMS is a must.			
Unit –I :	**Introduction:** what is data mining, KDD process, different types of data in data mining.			
Unit –II :	**Data Preprocessing:** data cleansing, missing values, data integration and transformation, feature extraction and selection.			
Unit –III :	**Patterns, associations and correlations:** data generalization, data summarization, pattern mining, association rule mining,			
Unit – IV :	**Classification and Prediction:** Preparing data for prediction and classification, Bayes classification method, rule-based classification, Cluster analysis.			
Unit – V :	**OLAP Technology:** What is OLAP, difference between OLAP and OLTP, OLAP Servers, OLAP Application.			
Text Books :	1. SQL for Data Analysis by Cathy Tanimura- O'Reilly 2. Harness the power of SQL to extract insights from data, 3rd Edition Jun Shan, Matt Goldwasser, Upom Malik, Benjamin Johnston 3.Fundamentals of Database Sysems, Elmasri Navathe			
Reference Books :	1. Datawarehousing fundamental – Paulraj Ponniah Wiley. 2. Introduction to data mining with case studies – G.K. Gupta. 3. Data Warehousing (OLAP) S. Nagabhushana New Age.			

Subject Title	**:**	**Data Mining Using SQL LAB**			
Subject Ref. No.	**:**	**MANC555**	**No. of Credits**	**:**	1
			No. of Periods / Week	**:**	2
			Internal	**:**	25
				:	
Course Objective	**:**	Practical based on SQL using PostgreSQL or Oracle.			

Subject Title		**Linux Administration and Server Config**			
Subject Ref. No.		**MANC522**	**No. of Credits**		2
			Assignments / Sessional		25
			Semester End Examination		50

Course Outcomes (COs)

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

CO-1	Understanding the basic set of commands and utilities in Linux/UNIX systems.
CO-2	Learn the important Linux library functions and system calls
CO-3	Understand the inner workings of Linux operating systems
CO-4	Design Live Servers.

Pre Requisite		Operating System Concepts, Windows Platform
Unit – I		**Introduction:** Basic Linux System Concepts, GNU, Free Software, and Open Source Software, Open Source Software Licenses, Distributions of Linux O.S, Installing Ubuntu, The GNOME Desktop, Linux Commands
Unit – II		**Managing the basics:** User Administration, Linux File-System Administration, File Permissions, and Networking Management.
Unit – III		**Software Installation**: The Package Management, Vi/Vim Editor, Regular Expressions. Open SSH Server, VNC Server, Installation of Python.
Unit – IV		**Server Configuration**: FTP Server, NFS Server, Samba Server, HTTP/Apache Server, DNS Server, DHCP Server, Mail Server, And Database Server: MySQL.
Unit – V		**Maintenance** : Backing Up and Restoring Files, Security and Firewall, Monitoring
Text Books		1. "Ubuntu Server Guide" by UBUNTU LTD. 2. "Introduction to Linux", A Hands on Guide by Machtelt Garrels 3. "GNU/Linux Advanced Administration", by Josep Jorba Esteve and Remo Suppi Boldrito
Additional Reference Books		1. Managing Linux® Systems with WebminTM System Administration and Module Development by Jamie Cameron
Web Reference		https://www.ubuntupit.com/27-best-linux-tutorial-books-need-download-now/

Subject Title		**Linux Admin & Server Config. Lab**			
Subject Ref. No.		**MANC556**	**No. of Credits**		1
			Internal		25

Course Outcomes (COs)

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

CO-1	Understanding the basic set of commands and utilities in Linux/UNIX systems.
CO-2	Learn the important Linux library functions and system calls
CO-3	Understand the inner workings of Linux operating systems
CO-4	Design Live Servers.

Subject Title :	**Mobile Application Development Using Android**			
Subject Ref. No.	**MANC523**	No. of Credits	:	03
Assignments/Sessional			:	25
Semester Exam.			:	50

Course Outcomes (COs)

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

CO-1	Write code for implementing concept of Android as different layouts, Services, components, activities
CO-2	Design User interface using Menus, labels, text control, button control, toggle button, images etc.
CO-3	Write the programs using concepts of JAVA + SQLite
CO-4	Write the programs using concepts of JAVA + PHP + MYSQL.
CO-5	Write programs for handling Bluetooth, camera, GPS services.
CO-6	Design Android applications.

Prerequisite :	Experience in Object Oriented programming language, Knowledge in XML format
Unit –I :	**1) Introduction To Mobile Apps** I. Why we Need Mobile Apps II. Different Kinds of Mobile Apps III. Briefly about Android **2) Introduction Android** I. History Behind Android Development II. What is Android?

	III. Pre-requisites to learn Android IV. Brief Discussion on Java Programming **3) Android Architecture** I. Overview of Android Stack II. Android Features III. Introduction to OS layers **4) Deep Overview in Android Stack** I. Linux Kernel II. Libraries III. Android Runtime IV. Application Framework V. Dalvik VM **5) Installing Android Machine** I. Configuring Android Stack II. Setting up Android Studio III. Working with Android Studio IV. Using Older Android Tools
Unit –II :	**1) Creating First Android Application** I. Creating Android Project II. Debugging Application through DDMS III. Setting up environment IV. AVD Creation V. Executing Project on Android Screen **2) Android Components** I. Activities II. Services III. Broadcast Receivers IV. Content Providers **3) Hello World App** I. Creating your first project II. The manifest file III. Layout resource IV. Running your app on Emulator
Unit –III :	**1) Building UI with Activities** I. Activities II. Views, layouts and Common UI components III. Creating UI through code and XML IV. Activity lifecycle V. Intents VI. Communicating data among Activities **2) Advanced UI** I. Selection components (GridView, ListView, Spinner) II. Adapters, Custom Adapters III. Complex UI components IV. Building UI for performance V. Menus VI. Creating custom and compound Views **3) Notifications** I. Toast, Custom Toast II. Dialogs III. Status bar Notifications

Unit – IV :	**1) Working with Database** I. SQLite Introducing SQLite SQLiteOpenHelper and creating a database Opening and closing a database Working with Inserts, updates, and deletes operations II. PHP + MySql Introduction to basic PHP & MySql Connectivity Using PHP code with Android Performing insert, delete, update, view operations on MySql Database
Unit – V :	**1) Camera** I. Taking pictures II. Media Recorder III. Rendering previews **2) Bluetooth** I. Controlling local Bluetooth device II. Discovering and bonding with Bluetooth devices III. Managing Bluetooth connections IV. Communicating with Bluetooth **3)Location Based Services and Google Maps** I. Using Location Based Services II. Finding current location and listening for changes in location III. Proximity alerts IV. Working with Google Maps i. Showing google map in an Activity ii. Map Overlays iii. Itemized overlays iv. Geocoder v. Displaying route on map
Reference Books :	1. Android Application Development All-In-One for Dummies, 2ed 2015 by Barry Burd 2. Android Application Development (With Kitkat Support), Black Book 2014 by Pradeep Kothari and Kogent Learning Solutions Inc. 3. Head First Android Development: A Brain-Friendly Guide, 2nd Edition by Dawn Griffiths and David Griffiths

Subject Title	:	**Android LAB**			
Subject Ref. No.	:	**MANC557**	**No. of Credits**	:	1
			Internal	:	25

Course Outcomes (COs)

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

CO-1	Write code for implementing concept of Android as different layouts, Services, components, activities
CO-2	Design User interface using Menus, labels, text control, button control, toggle button, images etc.
CO-3	Write the programs using concepts of JAVA + SQLite
CO-4	Write the programs using concepts of JAVA + PHP + MYSQL.
CO-5	Design Android applications.

Content	:	Assignment based on the Android will be covered.

Subject Title	:	**Cloud Computing**			
Subject Ref. No.	:	**MANC503**	**No. of Credits**	:	3
			Assignments / Sessional	:	25
			Semester Examination	:	50

Course Outcomes (COs)

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

Pre Requisite	:	
Unit – I	:	**Basic of Cloud Services-**Introduction to Cloud Computing,History, Why Cloud Computing? Cloud Hosting,Benefits of Cloud Computing Types of Cloud Computing Public Cloud Private Cloud Hybrid Cloud Community Cloud,Platformas a Service Providers,Evolution of Cloud computing,Characteristics,Advantages. Cloud Computing Issues Security Costing Model,Architecture of Cloud Computing,Infrastructure,Components.

Unit – II	**:**	**Virtualization-**Root of Cloud Computing ,Types of Virtualization,Hardware Virtualization,Types of Hardware Virtualization,Virtualization Reference Model, Benefits,Characteristics,Host Machine,Guest Machine Hypervisor Benefits, types,SOA Web Service,Grid computing,Automatic Computing.
Unit – III	**:**	**AWS Platform-** Introduction to AWS Elastic computing Introduction to the AWS products,Benefits.Regions and Availability Zones Signing up for AWS,Case Study,Use of AWS,Domains of AWS.AWS Free usage tier Introduction AWS management console.
Unit – IV	**:**	**EC2 Instance-**Understanding AMI Launching your first AWS instance On- demand Instance pricing,Reserved Instance pricing Spot instance pricing Settingup security Security groups,Choosing & Creating a new AMI Public and Private IP's,Deploying a new instance from the created AMI Key Pairs Elastic IP's
Unit – V	**:**	**Storage in Cloud-**Uploading Downloading S3 Permissions S3 Object Versioning S3 Lifecycle Policies Storage,S3 Transfer Acceleration Glacier storage,Gateway Import Export,Shutting down and rebooting the system Yum Command set, Installpackages by using yum.
Text Books	**:**	
Additional Reference Books		

Subject Title	**:**	**Cloud Computing LAB**			
Subject Ref. No.	**:**	**MANC558**	**No. of Credits**	**:**	1
			Internal	**:**	25

Course Outcomes (COs)

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

Content	**:**	Assignment based on the cloud computing will be covered.

Subject Title	**:**	**PHP LAB**			
Subject Ref. No.	**:**	**MANC552**	**No. of Credits**	**:**	1
			Internal	**:**	25

Course Outcomes (COs)

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

CO-1	Write code for implementing basic concept of PHP as loops, conditions, arrays, strings.
CO-2	Connect the My Sql database with PHP for performing operations such as insert, update, delete, retrieve.
CO-3	Implement the concepts of COOKIES and SESSION handling using PHP.
CO-4	Write the programs using concepts of HTML + JAVASCRIPT + PHP + MYSQL.
CO-5	Design the Web portals to fulfill the requirements.

Content	**:**	Assignment based on the PHP & supporting languages will be covered.

Subject Title	**:**	**Research Project**			
Subject Ref. No.	**:**	**MANC553**	**No. of Credits**	**:**	4
			Internal	**:**	100
Content	**:**	Research Projects needs to be performed.			

Subject Title	**:**	**Research Project - Seminar**			
Subject Ref. No.	**:**	**MANC554**	**No. of Credits**	**:**	2
			Internal	**:**	50
Content	**:**	Seminars based of topics given needs to be delivered.			

SEMESTER – IV

Subject Title	:	**Software Project Management**		
Subject ref. No.	:	**MANC506**		
		No. of credits	:	2
		No. of periods per week	:	2
		Internal	:	50
Course Objectives	:	**CO1**: Build an understanding of the fundamental concepts of SPM. **CO2**: Understand and explain the concept of Project estimation and various methods to evaluate it. **CO3**: Enumerate Quality testing and its importance.		
Pre Requisite	:	NA		
Unit-I **Project Management Framework**	:	Overview of project Management Project Organization Planning a s/w project Project management life cycle Risk management Identification of Risks Risk Analysis Risk Planning & Monitoring		
Unit-II **S/w Project Estimation**	:	Project Estimation Different methods of estimation (COCOMO model, Delphi cost estimation etc.) Function point analysis Project Management Tools & Techniques PERT & Gantt Charts		
Unit-III **Software Quality Management & Testing**	:	Quality Assurance & Standards Quality Planning Quality control Role of testing in Software development Testing Procedure Defect Management		
Text Books	:	1. Software Engineering Roger S. Pressman 2. Software Engineering concepts Richard Fairley		
Additional Reference Books	:	2. Software Project management Edwin Bennatan 3. Software Project Management S.A. Kelkar 4. Software Engineering IAN Sommerville		

Subject Title	:	**Entrepreneurship Development**			
Subject Ref. No.	:	**MANC507**	**No. of Credits**	:	2
			Assignments / Sessional	:	50
			Semester Examination	:	--

Course Outcomes (COs)

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

CO-1	Understanding the Entrepreneurship process
CO-2	Gaining the knowledge about creativity, innovation in business
CO-3	Identify key risks and most effective processes in bringing different types of products or Services to market
CO-4	Determine methods that can be used to minimize uncertainties at different stages of the entrepreneurial process

Pre Requisite	:	Basic knowledge of Entrepreneurship
Unit – I	:	**Introduction:** Entrepreneurship concept, Importance. Entrepreneurship Functions & Features, Entrepreneurial Traits & Motivation, Qualities of Entrepreneurship, **Role of Entrepreneurship in Economy**. Innovation and Creativity in Entrepreneurship
Unit – II	:	**Finance and Opportunities:** Sources of Finance, Institution Financing & different schemes, Business Opportunities identifying & evaluating business opportunities ideas & opportunities,. **Methods of Business**:-Quick start, Franchises, Turnkey, Buying
Unit – III	:	**Project Report:** Study of different Entrepreneurs in IT sector and Preparation of Small Project report.
Text Books	:	1. Entrepreneurial Development, Dr.S.S.Khanka, S Chand & Company 2. Dynamics of Entrepreneurial Development & Management by Vasant Desai, Himalaya Publication House. 3. Entreprenurship , P.C.Shejwalkar, Ameya Prakashan 4. Innovation and Entrepreneurship , Peter Drucker, Practice and Principals

Subject Title	:	**Report Writing**		
Subject ref. No.	:	**MANC508**		
		No. of credits	:	2
		No. of periods per week	:	2
		Internal	:	50
Course Objectives	:	To develop students' skills in writing structured, clear, and professional project reports, emphasizing technical documentation, proper formatting, and effective presentation of report.		
Course Outcomes (CO's)		Student's should be able to **CO1 :** Write clear, well-structured project reports with proper formatting and organization. **CO2:** Document technical information and integrate visuals, citations, and references into their reports. **CO3:** Present their project findings confidently in both written and oral formats, adhering to academic and professional standards.		
Pre Requisite	:	NA		
Unit-I	:	**Fundamentals of Project Report Writing** • Purpose and significance of a project report • Overview of the report structure (abstract, introduction, methodology, results, discussion, and conclusion) • Different types of project reports (thesis, industrial, research, and case study reports) • Writing for the target audience (supervisor, examiner, industry professionals) • Common mistakes in report writing		
Unit-II	:	**Technical Writing Skills** • Writing technical documents: clarity, precision, and objectivity • Developing a formal writing style: active vs passive voice, tense usage • Using visuals and figures: charts, graphs, and diagrams to support findings • Citing sources and creating bibliographies • Ethics in report writing (plagiarism and proper attribution)		
Unit-III	:	**Review, Revision, and Presentation** • Peer review and self-review techniques • Structuring an effective conclusion and recommendations • Formatting the final report (font, headings, page layout, and appendix) • Preparing for the viva or defense presentation (presentation slides, verbal communication) • Report submission guidelines and digital formats (PDF, Word, etc.)		
Text Books	:			
Additional Reference Books	:			

Subject Title	:	**Basics of Programming Languages**			
Subject Ref. No.	:	**MANC509**	**No. of Credits**	:	2
			Assignments / Sessional	:	50
			Semester Examination	:	

Course Objectives

The primary goal of introducing "Quantitative Aptitude" for mathematics students is to help them develop the skills they need to pass competitive tests and get better jobs. To inspire confidence in students, efforts have been made to incorporate essential mathematical principles. Enrich their understanding and develop their logical reasoning thinking skills.

Course Outcomes (COs)

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

CO-1	Enhance Problem Solving Skill
CO-2	Improve Verbal & Non-verbal ability skill
CO-3	Use their logical thinking and analytical abilities to solve reasoning questions
CO-4	Prepare for various public and private sector exams & placement drives.

Pre Requisite	:	Basic Mathematics , reasoning skill
Unit – I	:	Average & Number Aptitude, Compound Interest, Age, Calendar, Clocks, Height & Distance, Percent, Profit and Loss , Speed time & Distance, Simple Interest , problems on Train, Time & Work, Surds & Indices , HCF & LCM, Area Aptitude, Ration & Proportion , Area Aptitude , Decimal Fraction, Simplification
Unit – II	:	Logarithm , Square Roots & Cube Roots, Odd man out from series , Algebraic Equations , Probability & Combinations
Unit – III	:	Logical Reasoning : Verbal : Number Series, Letter Series, Analogies, Cause & Effect, Verbal Classification, Blood relations, Logical Sequence of words, Direction Sense Test, Logical Venn Diagram
Text Books	:	1. Quantitative Aptitude for Competitive Examinations All Government and Entrance Exams (Banking, SSC, Railway, Police, Civil Service, etc.) 40 Videos | 2000+ Solved Examples | 10000+ Practice Questions Paperback – 10 April 2022
Reference Book		2. Shortcuts in Quantitative Aptitude for Competitive Exams 3rd Edition by Disha Experts, Disha Publication
Website		3. Javatpoint.com 4. https://www.geeksforgeeks.org/quantitative-aptitude/ 5. https://www.indiabix.com/aptitude/questions-and-answers/#google_vignette

Subject Title	**:**	**Seminar**			
Subject Ref. No.	**:**	**MANC559**	**No. of Credits**	**:**	2
			Internal	**:**	50
Content	**:**	Seminars will be covered.			

Subject Title	**:**	**Project**			
Subject Ref. No.	**:**	**MANC560**	**No. of Credits**	**:**	10
			Internal	**:**	100
			External	**:**	150
Content	**:**	Major Projects needs to be performed.			

***** PROJECT DOCUMENTATION SAMPLE FORMAT ********

2 Blank Pages at beginning
Title Page
Certificate from Company
Certificate from Guide
Acknowledgement
Index with printed Page Numbers

CHAPTER 1 : INTRODUCTION

1.1 Company Profile
1.2 Existing System and Need for System
1.3 Scope of Work
1.4 Operating Environment – Hardware and Software
1.5 Detail Description of Technology Used

CHAPTER 2 : PROPOSED SYSTEM

2.1 Proposed System
2.2 Objectives of System
2.3 User Requirements

CHAPTER 3 : ANALYSIS & DESIGN

NOTE – All below diagrams are not compulsory. Students can decide which diagrams needs to add in project by consulting with PROJECT GUIDE.

3.1 Class Diagram
3.2 Activity Diagram
3.3 Use Case Diagrams
3.4 Component Diagram
3.5 Deployment Diagram
3.6 Sequence Diagram
3.7 Web Site Map Diagram (in case of Web Site)
3.8 Data Flow Diagram (DFD)
3.9 Functional Decomposition Diagram (FDD)

3.10 Entity Relationship Diagram (ERD)
3.11 User Interface Design (Screens etc.)
3.12 Table specifications (in case back end is a database)
3.13 Data Dictionary
3.16 Test Procedures and Implementation

CHAPTER 4 : USER MANUAL

4.1 User Manual
4.2 Operations Manual / Menu Explanation
4.3 Program Specifications / Flow Charts
Drawbacks and Limitations
Proposed Enhancements
Conclusions
Bibliography

ANNEXURES :

ANNEXURE 1 : USER INTERFACE SCREENS
ANNEXURE 2 : OUTPUT REPORTS WITH DATA (if any)
ANNEXURE 3 : SAMPLE PROGRAM CODE (which will prove sufficient development is done by the student)
2 Blank Pages at the end

General Instruction Regarding Preparation Of Project Report

TYPING

(a) The typing shall be standard 12 pts in double spaced using black ink only
(b) Margins must be Left 2 inches Right 1.5 inches
Top 2 inches Bottom 1.5 inches
(c) Paper A4 size Bond Paper

COPIES

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